Total Quality Control Approch for reduction in percentage repair for new water conductor system khopoli

By

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ABSTRACT

This is a case study of total quality control approach for reduction of percentage repair during fabrication and erection of new water conductor system. The Sub-merged Arc Welding without SMAW backing was used for welding of A517 Gr. F & Sumiten 780s (Quenched & Tempered steel). This process was used for the fabrication of penstock / steel liner for tunnel in M/s. PES Engineers workshop at Madap. The procedure was qualified by PES in workshop. While implementing the procedure on job, the percentage repair was 8 to 16% during December 2002 to April 2003. The paper describes how percentage repair was reduced using total quality control approach.

INTRODUCTION

Khopoli Penstocks of M/s. Tata Power Company Limited are almost 90 Years old and have outlived their lives. Khopoli Tunnel Project is being taken up as a replacement project for the existing penstock, which besides being more reliable shall also improve efficiency and minimize maintenance cost. The entire stretch traverses the hilly terrain of Western Ghat and crosses the busy Mumbai Pune railway lines and tunnels, both the express and national Highway and inhabited areas of Khandala. The length of tunnel liner / penstock for new water conductor system Khopoli is 3.8 km, Comprising of 6000 MT A517 Gr. F and Sumiten 780s steel. The plate thickness is ranging from 12mm to 72mm. The total job is divided in to two stretches called Stretch I and stretch II.

Stretch I: Comprising of 2650 MT and 7347 meters welding length. This stretch is awarded to M/s. Skanska Cementation (I) Ltd. M/s PES Engineer limited was subcontractor of M/s Skanska for the fabrication and erection

Stretch II: Comprising of 3300 MT and 4848 meters welding length. This stretch is awarded to M/s. L&T ECC.

M/s PES engineers have started fabrication at Madap workshop in June 2002 onwards. The repair percentage for Dec 2002 and January 2003 and February 2003 were 16, 16 and 15. This was a very high repair percentage. Paper describes how repair percentage was reduced using 7 QC tools.

INVESTIGATIONS

M/s PES and Skanska had arranged welding experts for anlysing above. But situation did not improve for three months. They thought that defects were because of new procedure. Then they wanted to discontinue the SAW procedure. But the defects were also found in conventional SAW procedure. Brain storming session was arranged involving PES welders, welding engineers, third party inspectors, SKANSKA engineer, and TPC engineer. The defect data was collected. The defects were classified as shown in table 1. The histogram of type of defects versus incidence of repair .was prepared and is as shown in figure 1. The Pareto diagram was drawn for the same and is as shown in figure 2. The vital few defects are lack of fusion and rounded crack or fish eye. Hence elimination of rounded crack indication and lack of fusion can reduce the percentage repair. Fish bone diagram was prepared for each defect as shown in figure 3, 4 and 5 using data in brain storming session. The problems identified are :-

a) NDT backlog prevents us to take corrective action in time

	Total Repair	Type of repair					
		Slag	LOF	Fish Eye/ Rounded crack	Crack	Porosity	Undercut
Long seam	142	35	58	47	0	2	0
Circular seam	128	32	45	42	0	8	1
Total	270	67	103	89	0	10	1

