



Total Productive Maintenance

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Bay Area Facility Management Show – Total Productive

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Making Buildings Perform Better

Best Practice

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Karim P. Allana, PE, RRC, RWC

- **Education:** B.S., Civil Engineering, Santa Clara University
- **Registration:** P.E., Civil Engineering, California, Washington, Nevada, and Hawaii
- **Certification:** Registered Roof Consultant (RRC), Roof Consultants Institute, and Registered Waterproofing Consultant (RWC)



- **Overview:**

- CEO and Senior Principal at Allana Buick & Bers.
- Former Turner Construction Employee (Project Engineering and Superintendent)
- Over 37 years experience providing superior technical standards in all aspects of building technology and energy efficiency.
- Principal consultant in forensic investigations of building assemblies, failure analysis, evaluation and design of building infrastructure and building envelope evaluation and design.
- Expert in all aspects of building envelope technology.
- Completed numerous new construction, addition, rehabilitation, remodel and modernization projects for public and private sector clients.
- Specialization in siding, roofing, cement plaster, wood, water intrusion damage, window assemblies, storefronts, below grade waterproofing, energy efficiency, solar engineering and complex building envelope and mechanical assemblies.

ABBAE Firm Overview

- Allana Buick & Bers (ABBAE) is an Architectural Engineering firm specializing in Building Envelope Systems
- ABBAE is one of the 5 largest building envelope consultants in the country
- ABBAE has over 33 years of experience & over 12,500 projects
- ABBAE is also a leading Forensic Defect firm with hundreds of forensic projects (litigation)
- Locations – 16 offices across California, Nevada, North Carolina, Oklahoma, Oregon, Texas, Virginia, Washington, Colorado and Hawaii



Staff & In-House Expertise

- Licensed Professional Engineers – Civil, Structural, and Mechanical
- Registered Architects
- Building Enclosure Commissioning Process Providers (BECxPs)
- Registered Building Envelope Consultant (RBEC)
- Registered Roofing Consultants (RRCs)
- Registered Waterproofing Consultants (RWCs)
- Registered Exterior Wall Consultant (REWCS)
- Registered Roof Observers (RROs)
- Certified Exterior Insulation and Finish System (EIFS) inspectors
- Curtain Wall Specialists
- ICC Certified Building Inspectors
- Quality Assurance Monitors
- Water Testing Experts
- Leak Investigation and Diagnosis Experts
- Infrared Imaging and Nuclear Moisture Scanning Experts

ABBAE Building Expertise

- Building Envelope Systems

- Roofing Systems
 - High-Slope/Low-Slope Roofs
 - Green/Garden Roofs
 - Drainage Systems
 - Pedestrian Plazas
- Exterior Wall Systems
 - Wall Cladding/Siding/GFRC/pre-cast
 - EIFS/cement plaster/stucco
 - Sheet Metal Flashings
- Windows and Glazing Systems
 - Punched Windows
 - Curtain Wall/Window Wall Systems
 - Sliding Glass Doors
 - Skylights

- Building Envelope Systems (cont'd)

- Roofing & Waterproofing Systems
 - Deck/Balcony/Lanai Waterproofing
 - Podium Waterproofing
 - Pool/Spa Deck Waterproofing
 - Above-Grade/Below-Grade Waterproofing
 - All types of low and steep sloped roofing
- Commissioning BECx
 - OPR/BOD/Commissioning Plan
- Mechanical/HVAC Systems
 - HVAC design
 - Plumbing systems
 - Commissioning and testing

ABBAE Core Services

- Consulting and third-party peer review services
- Engineer of record for building envelope systems
- Contract administration services
- Inspection services (usually direct with owner)
- Air and water performance testing
- Mock-up design, observation, and testing
- Building assessments and forensic investigations
- Litigation support and expert witness services
- Educational seminars with AIA credits



Operations and Maintenance is ...

- Interactive process of establishing methods, means and materials to maintain and operate the facility for its designed use and for its design lifetime...

TOTAL PRODUCTIVE MAINTENANCE IS...

