5.5 IMPLEMENTING THE NEW ENHANCED FUJITA SCALE WITHIN THE NWS

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1. INTRODUCTION

The enhanced Fujita Scale (EF-scale) has been accepted by the NWS as the new standard by which tornadoes will be rated after February of 2007 (McDonald et al., 2003; McDonald and Mehta, 2006) now enters the challenging task of educating NWS staff and the general public.

With 28 Damage Indicators (DIs) and anywhere from 3 to 12 Degrees of Damage (DODs) for each DI, the EF-scale involves a relatively steep learning curve compared to the F-scale. To further complicate training and education, there is built in uncertainty in the EF-scale in that each DOD exhibits a wide range of valid winds that overlap EF ratings. There is no single education approach which can accomplish complete understanding by the student.

The Warning Decision Training Branch (WDTB) structured a blended learning approach with three components: a small course containing two recorded asynchronous online lessons lasting an hour, a PC-based software package serving as an Electronic Performance Support System (EPSS) called the EFkit (Enhanced Fujita scale training tool kit), and a web-based forum involving damage survey experts, EF-scale developers, and NWS damage survey focal points (e.g., WCMs and other interested NWS staff) (Figure 1).

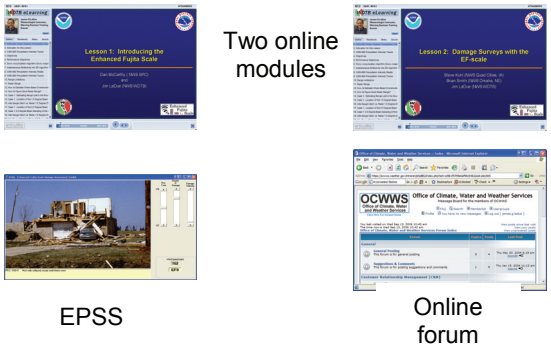

Figure 1: The blended learning approach used by the EF-scale training and education within the NWS.

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2. ASYNCHRONOUS MODULES

Two asynchronous lesson modules are to be made available online by November 01 on the WDTB website. The authors of the modules include those that have been on the EF-scale development team. Both modules are intended to be taken by all NWS staff that may have damage survey responsibilities, at least 1000 operational staff. The local Warning Coordination Meteorologist (WCM) has the local authority to determine who in his/her office may be involved in damage surveys. However, it is encouraged that as many employees as possible complete the training to allow for a more comprehensive damage survey after an event. Each WCM can also adapt the content in the modules to help educate people outside the NWS that may also become involved in damage surveys.

Stakeholders outside the NWS wishing to become familiar with applying the EF-scale may contact their local WCM and take the two asynchronous lessons. To become familiar with conducting a damage survey and rating tornadoes they should consult with their local WCM. The web-based delivery system allows WCMs to actively involve local damage assessment stakeholders in the survey process.

The first lesson concentrates mostly how the EF-scale was created and describes how it differs from the F-scale. We also make sure the strengths and limitations of the EF-scale are well understood.

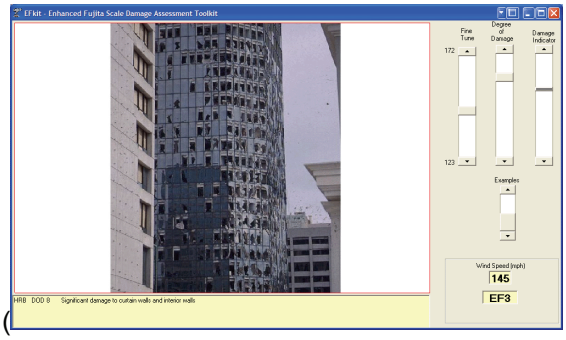
The second lesson applies the EF-scale to several case studies. It requires a learner to utilize either the document authored by McDonald and Mehta, 2006, and/or the EFkit during the course of this lesson. The document and the Efkit are available on http://wdtb.noaa.gov.

The complexity of the EF-scale cannot be completely covered by two online lessons. Instead, the two lessons are designed to introduce the student to the resources available. We anticipate that the EFkit and McDonald and Mehta, 2006 will be used as tools during actual damage surveys.

3. EFkit

This EFkit was developed to help a surveyor quickly match observed damage to the documented DI and DOD. Given the large number of DIs and DODs, searching through a hardcopy document could be prohibitively time consuming while on a survey. The EFkit also allows a user to view multiple examples of the same DI and DOD allowing a surveyor to effectively view large numbers of images during a survey. The EFkit satisfies one of the training requirements in that can be used in an exploratory fashion, not just in training but in the field too (Stolovich and Keeps, 2003).

The EFkit main interface features two to four slider controls on the right side (see figures 2 and 3). The user first selects the appropriate DI then the DOD. A third slider bar appears if multiple examples of a single DOD are available. A single large image window displays what a user selects and a bottom text display describes the DI and DOD in the image. The image itself is broken up into three clickable zones allowing the user to use a tablet PC to change DIs, DODs, and examples within a DOD. Finally, a user selecting a DI and DOD will see a slider bar to estimate the wind speed between a preset upper and lower bound value for a DOD



(Figure **3**). Additional displays show the wind speed selected and an EF-scale rating.