Table : 1

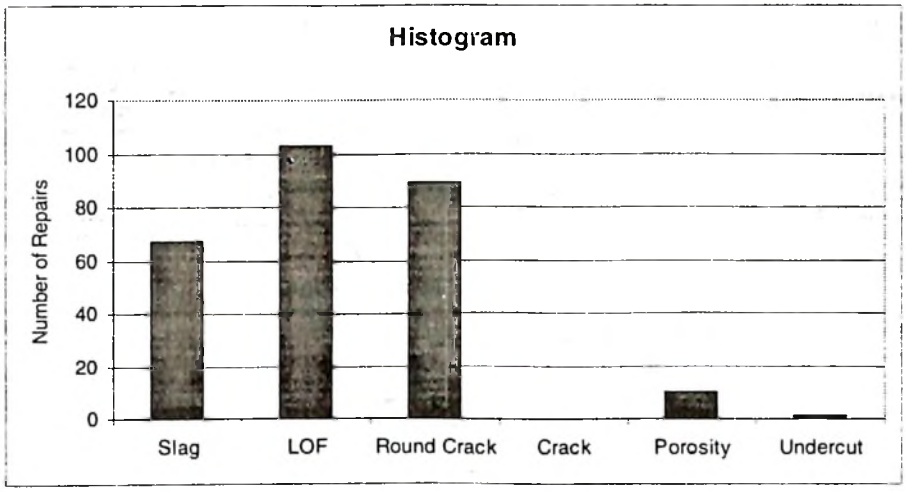

Fig. 1

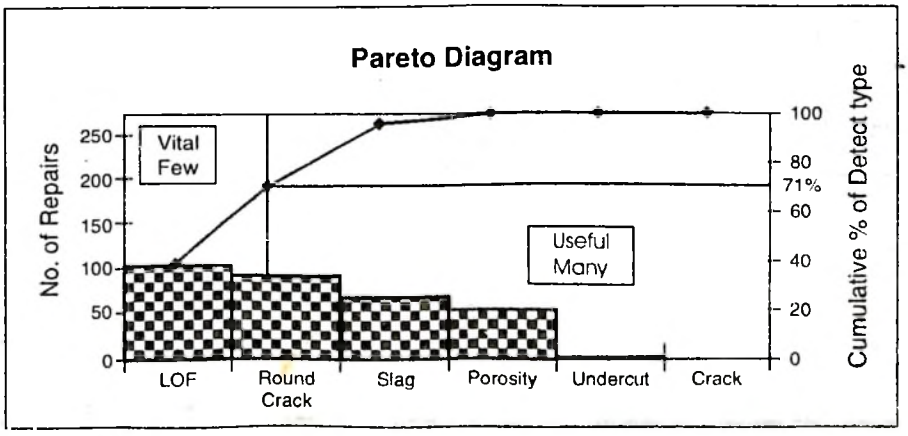

Fig. 2

b) Lack of fusion, fish eye and slag were prominent defects
c) Welding procedure employed was new for welders and employed for first time
d) Improper storage and use of flux leads to fish eye type crack
e) Rotators had a problem, pipe was jumping while long seam passes rotators
f) Welding machines were not giving required welding parameters.
g) Welding supervision was inadequate and less qualified

Following actions were taken to avoid the defects :-

a) Additional NDT contractors were mobilized to get the NDT done in time for immediate corrective action
b) Old Welding machines were replaced with new machines
c) Flux storage procedure given by manufacturer was followed with more care.
d) Quantity of flux was increased while welding joints so that arc cover was increased.
e) Long seam at the rotators were made flush by grinding to avoid jumping of pipe while welding circular seam.
f) Additional welding supervisor were employed for night shift.
g) Welder performance report was prepared monthly. Welders were warned if percentage repairs exceeded satisfactory level. The welders were disqualified if they were not able to improve performance even after repeated warnings. Feedback was given to welders, some times welders were warned and some welders disqualified on the basis of poor performance.

CONCLUSION

The repair percentage was reduced from 16% to within 4% for following months as shown in figure 6. The before and after pareto diagram was drawn and as shown in figure 7. Similar exercise was done for erection repair percentage and monitored Below 4% as shown in figure 8.

