

INSPECTION REPORT FOR “CONVEYOR BELT 5, 6 & 7 and TRANSFER TOWERS OF AFBC BOILER”



**INDIAN FARMERS FERTILISER COOPERATIVE
LTD, PARADEEP, ORISSA**

March – 2013

**STRUCTWEL DESIGNERS &
CONSULTANTS PVT. LTD.**



**Structwel, Plot No. 15, Sector 24,
Off Sion Panvel Highway, Turbhe,
Navi Mumbai – 400 705.**

**Tel. : 91-22-2784 10 10 (7 Lines) Fax : 91-22-2784 10 07
Email : structwel@vsnl.net Web : <http://www.structwel.com>**

INDEX

Sr. No.	Description	Page No.
1	Detailed inspection Report	1-28
a	History / Background of the Structure.	2-2
B	Observations.	3-14
C	Inference of Non-Destructive Test Reports.	15-20
D	Recommendations/ Conclusion.	21-22
E	N.D.T. Reports.	23-28

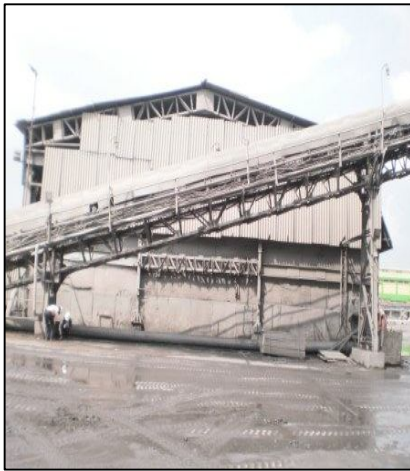
March 25, 2013

Health survey of the existing plant structures at IFFCO
Paradeep Unit.

INSPECTION REPORT
For
Condition Assessment
OF
Conveyor belt support structures
Of Belt No. 5, 6 & 7.
And Transfer Towers
Of
AFBC BOILER
At
Paradeep, Orissa.

History / Background of the structure:

- The structures under reference i.e. “conveyor belts No 5, 6 & 7 and Transfer Towers” situated in AFBC Boiler Plant at Indian Farmers Fertilizers Cooperative Ltd. (IFFCO), Paradeep Unit, and Orissa.
- The said conveyor support structures are intern supported by trestles (structural steel framed supporting system) at intermediate locations at every 12 m. (approximately) intervals, as seen in the photograph below. The bottom parts of the said trestles suitably rest on R.C.C. foundations and connected with base plates & anchor bolts. However, it was not visible since the said foundations were noted further encased in R.C.C. for the area above.
- The sides of the conveyor support structures covered with AC sheet claddings and MS sheet as seen in the photographs below. The A.C. sheet claddings on the elevations/sides are suitably supported by steel runners. The top of the structures also covered with A.C. sheets.



- The conveyor belts are suitably resting on its individual support frame system and there are service path walkways (of steel plates) provided on either sides of the said conveyor belts.

Observations:-

Structural Audit is an important technical requirement for any structure and has series of parameters to be adequately investigated and assuredly complied with. A detailed visual inspection of the structure has been carried out and observations of the same are, as given below.

During this exercise the structure was inspected thoroughly on several occasions by us to record, verify, and study the modifications/additions made if any, to observe distresses, level of malfunctioning and corrosion levels in structural steel members.

In the period of last approximately 12 years of its existence, various defects developed in the said structures, mainly as follows –

Detailed Observations:

1. Trestles -

The Trestles i.e. Vertical steel framed system provided to support conveyor belt supporting structures noted with several types of distresses mainly as below -

- **R.C.C. encasement** done at the bottom of steel columns noted with honey combing, unfinished construction joints, shuttering material left in the concrete matrix and gap between base plate and RCC pedestals.



