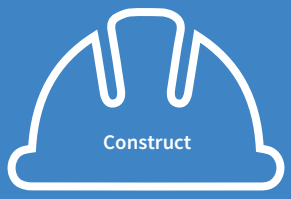
6.

CONSTRUCTION & POST OCCUPANCY

The construction and post-occupancy phases are often the least discussed phases of the architect/ designer's process. Build a discussion around what health means to a project from design, through construction to habitation.



CONSTRUCTION AND HEALTH

MATERIAL HEALTH IMPACTS DURING CONSTRUCTION

The construction phase has lasting health impacts on every project. But, during construction itself, the effects tend to be much more acute. Below you can find a few of the reasons that materials and procedures have such a dramatic impact during installation.

The jobsite is where both materials and people are most vulnerable because....

- ...materials are first unpacked, stored, cut, installed, disrupted and sometimes broken
- ...workers are handling or are in close proximity to these operations
- ...ventilation and climate control are frequently limited or non-existent

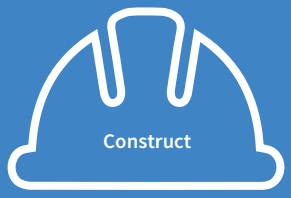
Within the life cycle of materials, the workers installing them have the highest risk because they are...

- ...the first to be exposed to off gassing of unpackaged new material
- ...inches away from wet applied products
- ...working directly in dusty environments from activities like grinding or sweeping

The invisible threats are frequently overlooked, such as...

- ...daily and prolonged exposure of less obvious odors or particulates
- ...contaminants brought home by workers on their clothes and shoes
- ...residual emissions from products affecting building occupants

Citations
Brock, Geoff. "Defining Practices and Coordinating Subcontractors." Presentation for Healthy Materials Lab online course, New York, NY. 2018.



STORAGE AND INSTALLATION

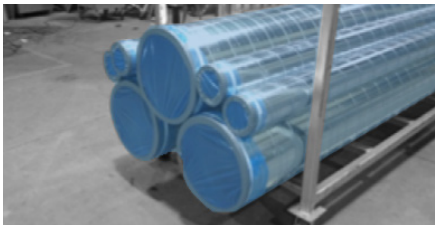
GUIDELINES FOR STORING AND INSTALLING DAMAGE-PRONE MATERIALS

Achieving a healthy building doesn't end with the design. During construction, material storage and air quality procedures play an important role in achieving health goals. Below we outline construction practices that can help prevent material damage and lasting damage to the indoor air quality. This both helps with creating a healthier space, and can also save money by preventing waste and by keeping the project on schedule.

ABSORBENT, FIBROUS, OR OTHER EASILY-DAMAGED MATERIALS

examples: wallboard, wood, insulation

- Store off of the floor
- Keep away from openings, as close to the center of the building as possible
- In large buildings, install a temporary roof for protection



MATERIALS WITH LONG-TERM IMPACT ON BUILDING HEALTH

examples: ductwork, mechanical systems

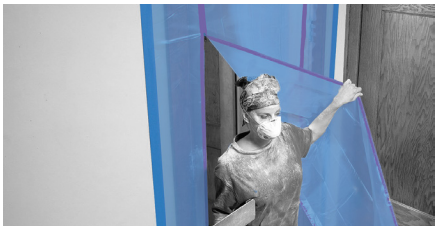
- Make sure they are delivered with plastic covering all of the openings
- Store wrapped and off of the floor
- Keep the plastic over the openings once they are installed, until construction is complete, to avoid contamination from dust-generating operations.

TYPE ONE AND TYPE TWO MATERIALS

examples | type one materials: composite wood products, paints, adhesives

examples | type two materials: carpet, fabric wallcoverings, upholstered furniture

- Install type 1 materials (those that off-gas) first. Allow them to dry and air out before installing type 2 materials (those that are susceptible to absorbing off-gassed contaminants).



OPERATIONS THAT GENERATE DUST

examples: sanding, cutting

- Isolate or areas where dust is generated from completed work

Citations
Brock, Geoff. "Protective Measures through Installation." Presentation for Healthy Materials Lab online course, New York, NY. 2018.
"Controlling Pollutants and Sources: Indoor Air Quality Design Tools for Schools," EPA, Accessed August 13, 2018, https://www.epa.gov/iaq-schools/controlling-pollutants-and-sources-indoor-air-quality-design-tools-schools

CALCULATING IMPACTS

METRICS AND TOOLS FOR CALCULATING IMPACTS

How can we begin to measure projects' health and environmental effects? Calculating avoided hazards and other quantifiable effects can help to track progress and to convey the importance of healthier design. Below you can find examples of metrics for calculating impacts as well as information on some tools that track impacts on a project scale.

METRICS

LCA/Carbon Impact

Measure the total carbon impact of the materials and products used throughout their life cycles

Hazard Avoidance

Six Classes

Use the Six Classes approach to avoid substances in six major classes of concern

Banned Lists

Used a banned list such as the LBC Red List to identify substances to avoid

Avoid Specific Hazards

Avoid hazardous substances such as PBTs or formaldehyde

VOC Emissions

Calculate health impacts by calculating and limiting VOC Emissions from materials and products.

TOOLS

Tally®

Tally® is a Life Cycle Assessment tool that integrates with a Revit® model and tracks carbon impact on a project scale.