CAUSE EFFECT DIAGRAM FOR LACK OF FUSION

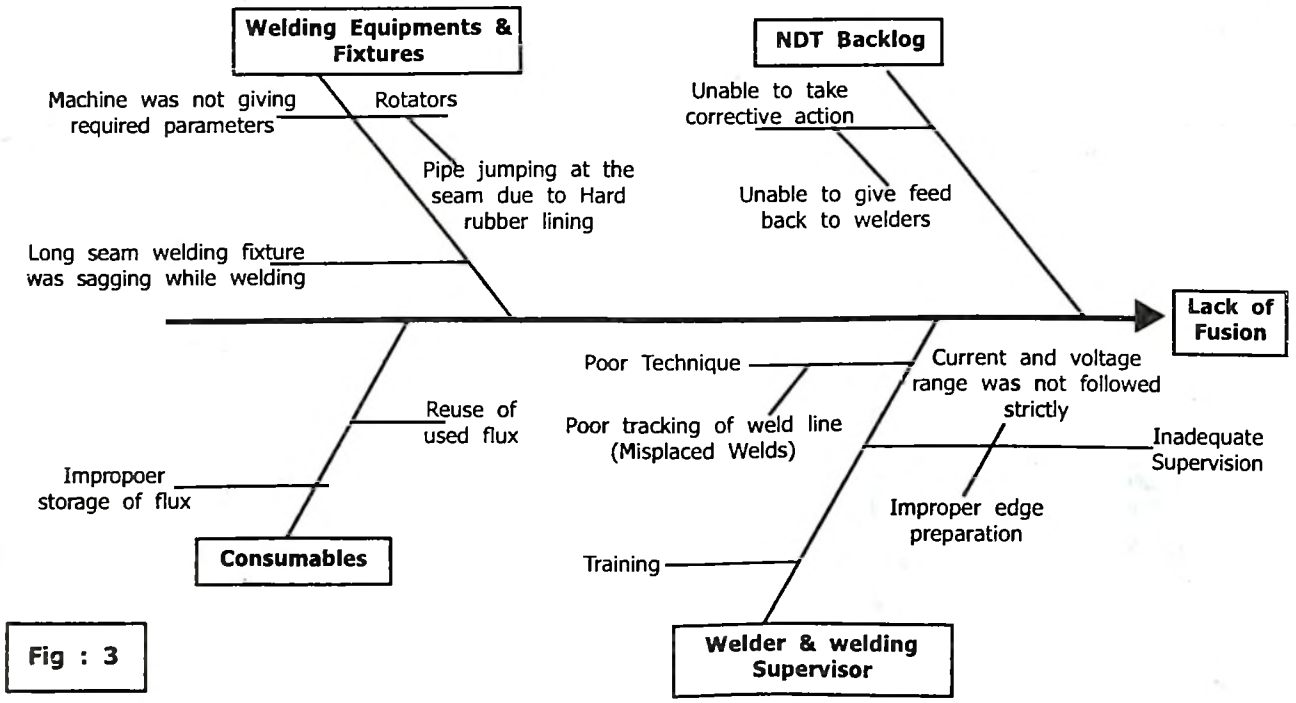

Fig : 3

CAUSE EFFECT DIAGRAM FOR ROUND CRACK

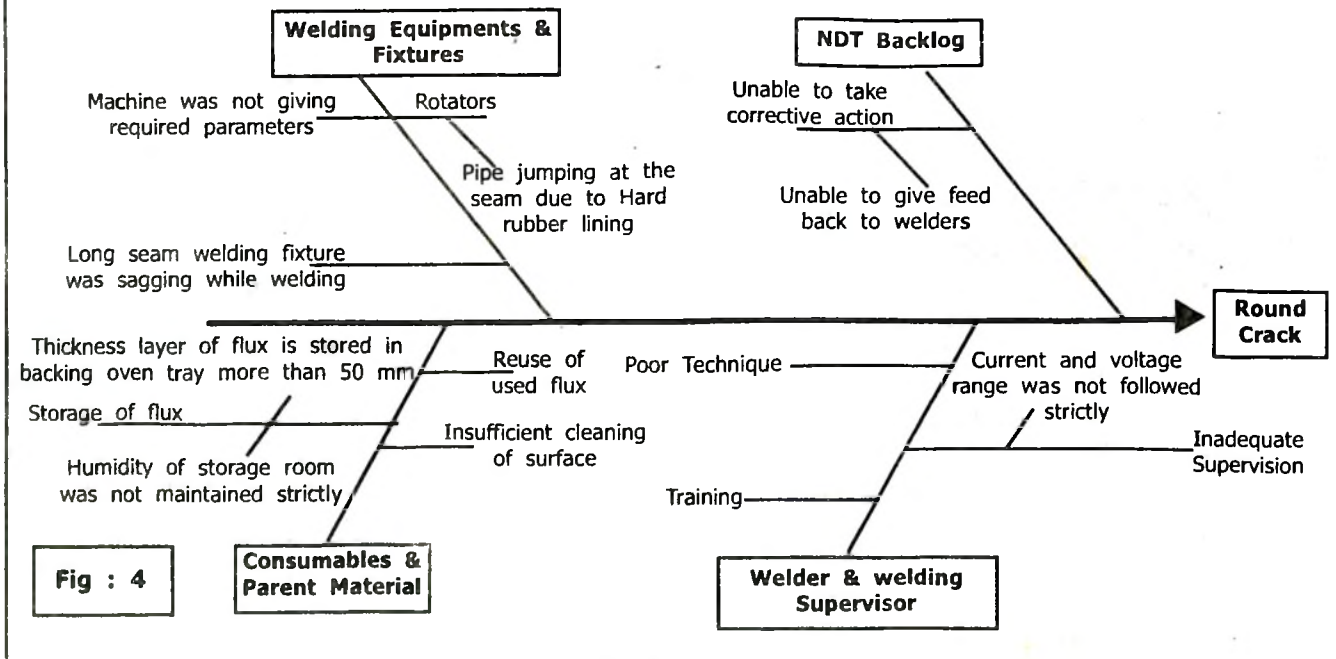

Fig : 4

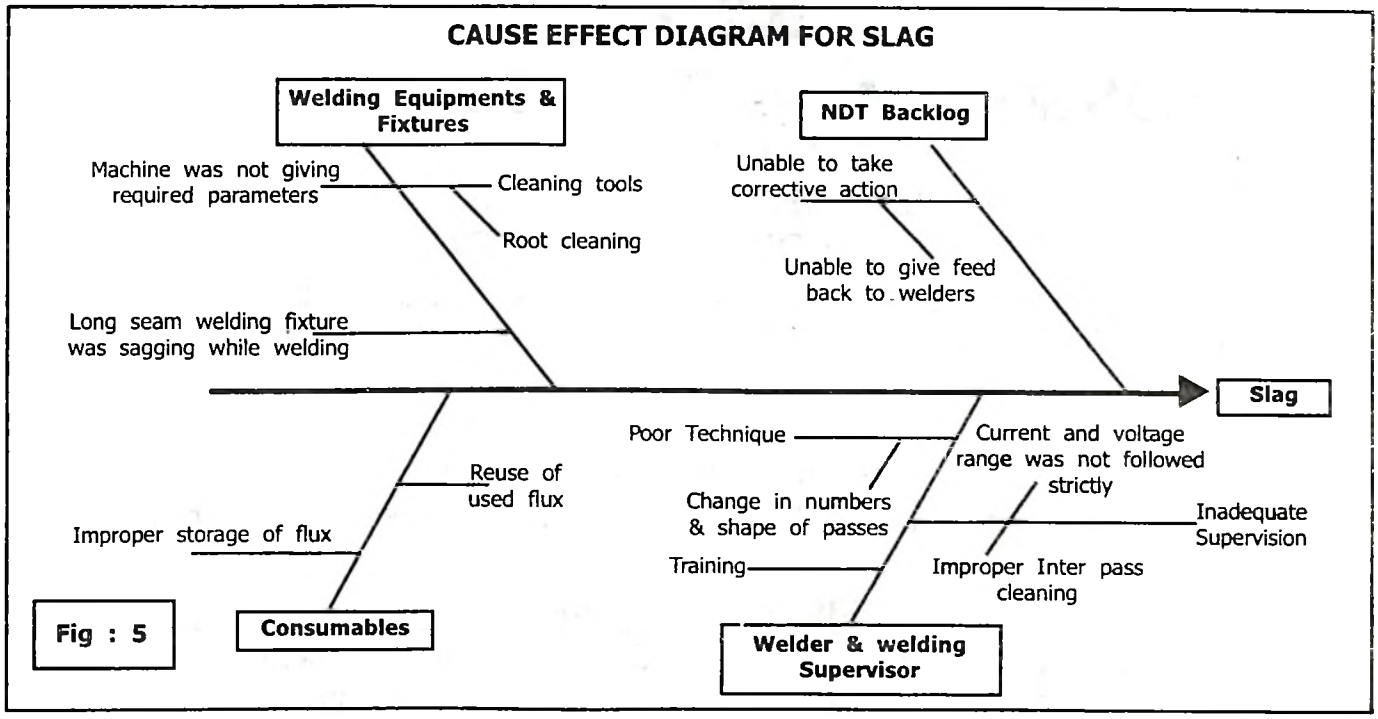

