Performance Improvement and cost reduction using Quality Tools

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ACC Limited
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- Way Forward
**Introduction**

ACC (ACC Limited) is India's foremost manufacturer of cement and concrete. ACC's operations are spread throughout the country with 17 modern cement factories, more than 55 Ready mix concrete plants, 21 sales offices, and several zonal offices. It has a workforce of about 9,000 persons and a countrywide distribution network of over 10,000 dealers.

- **ACC was incorporated on August 1, 1936**, in a historic merger of ten cement companies belonging to four business groups giants like Tatas, Kataus, Killick Nixon and F E Dinshaw groups.
- **ACC became Holcim group company in 2005**
- **ACC is first among equals**

1947 - First indigenous plant at Chaibasa, Jharkhand
1956 - First with bulk cement distribution at Okhla, Delhi
1961 - First with blended cement using blast furnace slag from TISCO
1978 - First to introduce energy efficient precalcinator technology
1982 - First to commission a 1 MTPA cement plant at Wadi, Karnataka
1994 - First to start commercial manufacture of Ready Mixed Concrete
2011 - World’s largest cement kiln installed at Wadi Karnataka, with a capacity of over 13000 MT of clinker per day
ACC: Nationwide footprint

- **Nationwide Plant presence**
  - 17 cement plants
- **ACC Cement Capacity**: 30.4 MT
- **ACC Clinker Capacity**: 18.0 MT
Performance Improvement Journey through SPC @ ACC Ltd

Quality tools and Systematic Problem solving methodology for achieving Process Excellence at each stage of Cement manufacturing to enhance Core Business & Customer Satisfaction.
Cement manufacturing Process

(1) Quarry: Lime Stone extraction, (2) Raw material storage and preblending, (3) Raw Meal feeding system, (4) Raw Meal grinding, (5 to 8) Pyro process for production of Clinker (Feeding system of Kiln feed / Preheater /Coal grinding / Kiln and Cooler), (9) Cement Grinding section (10) Cement packing and Dispatch.
Cross Functional “People Power”
**Need for SPC at ACC**

**Appraisal Costs**
- Verification
- Quality Audits
- Inspection Equipment

**Prevention Costs**
- Quality job planning
- Quality assurance
- Training

**Failure Costs**
- Rework & rectification
- Re-inspection
- Downgrading of process performance
- Waste
- Failure analysis
- Internal Customer complaints

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Key focus areas: 6 core dimensions

Core areas for the competitiveness & improvement

- Sales
- Quality / Production
- Quarry / Mines
- Maintenance
- Energy (Thermal / Electrical)
- Safety

To drive Tangible & Intangible benefits
Sectional approach of Quality tools and data evaluation

Flow of Process

Process Control Variables

Raw Mix

Pyro

Cement Grinding

Quality Assurance Interface

Review of Process Capability index (CpK) of Quality Parameters at each stage of process to reduce the variability and improve the Equipment health factor

Based on “SIPOC” concept:-

Supplier Input Process Output Customer

Raw Material Preparation

- LSF
- Residue

Kiln Feed

- LSF
- Residue

Clinker

- Free Lime
- LSF

Cement

- SO3
- R45 Mic

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Problem Solving tools and Project methodology

**Basic problem solving tools**

1. Check Sheet
2. Stratification/Classification
3. Pareto analysis
4. Cause & effect diagram
5. Histogram
6. Scatter plot
7. Graphs & charts

**SPC project methodology**

1. Problem Identification
2. Observation
3. Analysis
4. Action
5. Check
6. Standardization
7. Conclusion
Process Engineer to update process control chart. They should discuss variations in control charts with the Operator during the shift and log the corrective action to be taken to eliminate assignable causes.

- The process control charts to be displayed in respective control room.
- Analyze the charts with the help of process engineers.
- Handover the charge to the next shift operator explaining him about the variations and corrective action taken.

On daily basis review control charts and plan for effective corrective action in the process and equipments.

To hold weekly review meetings with Process engineers and operators and ensure implementation of the action plan. Development of Control plan and Preparation of SOPs.

To review progress on monthly basis with the team and present status in regional monthly review meetings.

<table>
<thead>
<tr>
<th>Time</th>
<th>Parameter Value</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0.35</td>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
<td>0.55</td>
</tr>
<tr>
<td>4</td>
<td>0.65</td>
</tr>
<tr>
<td>5</td>
<td>0.75</td>
</tr>
<tr>
<td>6</td>
<td>0.85</td>
</tr>
<tr>
<td>7</td>
<td>0.95</td>
</tr>
<tr>
<td>8</td>
<td>1.05</td>
</tr>
</tbody>
</table>

**Parameter Value**

- **Value**
- **X avg**
- **UCL**
- **LCL**

**Signal**
Data evaluation approach

**Daily Production Meeting**

Key parameter tracking on daily basis.

