

# Roof Design by WEIGHTED EVALUATION

By Luther C. Mock, RRC

## Abstract

Making appropriate roof design decisions can be a complex process when considering one's experience with different systems and all the options available. Weighted Evaluation is a process by which multiple roof design criteria and alternatives are formally organized to determine an optimum solution.

First, roof design criteria are considered (e.g., cost, durability, and wind resistance). Criteria options are weighed against one another to establish a relative importance factor through a scoring process. Next, alternatives are listed and rated according to the criteria factors. The alternatives are scored to determine the best solution. Sample problems will be reviewed using a Weighted Evaluation Matrix.

“Imagination is more important than knowledge.” — Albert Einstein

## Introduction

In day-to-day life, we make many easy and difficult decisions. As roofing consultants, contractors, or manufacturers, many decisions are easy, while others require delving deep into our pool of knowledge on the subject matter and our life experiences.

Data are either objective or subjective. That is, our decisions are affected by facts and influenced by emotion or personal preference. Many decisions are answered quite easily. Others require extended thought in order to work through all the possibilities.

Difficult decisions become even more difficult when there are multiple factors to consider and numerous alternatives. On the most difficult decisions, our brains collect and sort through multiple factors and assemble alternatives that will eventually become our decisions (or advice). Whether they are answers to our own questions or our professional recommendations to a customer, can we be sure the subjectivity of our decision-making process generated the best answer? Did we properly consider all facets of the question? Did personal preference improperly influence a decision?

What if we had a more organized approach that would help assure us that our resulting decision was the best – and could prove it based on the data considered?

## Weighted Evaluation Methodology

Weighted evaluation is an organized approach (methodology) that will help confirm our own decisions and assist customers in making the best decision for their circumstances. It involves proper consideration of all possible criteria and alternatives.

Consider the questions we have to answer and the advice we have to render in the roofing business. As aforementioned, the questions usually involve numerous factors (criteria) and alterna-

tives. The weighted evaluation methodology can be a very useful tool to assist us with our decision making. We can also use it to demonstrate all pertinent criteria and alternatives were considered, whether they are our client's or ours. It enables us to give more consideration to necessary facets of the decision. Our solution becomes a systematic selection rather than a random decision making process.

The weighted evaluation worksheet is broken down into two parts: the Criteria Scoring Matrix and the Analysis Matrix. Important criteria in the selection of alternatives are identified on the Criteria Scoring Matrix and compared to each other for relative importance. The comparison process is limited to two elements at a time. Preference of one criterion over another is established, and a numerical score of 1 to 4 is given to the preferred criteria. A key to the score definitions is identified on the worksheet. The sum of each criterion's scores is tabulated into a raw score. The raw score is converted into a weight of importance factor on a scale of 1 to 10.

Possible alternatives (solutions) are listed in the Analysis Matrix and compared to each of the criteria from the Criteria Scoring Matrix. A different numerical score of 1 to 5 is established for the alternative to criteria comparison. This score is multiplied by the weight of importance factor in order to establish an adjusted subtotal score. The sum of all alternative-to-criteria comparison (adjusted subtotal) scores is tallied to give a final numerical total score that ranks one alternative to another.

## Example

The following example will provide further direction for using the worksheet. The steps enumerated below follow a sample problem relating to roofing. See *Figure 1*.

# Weighted Evaluation

Question What type of roof system should be installed?

