

# **Project 1:**

## **Comparative Evaluation of Building Materials**

**(Individual - 40%)**

For this individual project, you will conduct a comparative evaluation of at least three (3) different building materials for an application of your choice. Two out of the three materials must be alternative or green building materials. As a class, we will develop a standard format and analysis template. The results of each student's analysis will be compiled into a green materials directory and distributed to the class and other interested parties. You will also develop a poster describing your findings, to be displayed in the Architecture Building.

A sign-up sheet will be available at the next class session. Please sign up for an application (e.g., decking, lighting, exterior cladding, structural wall systems, etc.) that interests you. You may not choose the same application as someone else; the sign-up sheet will be available on a first come, first served basis. You can also stake your claim to an application via email or phone to the instructor.

After you have selected an application, you will need to contact manufacturers and/or vendors of different materials used for that application. Choose at least three materials to compare, of which one should be a "traditional" material, and the other two alternative or green materials. For your project, you will need to collect the following for each of the three materials you are comparing:

- Samples (if feasible)
- Manufacturer's literature
- Current pricing and availability data

At a minimum, you should collect sufficient information to allow others to make a comparison between materials for the application you have selected, based upon the following criteria:

- Life-cycle economic feasibility (i.e., cost)
- Life-cycle technical performance
- Life-cycle environmental impacts
- Life-cycle social/ethical impacts

A preliminary outline of the information to include in your submission is shown on the following page. Formatting information follows. The written submission and displays are due on October 21. You should submit both electronic and hard copies of your submission to be included in the Green Building Materials Guide published by the class.

# Application Name

Your Name, Affiliation

## Application Parameters

Include a brief description of the application you have selected. For example, if you have elected to study alternative materials for exterior decks, describe:

- What kinds of built facilities incorporate exterior decks
- What exterior decks are used for
- Applicable codes and/or quantitative standards of performance
- Qualitative expectations of users for exterior decks

## Methodology

Describe why you chose the application you did, i.e., its significance to the built environment. Describe how you identified and selected materials to be compared; we recommend that you choose materials based on commercial availability. If there are more than three “green” materials for your application, briefly describe them, and justify why you selected the three materials you’re considering.

## Material 1: Traditional Solution for Your Application

Describe the most common “traditional” solution for your application, and why it is preferred in practice. List its benefits and limitations. Trace a typical path this material follows over its life cycle, from the extraction of raw materials which are used to manufacture it to its final “grave” at the end of its life cycle. Use and extend the built facility life cycle diagram included in Handout 1. Identify material requirements and processes for each of the phases of the building life cycle with respect to the material.

In the exterior decking example, you could select pressure-treated pine as the traditional alternative. Describe where the wood comes from, what processing is used to harvest it, pressure-treat it, and bring it to the shelves of Home Depot. Pay special attention to any processing using materials which may have environmental impacts. Describe how the material is used in construction, identifying any special construction requirements such as respirator use with pressure-treated lumber. Describe maintenance requirements during use, and identify the expected life of the material in a typical application. Describe what typically happens to the material when it has reached the end of its useful life, and include information about alternative uses for the material, such as chipping and recycling of decking lumber.

Pay special attention to any aspects of the material life cycle which may have adverse impacts on the natural or human environment. Provide a list of contacts and/or references you used for collecting information for each material. You should also include, as available, any quantitative information you can find about the technological or environmental performance of the material. Include any manufacturer’s literature you obtain as an attachment to the submission. If possible, include photographs or sketches of the material to supplement your description of the material life cycle.

## Materials 2 and 3: Alternative or Green Solutions

For each of these sections, include the same information as for the traditional material. As before, include the following for each material:

- Life-cycle description
- Adverse impacts to the natural or human environment
- Contacts/References/Manufacturer's Literature
- Technological or environmental performance information
- Special construction, handling, maintenance, or disposal requirements
- Cost and availability information

## Comparative Evaluation of Materials

In this section of the submission, you will perform a comparison of the three materials you've studied, in "Consumer Report" format. We will decide as a class what the parameters for evaluation will be. This section will contain a standardized set of tables in which you compare your three materials over the evaluation parameters. For example:

Parameter	PTL	RPL	Cedar
Initial cost	Low	High	High
Maintenance cost	High	Low	Avg.
Life cycle cost	Avg.	Low	Avg.
Service Life	10 years	50 years	20 years
•••			

The purpose of this section is to provide a comparative summary of the information you found and described in the preceding three sections. This section of the report should be useful for project stakeholders in comparing the materials you've researched for an application similar to the one you've selected.