**Action plan**

Action log is created as per gap analysis for performance tracking.

**Weekly CCR Meeting**

Weekly Control room meeting is held to take care of even small concerns of the operators.

**Downtime Analysis**

Use of Pareto’s for Downtime Analysis of the Equipments.

**Root Cause Analysis**

Use of Cause & Effect diagram for Root Cause(s) identification.

**Weekly CCR Meeting**

Weekly Control room meeting is held to take care of even small concerns of the operators.

**Root Cause Analysis**

Use of Cause & Effect diagram for Root Cause(s) identification.

**After Action Review**

Third party inspection by people of different department and Creation of completed Action Log.
Quality tools: Awareness for Capability buildings

- Training at Control room by Plant Champions
- Training to Shop floor associate
- Training and involvement of cross fn team
- Review of key parameter with cross fn team
- Online display of Quality control tools for review and evaluation.
- SPC at SAP system –Quality data base management & review
Performance review and People Engagement

- Performance Board at job site / department
- Daily Performance dialog at job Site
- Performance review & sharing with team

Gate meeting at Plant: For awareness of plant performance and recognizing individual or Team by Top management

Monthly Reward and Recognition at unit level
### Sectional Projects’2013

- **Project status:** Total 80 development projects for the year 2013
- **Sectional distribution of Projects:**

<table>
<thead>
<tr>
<th>Project'2013</th>
<th>Region-wise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>North</td>
</tr>
<tr>
<td>Safety</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>3</td>
</tr>
<tr>
<td>Quarry/Mines</td>
<td>5</td>
</tr>
<tr>
<td>Production</td>
<td>5</td>
</tr>
<tr>
<td>Energy/Power</td>
<td>2</td>
</tr>
<tr>
<td>Packing Section</td>
<td>1</td>
</tr>
<tr>
<td>Lubrication</td>
<td>1</td>
</tr>
<tr>
<td>Sales Unit</td>
<td></td>
</tr>
<tr>
<td>Cost/FICO</td>
<td></td>
</tr>
<tr>
<td>Maintenance/Electrical</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>18</td>
</tr>
</tbody>
</table>
Project methodology: Planning Cycle

1. Project Identification
   - Deep drive with Team for identification of Sectional improvement Project.
   - Schedule meeting & Conference call with Project leaders.

2. Discussion with Core & Regional Team
   - Review meeting with SPC core team
   - Review with Regional Technical coordinator and Plant team.
   - Finalize the key Potential Projects.

3. Training on Project methodology
   - SPC Project methodology training by MIQ faculty to participants.

4. Road map for Project completion
   - Creation of Road map for completion of each step as per Project methodology.
   - Primary review of Project and team formation by SPC core team.

5. Regional review for SPC Project
   - Regional Project review with Technical coordinator & MIQ to support & guidance as per methodology.

6. Evaluation of Project
   - Evaluation through Conference
   - Evaluation at Unit level & Regional level.
   - Selection of Best Project

7. Awards & Accolades to Project leaders
   - Corporate level- Reward & Recognition for improvemental Best Project.
   - Process Excellence award.
   - "Encouragement awards" for sectional improvements in new areas.

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Success story of Project

Completed in Y’2012

Project title: To reduce the Clinker factor in Cement grinding.

Plant Name : Gagal Cement Works (Himachal Pradesh)

Systematic approach of Project:-

a) Problem solving methodology
b) Involvement of Cross Function Team
c) Project time frame (April to Oct’2012)
d) Focus on Input and Process variation at each stage.
e) Tracking and continuously monitoring of process and Quality parameter.
f) Action plan and complete the job accordingly
g) Verify the results of completed Action point.
h) Changes in operating philosophy of Cement grinding by SOP
i) SOP of job and Horizontal deployment in other unit.
As per “Q&PD-Thane” recommendation: Optimization of raw mix design and improvement in Limestone pile formation results into increase the clinker one day strength.
We have reduced the clinker Factor after continuous improvements in Clinker Quality, cement mill circuit, Fly ash feeding system proper maintenance and implementation of initiatives by team.

**Project saving on Annual basis:** Rs 47 Lakh

Clinker factor reduction by 4.14%  
(Jan to May ‘2012 : 67.40 vs June to Dec:63.26%)
Sustainable performance: Year’2013

Performance sustain and continuously improved in Year’2013

Clinker Factor of Gagal II

Clinker factor reduction in Y’2013 by 2.6 % wrt Y’2012
Success story of Project’2013

- **Completed in Year’2013**
- **Project title:** To reduce the Specification Electrical Energy consumption of Clinkerisation from 65.58 to 62 Kwh/tClk.
- **Plant name:** Wadi Cement Works (Karnataka)
- **Electrical Energy of clinkering**

![Clinkering power Vs Production graph]

- **Power reduction by 3.25 Kwh/t.**
  - (Y’2012 : 65.60 vs Jan to Aug’2013 : 62.35)
  - Saving of Rs 18.14 per ton of Clinker.