PROS
- Integration with Revit®
- Potential promise of handing complete Revit® model to a contractor

CONS
- Compares common product profiles, not actual products available for purchase
- Only works well if model is very good
- Expensive and time-consuming to create a full list and quantity of materials within the software

Make your Own

Instead of using existing impact tracking tools, you may choose to make your own material tracking sheet.

PROS
- Can use color to code and make information more digestible
- Can be easier to share with clients
- Allows you to track metrics that are most important to your project

CONS
- Time-consuming to create the tool

Portico*

Healthy Building Network's Portico tool is a building materials evaluation application that integrates project management with HBN's material and product evaluation database.

*Note: As of November 2018, Portico is only available to Early Access Partners.

Citations
"Healthy Building Network and Google Announce Portico, a First-of-its-kind Building Materials Analytics and Decision-Making Tool." Healthy Building Network. Accessed November 21, 2018. https://healthybuilding.net/blog/221-healthy-building-network-and-google-announce-portico-a-first-of-its-kind-building-materials-analysis-and-decision-making-tool.
MacPherson, Rhys. "Tools for Calculating Impact." Presentation for Healthy Materials Lab online course, New York, NY. 2018.

THE NEW SCHOOL PARSONS HEALTHY MATERIALS LAB

MAINTENANCE AND OPERATIONS

Adapted from *The Collaborative for High Performance School's* "Best Practices Manual"

CREATING AN EFFECTIVE MAINTENANCE PLAN

Maintenance and operations play a key role in a building's continued health. Therefore, it is important that building managers and occupants understand the systems that were designed to maintain a healthy, sustainable building. *The Collaborative for High Performance Schools* outlines the key components of successful maintenance plan in their Best Practices Manual. These elements are explained below.

1. Educate occupants on the value of maintenance

A building's occupants play an important role in the continued health of a building. Sharing the benefits of a well-maintained space can help incentivize occupants to follow maintenance guidelines.

2. Establish a maintenance budget

When funds to manage a building become tight, maintenance budgets are often cut first. Ensure that there is enough money in the budget to properly maintain the building.

3. Hire qualified staff and contractors

Make sure that maintenance staff and contractors are qualified to maintain the health of the building.

4. Develop a preventive maintenance plan

Plan organized, routine maintenance in order to avoid system problems or failures. Preventive maintenance contrasts with reactive or deferred maintenance, which is performed to correct an existing problem.

5. Develop a *predictive* maintenance plan

Predictive maintenance involves the regular monitoring or testing of systems in order to predict problems. Predictive maintenance tasks can include tracking characteristics like temperature, efficiency, or vibrations.

6. Use a work order system

Establish a system to track work orders, maintenance, and equipment costs.

7. Ensure that maintenance staff has the proper manuals

Contractors and subcontractors should provide comprehensive maintenance and operations manuals for all equipment to the maintenance staff. Include this responsibility in the contract specifications during the design stage.

8. Ensure that the recommended spare parts are available

Keep recommended spare parts on hand in order to ensure expedient repairs when necessary.

9. Provide training to maintenance staff

Designers and contractors should train the building staff on how the building systems are supposed to operate and be maintained. Videotaping training sessions can help ensure the continuation of proper maintenance.

For more information, see *Volume I: Planning* and *Volume IV: Maintenance and Operations* of the CHPS Best Practices Manual.

Citations

Collaborative for High Performance Schools. "Volume I: Planning" and "Volume IV: Maintenance" in Best Practices Manual. 2006.
Nañez, Monica. "Project Turnover and the Role of Occupants." Presentation for Healthy Materials Lab online course, New York, NY. 2018.
U.S. Department of Energy. "Best Practices for Controlling Energy Costs". 2004. https://www.energy.gov/sites/prod/files/2015/04/f21/ED486496.pdf

POST-OCCUPANCY ENGAGEMENT

MEASURING IMPACT WITH POST-OCCUPANCY SURVEYS

Once construction has been completed, the health of a building relies on the building's maintenance and operation teams' continuation of the healthier conditions set forth by the design and construction teams. Post-occupancy surveys provide a means to get feedback from residents and to gauge health outcomes. They also provide operations teams with **measurable impacts** that they can share with residents, staff, and funders. Monica Nañez, Sustainability Program Manager of First Community Housing, suggests completing this type of evaluation every two to four years.

SAMPLE POST-OCCUPANCY SURVEY | INDOOR ENVIRONMENTAL QUALITY

On a sale of 1-7 (very dissatisfied = 1 to very satisfied = 7), how satisfied are you with:

The overall acoustic quality in your space

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

The adjustability of task lighting in your space

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

The adjustability of daylighting in your space

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

The adjustability of furnishings in your space

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

The temperature in your space (hot or cold)

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

The humidity in your space

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

The overall privacy in your space (sound and visual privacy)

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

The ability to limit undesired sounds in your space

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

The adjustability of thermal conditions in your space

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

The odors in your space

Very Dissatisfied Very Satisfied

1 2 3 4 5 6 7

Citations

Martin, Caren, Becky Alexander, and Chris Wingate. "Designing for Occupant Well-Being with B3 Post-Occupancy Evaluations." Presentation for AIA Minnesota Convention. Minneapolis, MN. 2017.

Nañez, Monica. "Post-Occupancy Monitoring and Engagement." Presentation for Healthy Materials Lab online course, New York, NY. 2018.