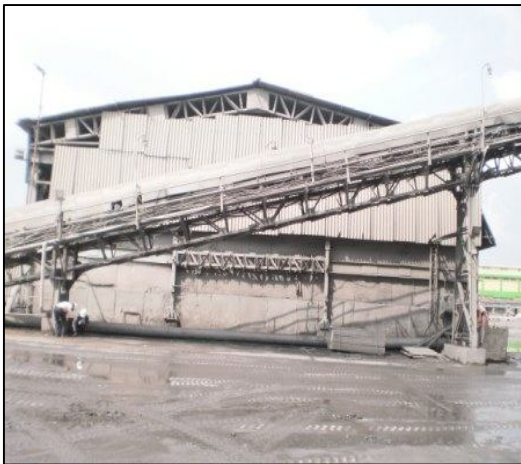
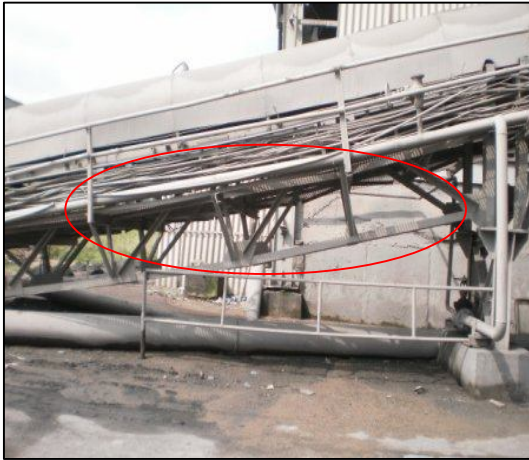


- As a matter of critical observation; deflection noted in the steel columns as seen in the photograph below; might be due to the original construction deficiency however the area need to be monitor for further development; if any.



- As a matter of critical observation; Conveyor belt support system between subsequent trestles noted with sag at few locations; as seen in the photographs below. This area needs further detailed investigation in the form of proof checking according to the load/design parameters.

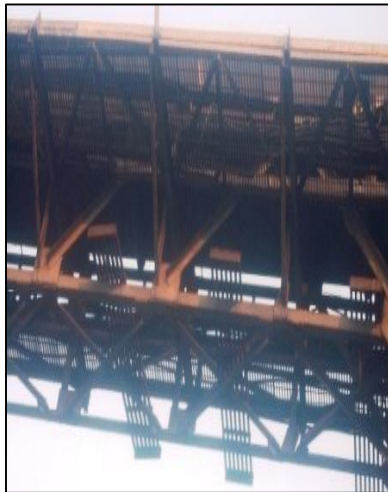
Conveyor 5



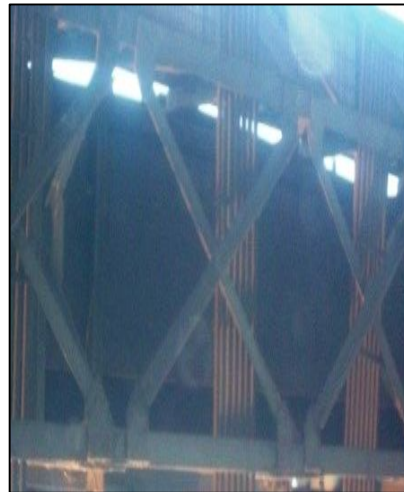
2. Bottom part of framing system:

- **All the steel members of the Bottom Part of the framing system** (i.e. Longitudinal & horizontal members, cross bracings, side & central gusset plates, steel plates provided at walkways and middle area and localized weld joints etc.) noted with **Minor to severe corrosion**, deposition of dust of raw material, localized scaling and peeling / delamination of existing protective paint at almost all locations. Please refer typical photographs below.

Conveyor 5



Conveyor 7



3. Side Elevation: (External)

- External side of the conveyor enclosed with MS sheet (for conveyor belt no. 5) and conveyor belt no. 7 has been covered with A.C sheet cladding with supporting structure framing system. A C sheets noted damaged and observed cracked, with holes and also broken etc. at many locations.
- Please refer typical photograph below.

Conveyor 5



Internal Area Observations

1. Side Elevations : (Internal conveyor belt no.7)

- **All the steel members of the framing system on elevations** (i.e. Longitudinal & vertical members, cross bracings, side gusset plates, steel runners supporting claddings, anchor bolts and localized weld joints etc.) noted with **corrosion**, deposition of dust of raw material, localized scaling and peeling / delamination of existing / new protective paint at almost all locations. Please refer typical photographs below

Conveyor 7:



Note: - Pictures are not clear due to accumulation of dust of raw material.

Note: - Internal area observations i.e. for top framing system of conveyor belts could not be possible due to the heavy accumulation of dust of raw material.

