Technical Challenges of Indoor Natatorium Design

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A presentation to identify technical challenges associated with the design of natatoriums facilities and examples of systems and approaches to address these challenges through good design planning and practice
INTRO

WELLNESS
DESIGN
MOISTURE
AIR QUALITY
THERMAL
CORROSION
LIGHTING
ACOUSTICS
SAFETY
Ron Witherspoon, AIA

- Architect at D/P/S
- Experience with pools and natatoriums
- On-call contracts with Albuquerque & Rio Rancho
- New pools in Gallup, Rio Rancho, and Belen
- Aquatic assessment in Farmington

This presentation is about natatorium design, wellness, and systems that work well over time.
• Evidence-based health and wellness research by medical professionals, scientists, and researchers
• People spending 90% of their time indoors
• Applications of universal design
• Limiting physical stress
• Opportunities for safe fitness
• Improve breathing
• Promotion of proper light exposure
• Alignment of circadian rhythm
• Adequate sound promotion and barriers
Identify the Users
Develop the program based on the use
Create Proper Relationships

- Isolate hazardous areas
- Separate office and lockers from pool
- Keep spectators off pool deck
- Circulate bathers through showers
Complement Other Site Amenities

- Identify the mechanical zone
- Adequate area for drop-off
- Solar orientation and glazing
- Play off existing site features
Lay Out Pool Deck Carefully Based of Uses

- Safe Exiting
- Proper places for life guards
- Places for timing equipment
- Spectator zones
- Competition zones
- Queuing areas for recreational users
Create Building Zones Based on the Site

- Keep spectators towards the entry
- Identify the back-of-house area
- Keep pool enclosure open
Separate Chemicals Rooms
- Direct seat-side access
- Limited access to public area
- Adjacent to mechanical rooms
- Vented and exhausted to outside
Mechanical Efficiency is Key

- Lower pumps to reduce head pressure
- Locate pumps close to the pools they serve
- HVAC near pool equipment
- Locate equipment inside when possible
Design Function

- Neatly organize chemical rooms, pump, and HVAC
- Direct outside access
- Wide paths and doors for delivery
- Utility service entries
- Separate structure
Once-through System

- Used in older natatoriums
- Cooling relies on exhaust for moisture control
- Energy inefficient
MOISTURE

Recirculating System

- Principles of heat recovery
- Determined fixation
- Energy efficient
- Reduction in water use
Wrap the Enclosure

- Design a continuous air barrier system for the exterior enclosure
- Use mechanical attachment methods where possible
Use high-performance fenestration systems
(Aligned with the thermal insulation, combined with active systems such as warm air washes, to minimize the incidence of interior condensation)
MOISTURE
COLD

LOW PRESSURE

HIGH PRESSURE
Minimize Evaporation
Principles of Condensation and Evaporation

- Air should be 2 degrees warmer than the water.
- The dew point of humid air is 62° F
Surface Condensation

- Avoid skylights and use translucent wall panel
- Avoid thermal bridging
- Avoid wall and ceiling cavities
- Balance mechanical systems
- Provide negative air pressure within the natatorium
The #1 HVAC Design Issue is Getting Air to the Breathing Zone!
## Air Quality

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Chlorination</td>
<td>Combines Chlorines (foul odor)</td>
</tr>
<tr>
<td>High pH Level or High Total Alkalinity</td>
<td>Scale Forming</td>
</tr>
<tr>
<td>Low pH Level or Low Total Alkalinity</td>
<td>Corrosion</td>
</tr>
</tbody>
</table>
Air changes per ASHRAE

- 4-6 per hour in a natatorium
- 6-8 per hour in a spectator area
- 8 per hour (occupied) in a water park
- Specify CFM needed to satisfy this requirement
Supply air to breathing zone!

- Supply air to where condensation is predictable
- Exterior Windows & Doors
- Return location must complement supply duct layout
Design continuous insulation for the enclosure and minimize the incidence of thermal bridges and structural penetrations through the insulation.
<table>
<thead>
<tr>
<th>Pool Type</th>
<th>Air Temperature</th>
<th>Activity Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competition</td>
<td>76° to 82° F</td>
<td>.65</td>
</tr>
<tr>
<td>Diving</td>
<td>84° to 88° F</td>
<td>.65</td>
</tr>
<tr>
<td>Elderly Swimmers</td>
<td>85° to 90° F</td>
<td>.8</td>
</tr>
<tr>
<td>Hotel</td>
<td>82° to 86° F</td>
<td>.8-1.0</td>
</tr>
<tr>
<td>Physical Therapy</td>
<td>90° to 95° F</td>
<td>.65</td>
</tr>
<tr>
<td>Recreational</td>
<td>80° to 85° F</td>
<td>1.0</td>
</tr>
<tr>
<td>Whirlpool / Spa</td>
<td>102° to 104° F</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Water Temperatures are Critical**

- More activity = greater air circulation
- Building HVAC zones for air temperature
Pool Chemistry is Key

- Water Quality
- Water Chemistry
- Dehumidification
- Air Circulation
Off-gassed chloramines have a strong attraction to the airborne humidity.

Chloramines = Corrosive Condensate
Use Simple Structural Systems

- Less surface area
- Avoid shelves
- Simple geometry and connections
- Pre-finished materials

CORROSION
Use the Right Materials

- Avoid specifying stainless steel for ductwork, use non-corrosive duct material
- Galvanized steel
- Aluminum
- Fabric

- Avoid using stainless steel in applications deemed ‘safety-critical’ or where components will not be frequently wetted or cleaned
Use the Right Finishes

- Use galvanized steel
- High grade paint systems
- Vinyl
- Plastics
Maintenance

- Easy to change lamps
- Even lighting across the water (Provide diffuse lighting to avoid glare)
Good lighting provides a safe environment
Even Lighting

- Provide regularly spaced lighting with heavier FC output
- Dual switching ability for energy savings
- Less glare for safety
Daylighting

- Avoid clear glass to the outside
- Use diffuse glazing for natural light
- Consider light shelves
Reflectivity

- Use reflective surfaces
- Use light colors
- Higher lighting around decks
ACOUSTICS

Principles of Acoustics

- Deflection
- Refraction
- Reflection
- Absorption
- Isolation
ACOUSTICS

Noise Levels

- Recreation
- Spectators
- Coaches
- Mechanical Systems
Deflection

- Nonparallel surfaces when possible
- Recessed openings
- Offset ceilings
Absorption
- Provide acoustical banner
- Wall panels
- Inset areas
ACOUSTICS

Isolation

- Isolate HVAC equipment to minimize harmonics
- Longer duct runs
- Adequate space for return air
- Equipment dampers
Chlorine is still the best sanitation system for a public pool facility
Maintain water chemistry and backwash regularly.
Provide good locations for lifeguards

- Slides
- Diving
- Rescue
REFERENCES