The EFkit interface is designed such that the main image body is as large as possible to maximize image details. Surveyors have the option of loading it onto very small PC devices as shown in Figure 4. The library of images in the EFkit is evolving; however there are still gaps, especially for uncommon DIs such as institutional buildings. We expect that the image library will grow with time as surveyors contribute to the process.

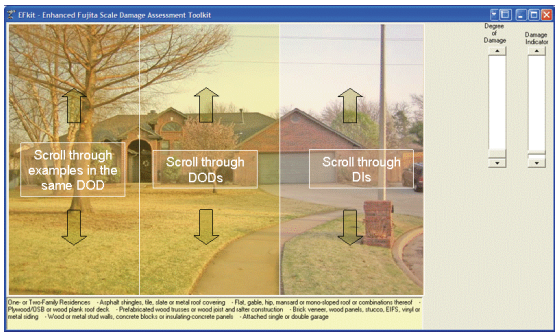


Figure 2: This is the main display of the EFkit. As an alternative to the scroll bars, the EFkit provides three clickable zones (highlighted) on the main image. Each zone is split into two subzones to allow the user to scroll up or down.

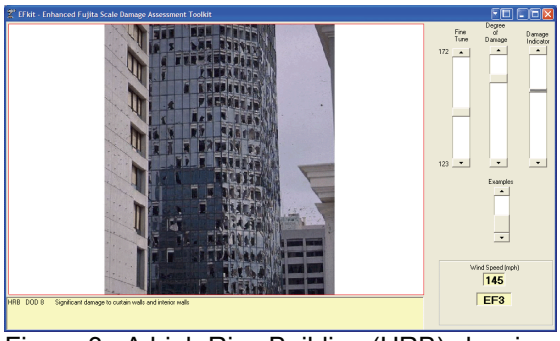


Figure 3: A high Rise Building (HRB) showing DOD=8 corresponding to an expected wind speed estimate of 65 m/s (145 mph) and an EF3 rating. The appearance of the lower right sliderbar indicates there are multiple examples of HRB with a DOD=8.

Figure 4: The EFkit here is running on a device with a 4 X 6 inch screen.

4. COLLABORATIVE LEARNING

The content of the two asynchronous lessons and the usage of the EFkit directly show examples of 5 to 6 DIs and a few DODs for each; far short of the 28 DIs available. The EFkit is a tool but it is a passive tool failing to answer questions or provide dialogue between users and developers of the EF-scale. These two training components by themselves are necessary but insufficient to adequately educate damage surveyors considering the complexity of the surveys including application of the EF-scale. Therefore, the training developers have a strong incentive to have the experts and the users to interact with each other well after the standard training is over. To enhance training effectiveness, a learning environment needs to be set up to enhance Collaborative Learning; that is situations "… in which two or more subjects build synchronously and interactively a joint solution to some problem" (Dillenbourg and Schneider, 1996). We want to encourage positive social rather than individualistic and competitive environments (Johnson and Johnson, 1996).

The training approach in this component is to set up a collaborative online learning environment where NWS damage surveyors and EF-scale experts become actively engaged with each other through a web-based forum.

There are challenges to could inhibit a successful collaborative learning environment. Misunderstandings can be common in e-mail types of communications owing to the limited information capacity of text-based communications (Curtis and Lawson, 2001). The proverbial "flame post" is a symptom of this kind of behavior and it needs to be avoided as much as possible. Yet, we do want constructive criticism. Participants may not engage the forum because they are not familiar with it and there is no reminder of its existence. Activating the capacity to send and receive e-mails to the forum is important to maintain the forum's presence in the participant's daily activities.

A successful EF-scale and damage survey forum could involve this sequence of events. A WCM provides some information about a damage survey he/she completed on the forum and provides a link to a damage survey website containing pictures of individual DIs and DODs, a mapped tornado track, and descriptions of the damage. Forum members, including experts then exchange ideas and comments. Perhaps a discussion ensues about the EF-scale. All Forum members would have access to McDonald and Mehta, 2006 and the EFkit to help in everyone's discussion. Constructive, respectful criticism would be allowed. We would encourage private discussion if the content is of a critical nature between an EF-scale expert and a surveyor, however, everyone would benefit from a synopsis of that discussion.

5. SUMMARY

The NWS is changing the way it rates tornado strength as the EF-scale becomes the new standard rating tool. There are many challenges to educating NWS and their stakeholders about the new scale given that surveyors have been using the Fujita Scale for decades, over 50 years of tornado strength climatology have been completed, and the public considers the F-scale a household word.

The Warning Decision Training Branch is embarking on an education strategy that involves its stakeholders, the WCMs, the NWS staff, and the EF-scale developers that will help effectively educate surveyors and others about the EF-scale. The three components of education include two asynchronous online lessons, the EFkit, and a web-based forum. The NWS staff will be taking the two lessons and then be certified to begin using the EF-scale. However the two lessons serve to familiarize the learners about the EF-scale. However, the EFkit and the online forum will help to further educate learners about the details of the EF-scale. The WCMs in turn, will be educating their partners outside the NWS the same training material and some of their own. As a reminder, the EF-scale training including the EFkit is available at http://wdtb.noaa.gov.

6. ACKNOWLEDGEMENTS

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