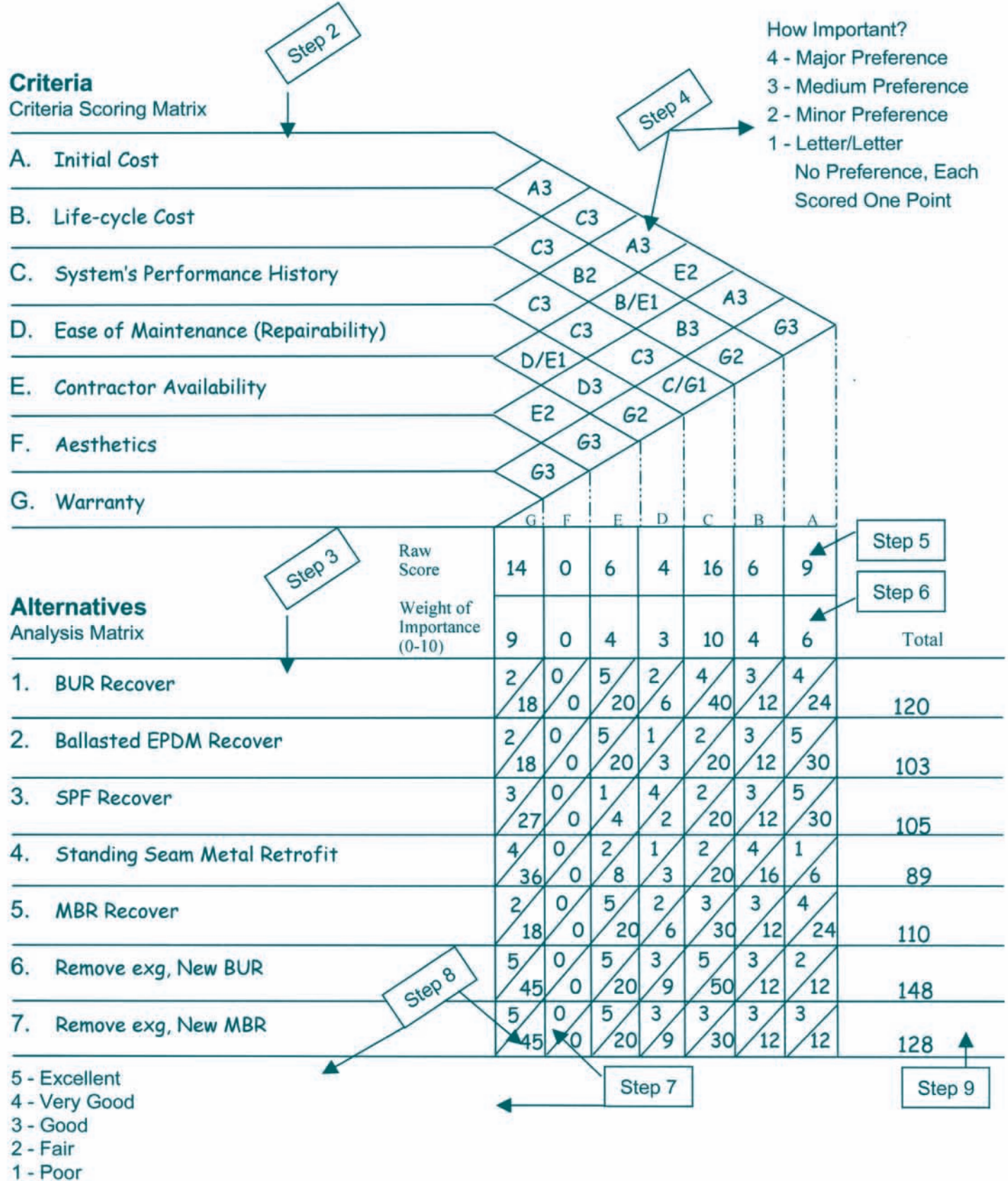


Figure 1

- Step 1** Identify and ask the question. For example, which type of roof system should be installed?
- Step 2** Brainstorm characteristics (criteria) that may be important factors relative to solutions (alternatives). Choose, by consensus, the most important criteria factors and list them on the Criteria Scoring Matrix portion of the worksheet.
- Step 3** Brainstorm solutions. Choose, by consensus, the best alternatives and list them on the Analysis Matrix portion of the worksheet.
- Step 4** Compare each criteria factor with each of the other criteria factors using the importance value scale of 1 to 4. Identify the more important of the two and assign an importance score. Take note in the example that “Aesthetics,” Item F, was not considered a preference over any of the other six criteria factors; therefore, it did not receive any value.
- Step 5** Add the number of points each criteria factor received and insert the total into the respective raw score cell of the matrix.
- Step 6** Identify the criteria factor with the largest raw score and assign a weight of importance factor of 10. Calculate each criteria factor’s raw score as a direct relationship to a scale of 10. For example, if criteria factor “C” has the largest raw score of 16, it is assigned a weight of importance factor of 10. And, if criteria factor “A” has a raw score of 9, it is assigned a weight of importance factor of 6. Decimal values should be rounded to the nearest whole number.
- Step 7** Compare each alternative from the Analysis Matrix to each criteria from the Criteria Scoring Matrix using the analysis scoring scale of 1-5. Insert the value in the upper portion of the intersecting cell.
- Step 8** Multiply the analysis score by the corresponding criteria weight of importance factor to establish adjusted subtotal score. Insert the value in the lower portion of the intersecting cell.
- Step 9** Add each alternative’s adjusted subtotal scores to establish a final numerical score. The alternative with the largest numerical score is the preferred alternative (solution) to the problem.

## Summary

The example combines an unrefined list of solutions (alternatives) in the Analysis Matrix portion of the worksheet. It may be necessary in the problem-solving process to determine solutions to more general questions using the weighted evaluation methodology. In the example, it has been determined that a new roof is needed. However, the previous question may have been, “What should be done about recurring and increasing roof leaks?” With a different question, there are different alternatives and criteria factors to be considered. An aggressive repair and maintenance program rather than a new roof may have been the best answer.

The particular assessment in the example tabulates the best reroof alternative as removal of the existing system and a new BUR membrane. One could refine the decision even further using weighted evaluation. The next question might be, “Which type of BUR system should be installed? Asphalt and fiberglass reinforcement with aggregate surfacing? Coal-tar pitch and organic felts? Asphalt and fiberglass reinforcement with an emulsion coating?” The methodology can be repeated with new criteria factors. Some, like “Initial Cost,” may be appropriate for several questions.

The questions consultants face in the roofing business involve personal bias and preference. Although opinions are a necessary element in the problem solving process, quick opinions without proper consideration to many alternatives and criteria factors may be rendered. The weighted evaluation methodology is a measurement tool to assist with complex decision making. It disciplines all members of the decision making team to consider all alternatives and criteria factors. ■

**“The greatest shortcoming in today’s traditional approach to the design of facilities is the use of ‘undiscipline’– oriented decision making. This approach tends to sacrifice total system performance by maximizing sub-system performance.”**

— Aphonse J. Dell’Isola

## References

- Dell’Isola, Aphonse J., PE, CVS, and Stephen J. Kirk, AIA, CVS. “Life Cycle Costing For Design Professionals,” ACEC/AIA Seminars, 1978-1979.

## ABOUT THE AUTHOR

**Luther C. Mock, RRC**, is the first vice president of RCI. He has been involved in roofing and moisture technology since 1978 and owner of Martin, Riley & Mock Inc. since its formation in 1986. Luther is also managing partner of EDIFIS Building Exterior Solutions, a division of Martin, Riley & Mock. Mock is a member of AIA, CSI, ASTM, and MRCA, is active in his community, and the father of two children.



**LUTHER C. MOCK,  
RRC**