

Construction, Preservation and Restoration

Construction

Certainly constructing a structure 86 feet tall and completely exposed to the harsh winds and weather the Maine coast has to offer would have taken some planning, surprisingly the structure went up in less than a year. No original plans of the Observatory survive and one can only assume that Moody would have applied the principles used in constructing a sailing vessel in his design of the Portland Observatory. Moody's plan included placing 122 ton of stone in the basement of the Portland Observatory holding it fast to the ground, just as you would use ballast in a boat to keep the vessel upright in the water. This plan of creating a lower center of gravity for the building has helped to keep the Observatory steadfast on the exposed land of Munjoy Hill.

Activity: The Economics of Construction

Targeted Learning Results:

Objectives

Middle Grades 5-8 Students will understand the economic system of the United States, including its principles, development, and institutions.

Standards: Social Studies, Economic Systems of the United States #1

Materials: Internet connection

Graph paper

Calculator

"Construction" slide show at Maine Memory Network:

<http://www.mainememory.net/ss.shtml?f=lb&user=>

[Lemuel&lb=Construction](http://www.mainememory.net/ss.shtml?f=lb&user=Lemuel&lb=Construction)

Captain Moody understood that in order to keep pace with other seaports, Portland's waterfront had to be managed efficiently. He also understood that an efficient and productive harbor was something that local ship owners and merchants would be willing to pay a price for. His plan to build the Portland Observatory was therefore a successful one. Combining his experience as a Captain, his familiarity with the harbor and his family's reputation he was the perfect person at the perfect time to propose such a plan. To be completely successful Moody would need investors, subscribers and the ability to control his costs for construction.

Economics

Students should start by visiting www.mainememory.net and review the "Construction" slide show. Students will find receipts for lumber, agreements for the purchase of a parcel of land, documents calling for the construction of

a "marine lookout" and payments made to laborers. Where did Moody purchase the lumber? How much did it cost and what does that translate to in modern money? Students can find the answers to inflation rate changes by visiting this website www.cjr.org/resources/inflater.asp. Because the rate of inflation is based on labor statistics and other monetary factors and not on the real world value it is important to have students also call local lumber companies to find current pricing on lumber. Because the supply of lumber, the size of which was used in building the Observatory is scarce the price will reflect the economic principles of supply and demand and hence the inflation calculator becomes a measure of actual dollars and not of product worth.

Further explore supply and demand and inflation of product value by having students compare the costs of other materials used in building the Observatory such as nails and hammers, telescopes, and labor. This lesson is helpful in answering the ever-present question of "How much would that cost now?" To fully answer that question have students calculate the modern cost of building the Observatory or another historic structure in their town or city. Students can use the information available at www.cjr.org/resources/inflater.asp to translate actual dollars and compare that to actual product costs.

Have students create a graph to show the individual differences in costs to build the observatory modern to historic. The more difficult economic question and one that may be near impossible to calculate is the economic benefit of the Observatory to Portland in 1807 and in 2003. How is this building significant in economic terms to the maritime-based industry of 1807? How is it significant to the tourist-based industry of today?

Activity: Construction and Observatory Physics

Targeted Learning Results

Objective:

Secondary Grades: Students will understand the motion of objects and how forces can change that motion.

Standards: Science and Technology, Motion #3 and #4

Materials: Scientific Calculator
Paper and pencil
Computer and Internet Connection

Although no original plans for the Portland Observatory survive simple engineering and basic physics hold the key to understanding the construction and stability of the structure. Most certainly Moody knew that for his Observatory to remain standing through the years it would need to be able to

withstand extreme wind forces. To serve its intended purpose the building would need to be tall enough to view ships coming towards Portland harbor allowing enough time for merchants to prepare wharf space.

Observatory Physics

Observatory physics facts are listed at the end of this activity outline. Students should figure out what wind velocity the building can withstand using the facts and equations below.

T = torque (lb·ft)

W = weight (lb)

F = force (lb)

H = height

M = moment of inertia (ft)

P = pressure (lb/ft²)

A = area (ft²)

V = velocity (ft/hr)

G = acceleration due to gravity (ft/hr²) = 115,920 ft/hr² = 32.2 ft/s²

θ (rho) = density of air at 32° F = 0.0805 lb/ft³

The Observatory Facts:

Overall height:	84' - 4 5/16" from base to finial
Height of observation deck:	65' - 7 1/2" from foundation
Height of lantern:	16' - 4 1/4"
Above sea level:	141 feet above mean tide (at the base)
Diameter:	base 31' - 5 11/16" top 14' - 10 5/16" lantern 8' - 10 7/8" finial 1' - 5"
Slope of sides:	7.7 degrees
Ballast:	244,000 lb
Distance to Portland Head Light:	3.6 miles (in a straight line)
Telescope:	Dollond Refracting telescope Brass 5 feet long Magnification power 65X

Equations

1. Find the torque exerted by ballast,

$$T_{\text{ballast}} = W * M_{\text{ballast}}$$

2. Find the wind force required to produce equal torque,

$$T_{\text{ballast}} = T_{\text{wind}} = F * M_{\text{wind}}$$

$$F = T_{\text{ballast}} / M_{\text{wind}}$$

3. Find the wind pressure needed to produce this force

$$P = F / A$$

$$A = A_{\text{tower}} + A_{\text{lantern}} + A_{\text{finial}}$$

4. Find the wind velocity required to produce this pressure using the Bernoulli equation.

$$P + \frac{1}{2}\rho V^2 + \rho g h = \text{constant}$$

Where points 1 and 2 lie on a streamline, the fluid has constant density, the flow is steady, and there is no friction

For more information on the Bernoulli equation check out http://www.princeton.edu/~asmits/Bicycle_web/Bernoulli.html. For further information about using physics lessons with your class check out <http://hypertextbook.com>. Should you or your students need to convert units of measurement http://www.processassociates.com/process/convert/cf_all.htm is a great place to visit. Keep in mind that the highest ever-recorded wind velocity was 231mph recorded atop Mt. Washington in 1934. Students can find average wind, temperatures and precipitation for Portland, Maine by visiting www.noaa.gov.

Most likely, Moody had the Observatory built to its height not by calculating how far he would be able to see at a specific height but on what was available for lengths of lumber. Students can use the resources available at Maine Memory Network and Greater Portland Landmarks in determining how far Moody could see, was Munjoy Hill the best spot to build the Observatory and did Moody overcompensate the amount of ballast needed in the building? Check out Greater Portland Landmarks Summer 2002 newsletter at http://www.portlandlandmarks.org/observer_summer_2002/observer_summer_2002_feature_1.htm. Students should be able to differentiate between what resources are available to them and what Moody was working with. Students should determine how much time it might take to prepare wharf space for incoming vessels, taking into account the average number of vessels entering the harbor, the number of wharves available and the time it takes to unload a ship.

Preservation and Restoration

Moody's family kept the Observatory in good repair throughout its 116 years of service as a maritime signal tower. Historians know that the building was re-shingled circa 1905, and have assumed that the family kept up with regular maintenance by painting the shingles when needed, replacing windows as necessary and stair treads as they wore. After the Observatory stopped signaling in 1923 the building was left vacant and fell into some disrepair. By 1939 Moody's descendants decided to give the Observatory to the City of Portland, by this point the building was in need of extensive repairs. The City of Portland enlisted the help of the Works Progress Administration (WPA) to restore and repair the building. During the course of one summer and for a cost of just over \$6,000 the WPA did just that.

In the years that followed the 1939 restoration the city kept the building open for the public to view. The Observatory was continuing to be a central place of the people of Portland to gather, for picnics, informal meetings and to share the view of harbor and city.

In 1982 Greater Portland Landmarks took over the operations of the Portland Observatory to provide a more complete picture of the Tower's role in Portland and maritime history and to insure that the building would continue to be open and available for the public to use. In 1995 city of Portland employees came to the building on a routine inspection and discovered that powder post beetles had made the Observatory their home. A massive restoration project and grassroots campaign to save the Portland Observatory resulted in the building's restoration. The project came at a cost of 1.2 million dollars, which was paid for by the City of Portland, private foundations, corporations and concerned citizens. The Observatory reopened in June 2000 and on average hosts ten thousand (10,000) visitors during the summer season.

Activity: To Save or To Destroy

Targeted Learning Results

Objectives:

Middle Grades 5- 8:

Students will understand the rights and responsibilities of civic life and will employ the skills of effective civic participation.

Students will work, write and speak effectively when doing research in all content areas.

Standards: Social Studies, Civic and Government, Rights, Responsibilities and Participation, #1, #2, and #4.

English Language Arts, Research Related Writing and Speaking, #1, #6, #7, and #8.

Materials: Internet Connection
Notebook and pencil
Access to registry of deeds, local library and historical societies

The Portland Observatory was saved because people in the Portland community realized the value of the building. Not simply in terms of the real estate, but in broader terms of its place in the neighborhood, its historical purpose, its role in the community. The city and its citizens rallied around the Portland Observatory restoring the building and continuing the revitalization of the neighborhood.