Fig : 5

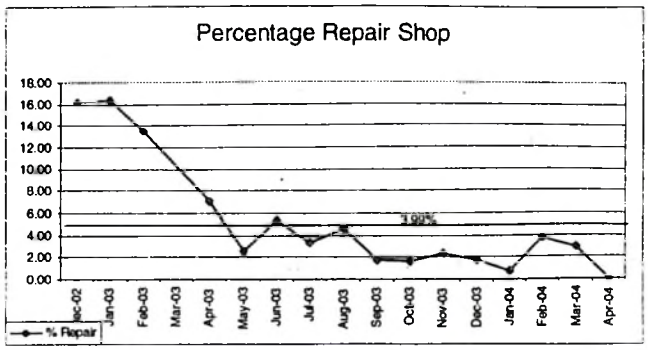

Fig. 6

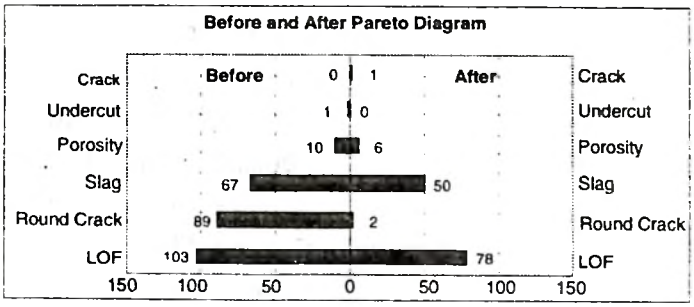

Fig. 7

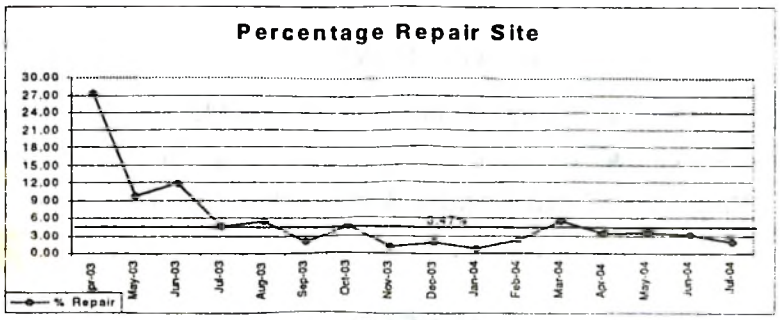

Fig. 8

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