Transfer Towers

History / Background of the structure:

- The structures under reference i.e. "Transfer House No.5, 6, & 7" situated in AFBC Plant at Indian Farmers Fertilizers Cooperative Ltd. (IFFCO), Paradee
- p Unit, Orissa.
- The structure provided at the junctions of conveyor belts known as Transfer Tower. The tower supporting structures, under reference, are the structures, spread between the subsequent Conveyor belts i.e. at the junction/or and at the change of the alignment of the conveyor belts.
- The bottom parts of the steel columns have suitably rest on R.C.C. foundations and connected with base plates & anchor bolts, as per design. However, it was not visible since the said foundations were further encased with R.C.C. for the area above.

- The sides of the transfer House structures covered with AC sheet claddings at top level seen in the photograph below. The A.C. sheet claddings on the elevations/sides are suitably supported by steel runners. The top of the structures also covered with A.C. sheets, supported by steel trusses and required support system.



- Steel staircase is provided for safe access at various levels in the Transfer Houses.



Observations:-

- **R.C.C. encasement** done at the bottom noted with localized cracks & deposition of dust of raw material at many locations. Please refer typical photographs below.



Honey combing and crack noted at subsequent concrete pour

- **All the steel members of the Transfer House system (i.e. vertical & horizontal members, cross bracings, side & central gusset plates, anchor bolts and localized weld joints etc.)** noted with corrosion, deposition of dust of raw material, localized scaling and peeling / delamination of existing / new protective paint at almost all locations. Please refer typical photographs below.



Severe corrosion & scaling, pitting on bracing and cross bracing



Corrosion in horizontal bracing



Noted bent cross bracing with corrosion

2. Bottom part of framing system:

- **All the steel members of the Bottom Part of the framing system** (i.e. Longitudinal & horizontal members, cross bracings, side & central steel plates provided at platforms, anchor bolts and localized weld joints etc.) noted with **severe corrosion**, deposition of dust of raw material, localized scaling and peeling / delamination of existing / new protective paint at almost all locations.. Please refer typical photographs below.



Severe corrosion, scaling, deposition of raw dust in longitudinal member, bracing, steel platform grating



Sever corrosion & deposition of dust on the all the members

3. Side Elevation: (External)

- External elevations on either side of the Transfer supporting structure enclosed with A. C. sheets cladding supported with steel runners. However, A. C. sheets noted damaged and observed in the form of cracks, holes, broken etc. at many locations.

Please refer typical photographs below.



A.C sheet broken/ damaged

Internal Area Observations

2. Side Elevations : (Internal)

- **All the steel members of the framing system on elevations** (i.e. Longitudinal & vertical members, cross bracings, side gusset plates, steel runners supporting claddings, anchor bolts and localized weld joints etc.) noted with **corrosion**, deposition of dust of raw material, localized scaling and peeling / delamination of existing / new protective paint at almost all locations. Please refer typical photographs below.



Heavy deposition of dust & corrosion noted on the member

INFERENCE OF N.D.T. RESULTS:

In order to have adequate assessment of the pathological condition of the structure i.e. series of health parameters, series of NDT investigations are carried out. These mainly include number of Steel thickness tests which have been carried out for checking the actual thickness of steel members.

All the NDT findings are enclosed herewith.

1. Steel Thickness Gauge:

This test is performed to acquire the thickness of the Structural steel members, as per actual.

Sr.	Locations	Member	Standard	Thickness Obtained	% Reduction
No.	-	-	Thickness	(mm)	
	<u>AFBC Boiler Plant</u>				
	<u>Conveyor Belt No.5</u>				
1	<u>Bottom</u>				
2	Bottom Long Member 1 (90x90x8)	ISA	8.00	7.80	2.50
3	Bottom Long Member 2 (90x90x8)	ISA	8.00	7.00	12.50
4	Bottom Long Member 3 (90x90x6)	ISA	6.00	5.00	16.67
5	Vertical Member 1 (65x65x8)	ISA	8.00	5.30	33.75
6	Vertical Member 2 (65x65x8)	ISA	8.00	5.70	28.75
7	Vertical Member 3 (65x65x8)	ISA	8.00	7.40	7.50
8	Cross Bracing 1 (65x65x8)	ISA	8.00	7.90	1.25
9	Cross Bracket 1 (65x65x8)	ISA	8.00	8.00	0.00
10	Cross Bracing 2 (65x65x8)	ISA	8.00	7.10	11.25
11	Cross Bracket 2 (65x65x8)	ISA	8.00	7.90	1.25
12	Cross Bracing 3 (65x65x8)	ISA	8.00	6.70	16.25