The National Park Service administers the National Register of Historic Places. Check www.cr.nps.gov/nr/research/nris.htm for a searchable database of historically significant properties in your town, city or state. Find a property that is near your school, or well known in the community. *Please* get permission from the property owner before attempting this project, they may have some of the information that your students will be researching and should you decide to assess the property you will need their permission to walk the grounds.

The scenario: the historic structure goes up for sale and a developer purchases it with designs to raze the building and build a "Yuppie Puppy Super Store". Assign students roles in the debate: building owner, historian, preservation officer, reporters, city planner, banker, citizens, developers, and real estate agents. Have students assess the property from the perspective of the role that you have assigned them. Students can research the property through town records, the local library, the local historical society, interviewing neighbors to the property and the property owner. Take a walk to the property and have students assess the condition of the building and the land.

Students should write a position paper from the perspective of their assigned role. Take a full class period and have students debate the issue. Students should be able to defend their assigned position both within the debate and in their written statement.

Sample Roles:

Building Owner: This person or organization owns the property and is responsible for the maintenance.

Historian: This person will have the facts about the building's historic significance in the community.

Preservation Officer: This person understands the building's style and importance to the community. Additionally this person understands the steps taken in historical preservation.

Reporter: This person covers all aspects of the proposal from plans to raze the building to alternative reuse proposals put forth by the preservation officer, historian and citizens.

City Planner: This person may suggest adaptive reuse of the existing structure.

Banker: Whether this person is financing the razing of the building or the adaptive reuse they will consider all the financial ramifications of the project.

Citizens: These people live in the community and can write letters to the editor to try to influence city officials and other citizens.

Developer: This person is trying to purchase the building in order to raze it for a "Yuppie Puppy Super Store". They argue that the new store will bring in extra tax revenue and additional jobs for the community.

Real Estate Agent: This person wants to reuse the building as unique condo space.

Activity: Community Activism

Targeted Learning Results

Objectives:

Middle Grades 5- 8: Students will understand the rights and responsibilities of civic life and will employ the skills of effective civic participation.

Students will work, write and speak effectively when doing research in all content areas.

Students will use stylistic and rhetorical aspects of writing and speaking to explore ideas, present lines of thought, to represent and reflect human experience, and to communicate feelings, knowledge and opinions.

Standards: Social Studies, Civic and Government, Rights, Responsibilities and Participation, #1, #2, and #4.

English Language Arts, Research Related Writing and Speaking, #1, #6, #7, and #8.

English Language Arts, Stylistic and Rhetorical Aspects of Writing and Speaking, #4, #5, and #6.

Elementary Grades 3-4: Students will understand the rights and responsibilities of civic life and will employ the skills of effective civic participation.

Students will use stylistic and rhetorical aspects of writing and speaking to explore ideas, present lines of thought, to represent and reflect human experience, and to communicate feelings, knowledge and opinions.

Students will work, write and speak effectively when doing research in all content areas.

Standards: Social Studies, Civics and Government, Rights, Responsibilities and Participation, #1 and #2

English Language Arts, Stylistic and Rhetorical Aspects of Writing and Speaking, #3, #4 and #7

Standards: English Language Arts, Research-Related Writing and Speaking, #2 and #4.

Materials: Internet Connection
Notebook and pencil

Review the National Register of Historic Places on-line database to find buildings and landscapes in your community listed on the site

www.cr.nps.gov/nr/research/nris.htm. Are any of the buildings or landscapes at risk? Check the National Trust for Historic Preservation web-site www.nthp.org to find a national list of properties deemed "at risk".

Frequently cemeteries are overlooked as valuable landscapes and are often most at risk. Contact your local preservation organization to find out what efforts are being made to save the building or landscape you've chosen, and how your students can become involved.

Students can use the skills they acquired in "To Save or Destroy" to research the property. Students can affect change in their community by becoming involved in the effort to save, preserve or restore a building or landscape in their community. Students can take the information they gathered about the property to create a web-site and let others know about the building or landscape that they have researched. For a great example of students taking an active role in preservation visit

www.portlandlandmarks.org/kidsport/homePORT.html. Students can write letters to the editor, use a community television station to produce a television show about the building or landscape at risk. Students can help in the efforts to raise money for the capital campaign to save the building or landscape. Students can write a play, create posters and flyers to present to the community about the importance of preservation. Encourage students to attend planning board meetings, as community members they should be able to communicate the importance of the building or landscape at risk to members of the board and other community members in attendance.