## Summary and Conclusions

In this section, you will be able to discuss the comparative results you developed in the previous section. This is your opportunity to argue for the use of alternative materials, or to describe what you've discovered about why they are not being used. Present any explanations you have for why people have not adopted the alternative materials, and describe what changes in professional practice, economic systems, or other elements of the current paradigm may be necessary to aid the shift to green buildings.

## Resources

In this section, list any resources you've discovered for learning more about the materials you've studied, or about green materials for your application. You may also want to list other materials which were not included in the study, along with resources for learning more about those materials. Web resources are encouraged!

## **References**

List the references you consulted for your study. Please be consistent and use the ASCE format for references. This format is available from the instructor.

## **Attachments**

In this section, include any manufacturer's literature you obtained which describes your materials or applications. You may also include relevant codes or performance specifications for your application, as well as any other information which does not fit into the text. Be sure to reference each attachment in the narrative!

## **Formatting Information**

Since we will be compiling each of your submissions into a common publication, you must observe the following formatting requirements:

- Use 12 point Times or Times Roman for narrative, justified, with 1" margins
- Use 12 point Helvetica Bold for subheadings, flush left
- Use 14 point Helvetica Bold for submission title
- Use 12 point Helvetica Bold for your name and affiliation
- Page numbers should be centered in bottom margin
- Text should be single-spaced
- Tables should be formatted as in the above example

In general, you should follow the formatting as observed in this handout. Please contact the instructor if you have any questions.

## BC 4953 A - Project 1 Addendum

### Comparative Evaluation of Building Materials

#### Attributes and Indicators of Green Building Materials

As per our class discussion on October 2, here is a list of four primary classes of green building material indicators which you will use for your comparative evaluation of materials. You should select at least three indicators from each category appropriate for the application you have selected, for which you will collect quantitative information as possible. As discussed in class, you will be required to construct a comparison matrix for the three materials you choose, in terms of the four attribute categories. A qualitative summary indicator for each of the categories should be assessed in “Consumer Report” format, based on the relative values of each sub-indicator for the category. Your matrix should look something like the sample on page 2 of this addendum.

Attributes and sample indicators are shown in the table below. You are not limited to using the indicators on this table; in fact, you are encouraged to identify and select indicators which are appropriate for your specific application. In the Methodology section of your submission, you should discuss why you’ve selected the indicators you chose. For example, if your application is pavements, one possible indicator of environmental performance might be pavement porosity, since low porosity is a characteristic of non-green pavements, resulting in large quantities of runoff containing heavy metals during stormwater events.

Environmental Performance	Technological Performance	Resource Use Performance	Socio-Economic Performance
<b>Impacts on Air Quality</b> <ul style="list-style-type: none"> <li>• Carbon Dioxide</li> <li>• Hydrocarbons</li> </ul> <b>Impacts on Water Quality</b> <b>Impacts on Soil Quality</b> <b>Ozone Depletion Potential</b> <b>Site Disturbance</b> <b>Assimilability</b> <b>Scarceness</b> <b>Impacts during Harvest</b> <b>Processing Impacts</b>	<b>Durability</b>  <b>Service Life</b> <b>Maintainability</b> <b>Serviceability</b>  <b>Code Compliance</b>  <b>R-value</b>  <b>Strength</b> <b>Constructability</b>	<b>Energy</b> <ul style="list-style-type: none"> <li>• Embodied</li> <li>• Operational</li> <li>• Efficiency</li> <li>• Distributional</li> </ul> <b>Degree of Processing</b> <b>Source Reduction</b> <b>Materials</b> <ul style="list-style-type: none"> <li>• Renewable</li> <li>• Recycled/Recyclability</li> <li>• Reused/ Reusability</li> <li>• Renewability</li> <li>• Local/Transport Distance</li> <li>• Packaging Requirements</li> </ul>	<b>Occupant Health/ Indoor Env’l Quality</b> <ul style="list-style-type: none"> <li>• VOC Outgassing</li> <li>• Toxicity</li> <li>• Susceptibility to biocontamination</li> </ul> <b>Appropriateness for:</b> <ul style="list-style-type: none"> <li>• Scale</li> <li>• Climate</li> <li>• Culture</li> <li>• Site</li> </ul> <b>Economics:</b> <ul style="list-style-type: none"> <li>• Contribution to Economic Dev’t.</li> <li>• Cost</li> <li>• Labor Skill Requirements</li> <li>• Labor Amount Requirements</li> </ul>