**Project saving:** Rs 18 per ton of production
Electrical Energy consumption: ACC

ACC plants: Total Electrical Energy consumption

<table>
<thead>
<tr>
<th></th>
<th>Year 2012</th>
<th>Jan – Sep’2013</th>
</tr>
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<tbody>
<tr>
<td>Up to Clinker</td>
<td>73.4</td>
<td>71.25</td>
</tr>
<tr>
<td>Grinding</td>
<td>40.95</td>
<td>39.23</td>
</tr>
<tr>
<td>Total Cement</td>
<td>88.13</td>
<td>85.08</td>
</tr>
</tbody>
</table>

Total Electrical Energy consumption reduction by 3 Kwh/t.
 ACC plants: Total Thermal Energy consumption

Total Thermal Energy consumption reduction by 11 MJ/T
Projects saving: Y’2010 to Y’2013

<table>
<thead>
<tr>
<th>Year</th>
<th>SPC Projects</th>
<th>Savings on Annual Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>29</td>
<td>11</td>
</tr>
<tr>
<td>2011</td>
<td>46</td>
<td>17.1</td>
</tr>
<tr>
<td>2012</td>
<td>68</td>
<td>61</td>
</tr>
<tr>
<td>2013</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

* Project’2013 – Under Evaluation

* Expected Saving

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Corporate level: Reward & Recognition Programme

Hon’ble CEO & MD Mr. Kuldip Kaura, addressing the participant during SPC Certification ceremony.

Participant from Pan ACC during programme.

SPC trophy for Best Project & Encouragement Award.

Prize distribution ceremony for Best Project by H’ble CEO & MD Mr. Kuldip Kaura.

Certificate distribution by Dean – MIQ & ACC-SPC core member.

SPC Team group photograph with Dignitaries.

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Passion for “SPC” (Statistical Process Control)

- **Set the Culture**
  - Make SPC a Condition of Success
    - Data analysis through problem solving tools to meet the Objectives
    - Goals and KPIs

- **Drive Accountability**
  - Reinforce Leadership & Establish Structures
    - SPC responsibility with Line Management
    - Corporate supports
    - Local committees (CCR, Lab, Site)

- **Mobilize People**
  - Enhance Skills and Competencies
    - Training various levels (CCR, lab, Site Operations)
    - PMA approach for SPC projects
    - Keeping momentum via good communication

- **Accelerate Performance**
  - Monitoring and Recognizing
    - Analysis of performance and consequent actions
    - Review mechanism
    - Feedback for improvement
SPC journey @ ACC limited

2014
- SPC Project align with "Institutionalizing Excellence”.
- Sustainable improvement by imparting trainees to new people
- Re orientation training to previous trained people.
- “LIMS” data integration with SAP^SPC Platform.
- Expand the horizon of SPC projects to other section.
- Passion for SPC & Set a Quality Culture to accelerate the performance

2013
- SPC Project align with "Institutionalizing Excellence”.
- Feasibility of “LIMS” data integration with SAP^SPC Platform.
- Expand the horizon of SPC (Mines Diesel, Sales unit & logistics.
- Weekly review of SPC (CpK) and Conference call with Team

2012
- Expand the horizon of SPC (Sales unit, HR, Plant logistic, Added)
- Standardization of improvements.
- SPC-SAP system for new unit, new product portfolio.

2011
- Sustainability of Performance by involvement of 2009 batch
- Plant SPC Champion for coordinating development project.
- SAP system hookup with Excel
- Rewards and Recognition at Corporate level.

2010
- “SAP” system implementation
- Expand the horizon of SPC concept (Mines, Maint, E&I Added)
- Formation of SPC plant champion & Regional coordinator.
- SPC Project share folder (Region-wise)

2009
- Performance analysis based on Sectional Cp k achieved
- Review of Specification limits & Target setting
- Analysis of control charts – Shift wise, Development of trainers at plant level
- SPC Project initiated at all stages, Implementation of SPC at extraction stage
- Implementation of training, SPC awareness by MIQ- Nasik

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Way Forward for Sustainable improvement

- “Manufacturing Excellence” through implementation of SPC tools and systematic problem solving methodology.
- SPC Champion at each Plant & Regional Coordinator to support the Project Leader & his Team for pursuing of sectional developmental project.
- Monthly review of SPC report with cross functional team at Plant and Regional meeting.
- Sustainable improvement by imparting Training for new participants and Project leaders.