- An innovative approach to maintenance
- Creatively combines preventive, predictive and maintainability improvement techniques with principles of design-to-live cycle cost
- Assure reliability in function and ease of maintenance

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- **BUT FIRST, SOME BASICS**

Facilities Managers Flow Chart



Strategic Planning

- Definition: Space needs set by business needs: support the business
- Issues: Facility timing, sizes, location, types
- Strategic planning is a process – tied to the business strategy or business plan
- 80/20 rule – 80% of issues can be addressed with 20% of the effort, during the strategic planning process

Programming

- Definition: Determine requirements for specific facility and specific project
- Issues: Square footage, affinities, requirements and special requirements
- Consideration of four issues: function, form, economy, time
- Programming is: getting to the essence
- See: Problem Seeking by William Pena, AIA Press

Space Planning

- Definition: Space allocation and negotiation. It is the TACTICAL response to Business Strategy and Strategic Facility Plans
- Issues: Space layout and plans
- Good space planning early on (80/20 rule also applies) makes the job of the facility manager that much easier in the long run
- Space wars needs to be resolved at the highest level in the Company

Project Management and Construction

- Definitions: Preparation of construction details and specifications
- Issues: Method of delivery of project
- Merges the strategic issues, programming issues and space plans
- Scope, cost, quality, time and communication
- Direct involvement of all parties

On Site Facilities Management

- Definition: Operations, maintenance and the day to day issues
- Issues: Does the building continue to function it the way it was intended?
- Facility manager needs to understand how the process brought the facility to its current state
- Sell ourselves!!

Finite Stages of a Building's Life

- **Conceptual Planning** – *General Concepts, Schematic Drawings, Master Plans*
- **Design** – *Architectural Renderings, Schematic Design, Design Development, Construction Drawings*
- **Procurement** – *Construction Contracts, Contracts, lowest responsive bid, lowest responsible bidder*
- **Construction** – *all types, Traditional design bid build, design build, spec build*
- **Start Up** – *Building Commissioning, burn in, shake down, initial operation, hand over, punch list*
- **Operations** – *how many years? Occupation and use, repair and rehabilitation, maintenance, operations*
- **Demolition**

Total Productive Maintenance

- Seiichi Nakajima is the father of TPM
- Innovative, somewhat still new, approach

“TPM is an innovative approach to maintenance that optimizes equipment effectiveness, eliminates breakdowns and promotes autonomous operator maintenance through day to day activities involving the total work force...(it) creatively combines preventive, predictive and maintainability improvement techniques with principles of design-to-live cycle cost, to assure reliability in function and ease of maintenance.”

From *Introduction to TPM* by Seiichi Nakajima

Total Productive Maintenance

- Maximize equipment effectiveness
- Maintenance for the life of the equipment
- Cross-functional
- Employee involvement in teams
- Small group activities

Stages of Total Productive Maintenance

- Breakdown maintenance cycle
- Preventive maintenance cycle through routine maintenance
- Predictive maintenance cycle through operator involvement and studying operating procedures and use
- Maintainability improvement through design integration

Stages of Total Productive Maintenance

- *Breakdown maintenance*
- *Preventive maintenance*
- *Predictive maintenance*
 - *Design integration*

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- In short, TPM is the art of installing new equipment and processes, 30 seconds before they are needed.

IS THIS POSSIBLE?

Mechanical System Examples

- Examples of breakdown maintenance
Repair an HVAC system only when it fails
- Examples of preventive maintenance
Change filters, belts, etc on a regular basis
- Examples of maintenance prediction
Oil Analysis
Vibration Analysis
Infrared Sensing
[HVAC.ppt](#)
Pressure gauges
Detect line harmonics
- Examples of improvement through design
Sizing
Cycling
Lead/lag cycles
Know how long things “should last”
[Value.DOC](#)

Roofing TPM Examples

- Examples of breakdown maintenance

Fix leaks on call only [Roof patches.ppt](#)

- Examples of preventive maintenance

[Preventive Maintenance.ppt](#)

- Examples of maintenance prediction

[Diagnosis and Evaluation.ppt](#)

- Examples of improvement through design

[Metal roof.ppt](#)

Custodial TPM Examples

- Examples of breakdown maintenance

Individual toilet rolls – replace when empty

Clean areas only when needed

Replace burnt lamps only when a call is received

Empty trash bins only when full

- Examples of preventive maintenance

Place extra small rolls near the toilet

Clean areas on a cycle

Have an electrician visit areas of a building to find burnt lamps

Empty trash bins on a cycle

- Examples of maintenance prevention

Larger toilet rolls

Walk off mats at doors

Trash cans at the restroom exit doors

Group relamp

- Examples of improvement through design/early warning

[TPM bathroom.ppt](#)

[TPM Bathroom2.ppt](#)

[Toilet paper hanging.ppt](#)

Stages of Total Productive Maintenance

Breakdown maintenance

Preventive maintenance

Predictive maintenance

Design integration