13	Cross Bracket 3 (65x65x8)	ISA	8.00	6.30	21.25
14	Gusset Plate 1 (10mm)	GP	10.00	8.90	11.00
15	Gusset Plate 2 (10mm)	GP	10.00	8.40	16.00
16	Gusset Plate 3 (10mm)	GP	10.00	5.50	45.00
	Trussel				
17	Trussel 1A (400)	ISMB	8.90	8.10	8.99
18	Trussel 1B (400)	ISMB	8.90	8.60	3.37
19	Trussel 2A (300)	ISMB	7.50	7.40	1.33
20	Trussel 2B (300)	ISMB	7.50	6.30	16.00
21	Trussel 3A (300)	ISMB	7.50	7.80	-
22	Trussel 3B (300)	ISMB	7.50	7.80	-
23	Trussel 4A (400)	ISMB	8.90	5.40	39.33
24	Trussel 4B (400)	ISMB	8.90	5.70	35.96
25	Trussel 5A (400)	ISMB	8.90	5.40	39.33
26	Trussel 5B (400)	ISMB	8.90	5.90	33.71

The percentage of reduction in the thickness of steel members varies from i.e. cross bracing ISA 1.25 to 11.00%, gusset plate 11.00 to 45.00% and trussel (web) varies from 1.33 % to 39.33 with respect to the original thickness.

Inference of N.D.T. Results at Transfer house No.5

Steel Thickness Gauge:

This test is performed to acquire the thickness of the Structural steel members, as per actual.

Transfer house No.5					
Sr.	Locations	Member	Standard	Thickness Obtained	% Reduction
No.	-	-	Thickness	(mm)	
	AFBC Boiler Plant				
	Transfer house No.5				
	Column				
1	Column A1 (300)	ISMB	7.50	7.60	-
2	Column A1 (300)	ISMB	7.50	7.40	1.33
3	Column B1 (300)	ISMB	7.50	7.70	-
4	Column B2 (300)	ISMB	7.50	7.40	1.33
The percentage of reduction in the thickness of column (web) varies from 0 % to 1.33% with respect to the original thickness.					

Inference of N.D.T. Results at Conveyor Belt No.6

Steel Thickness Gauge:

This test is performed to acquire the thickness of the Structural steel members, as per actual.

Sr.	Locations	Member	Standard	Thickness Obtained	% Reduction
No.	-	-	Thickness	(mm)	
	<u>AFBC Boiler Plant</u>				
	<u>Conveyor Belt No.6</u>				
	<u>Column</u>				
1	Trussel 1A (400)	ISMB	8.90	8.40	5.62
2	Trussel 2A (400)	ISMB	8.90	8.20	7.87
3	Trussel 2B (400)	ISMB	8.90	8.60	3.37

The percentage of reduction in the thickness of ISMB (web) varies from 3.37 % to 7.87 with respect to the original thickness.

Inference of N.D.T. Results at Transfer House no.6

Steel Thickness Gauge:

This test is performed to acquire the thickness of the Structural steel members, as per actual.

Sr. No.	Locations	Member	Standard Thickness	Thickness Obtained (mm)	% Reduction
<u>AFBC Boiler Plant</u>					
<u>Transfer House no.6</u>					
<u>Column</u>					
<u>Ground Floor</u>					
1	Column A1 (400)	ISMB	8.90	9.00	-
2	Column A2 (400)	ISMB	8.90	8.40	5.62
<u>3rd Floor</u>					
3	Column A1 (400)	ISMB	8.90	9.00	-
4	Column A2 (400)	ISMB	8.90	8.40	5.62
<u>4th Floor</u>					
5	Column A1 (400)	ISMB	8.90	9.40	-
6	Column A2 (400)	ISMB	8.90	9.40	-
<u>5th Floor</u>					
7	Column A1 (400)	ISMB	8.90	9.00	-
8	Column A2 (400)	ISMB	8.90	No Reading	
9	Column A3 (400)	ISMB	8.90	8.40	5.62
10	Column B1 (400)	ISMB	8.90	8.80	1.12
11	Column B2 (400)	ISMB	8.90	8.90	0.00
12	Column B3 (400)	ISMB	8.90	8.10	8.99

The percentage of reduction in the thickness of column (web) varies from 1.12 % to 8.99% with respect to the original thickness.

Inference of N.D.T. Results at AFBC Conveyor belt No.7

Steel Thickness Gauge:

This test is performed to acquire the thickness of the Structural steel members, as per actual.

Sr.	Locations	Member	Standard	Thickness Obtained	% Reduction
No.	-	-	Thickness	(mm)	
	<u>AFBC Boiler Plant</u>				
	<u>AFBC Conveyor belt No.7</u>				
	<u>Column</u>				
1	Column A1 (300)	ISMC	7.60	7.60	0.00
2	Column B1 (300)	ISMC	7.60	7.50	1.32
3	Column A3 (200)	ISMC	6.10	6.00	1.64
4	Column A4 (200)	ISMC	6.10	6.00	1.64
5	Column A5 (200)	ISMC	6.10	6.00	1.64
6	Column A6 (200)	ISMC	6.10	5.90	3.28
7	Column B2 (200)	ISMC	6.10	6.10	0.00
8	Column B3 (200)	ISMC	6.10	6.00	1.64
9	Column B4 (200)	ISMC	6.10	6.00	1.64
10	Column B5 (200)	ISMC	6.10	6.00	1.64
11	Column B6 (200)	ISMC	6.10	6.20	
12	Column A7 (300)	ISMC	7.60	7.70	
13	Column B7 (300)	ISMC	7.60	7.50	1.32
	<u>Cross Bracing</u>				
14	Cross Bracing B1-B2 (100x100x10)	ISA	10.00	8.40	16.00
15	Cross Bracing B2-B3 (100x100x10)	ISA	10.00	8.80	12.00
16	Cross Bracing B3-B4 (100x100x10)	ISA	10.00	9.80	2.00
17	Cross Bracing B4-B5 (100x100x10)	ISA	10.00	9.80	2.00
18	Cross Bracing A1-A2 (100x100x10)	ISA	10.00	9.80	2.00
19	Cross Bracing A2-A3 (100x100x10)	ISA	10.00	8.80	12.00
20	Cross Bracing A3-A4 (100x100x10)	ISA	10.00	8.40	16.00
21	Cross Bracing A4-A5 (100x100x10)	ISA	10.00	9.00	10.00

The percentage of reduction in the thickness of Column ISMC (Web) 0.00 to 3.28% and Cross bracing ISA 2.00 to 16.00%.

Recommendations / Conclusion:-

- The structures under reference (**Conveyor support structures of belt nos. 5, 6 & 7 & Transfer Towers of AFBC plant**) are in service and performing over twelve years in spite of the heavy demand for regular maintenance due to combined effects of age, various loading conditions and aggressive severe corrosive environments.
- The area being located typically in a cyclone prone zone has experienced torrential rains. An effect of dynamic wind loads to such isolated structure situated at higher altitude has clearly caused stresses on its members as noted invariably.
- The distresses like severe corrosion in the supporting steel members (at top, bottom & vertical framing system, bracings; locally), complete deterioration of the particular localized members especially the steel plates provided at the walkways etc. are the areas of concern. Few structural elements noted with considerable reduction in the thickness (as per the readings obtained by N.D. Testing done at representative locations), confirms the deteriorated condition of the localized structural elements. **Hence, localized replacement of the said deteriorated steel elements as also further strengthening has to be done and need to be followed for the proposed rehabilitation work. However, the said strengthening work shall be done according to the detailed design.**
- Most of the distresses related to the inadequate connection details need be re-done with providing ideal connection details as can be best designed with improved specifications.
- **Vertical support system of conveyors (i.e. Trestles) needs strengthening according to the actual design. Provision of additional trestles also required for enhancing the load carrying capacity of the conveyor belt support systems; according to the actual design.**

- Few General distresses like Existing corrosion of the steel members shall be removed as per standard methodology and all the Structural Steel members shall be treated with application of 3 coats of 'SUNPUGUARD' (a high quality Anti corrosive two component Polyurethane coating) or equivalent as per manufacturers recommendations. Proper surface preparation of all Structural Steel members shall be done before application of SUNPUGUARD or equivalent, as per manufacturer's recommendations.
- Severely damaged/fallen/broken A.C. sheets of cladding & roof shall be removed and replaced with new sheets, as per the existing design with the material of similar specifications.
- This is the broad assessment of the structural health at this stage.

C.Y.Chandanshive
Project Manager

Mahendra Barde
Sr. Associate

J. C. Kadam
Technical Director

