Emerging Technology Advisory Committee
July 19, 2005

The Joint Commission on Technology and Science Emerging Technology Advisory Committee held its second meeting on July 19, 2005 in Richmond. Co-chairmen Delegate Joe T. May and Senator Stephen D. Newman were present. The meeting continued discussions regarding the use of underground transmission lines. The Advisory Committee also received a briefing on a recent transportation study involving soil stabilizers, and learned about technology workforce development initiatives in Harrisonburg.

Daniel S. Roosevelt, P.E., a research scientist with the Virginia Transportation Research Council, reviewed the results of a soil stabilizer study requested by the General Assembly in the 2004 budget bill. Soil stabilizers can be added to aggregate or soil surfaces to improve or maintain surface stability and firmness, resist erosion and deterioration, and control dust. Based on the positive results of using soil stabilizers on higher-volume gravel roads, the study was conducted to see if the use of soil stabilizers showed promise as a cost-effective measure to reduce the occurrence of shoulder drop-off on unpaved road shoulders.

Mr. Roosevelt indicated that low road shoulders occur for a number of reasons. The most common include traffic action, erosion caused by a concentrated flow of water, and resurfacing that raises the elevation of the pavement. Those instances that result from traffic and water run-off are considered maintenance issues, and the ability of the shoulder to resist the deterioration is affected by its durability and load-carrying capacity.

The study was conducted as a field study at locations with documented past experience with low shoulders. Three different types of soil stabilizers were tested: Soiltac (a vinyl acetate copolymer emulsion), Centrophase AD (a soy/lecithin emulsion) and magnesium chloride (salt). There was also a control section. The working hypothesis was that the addition of the stabilizers would affect the strength of the shoulder material, as measured by its stiffness and bearing capacity. However, the results supported the null hypothesis that the addition of the soil stabilizers did not affect the shoulder strength. From a statistical perspective, on no occasion was the test section data any better than the control section data. The resulting recommendations, therefore, were that shoulders should be designed to handle the anticipated traffic load and that soil stabilizers should not be used with the intent of improving the life of the shoulder. However, additional study might be considered to study the use of the stabilizers as a short-term solution to shoulder erosion. Overall, a cost-benefit comparison indicated that the use of the stabilizers is not a cost-effective substitute for proper design or preventative maintenance.

The Advisory Committee briefly discussed the results. It was suggested that the use of stabilizers proved effective on higher-volume dirt roads because those roads do not have to meet a certain elevation, whereas shoulders are next to paved roads that do not move or give. It was also suggested that a lack of compaction of the shoulders may account for

the differing results. Delegate May indicated that these were issues that he would like to see further pursued. The complete study is available in the July 19 meeting materials.

Dr. James L. Barnes, Assistant Economic Director for the City of Harrisonburg, Professor of Integrated Science and Technology at James Madison University, and member of the Advisory Committee next updated the Advisory Committee on workforce development and training issues in Harrisonburg. In addressing the rapid rate of change in science and technology, Dr. Barnes indicated that traditional education and training measures are no longer appropriate to prepare tomorrow's workforce. Efforts must be taken now to educate tomorrow's workforce to counteract the affects of off-shoring and a lack of people entering science and technology fields. At the most basic level, science and technology education must be made attractive in K12 education, as well as be made adaptive and flexible to train and educate low-skilled adults. This requires a practice-oriented educational environment, in which the curriculum remains fluid so that it may be reconfigured as science, technology, and the learner's needs change.

Dr. Barnes highlighted some of the recent initiatives being undertaken in Harrisonburg. The city recently established the Harrisonburg Innovation Center (HIC), the first technology innovation center in the newly created Harrisonburg Downtown Technology Zone (HDTZ). He indicated that because of its proximity to Washington, D.C., Harrisonburg is an ideal for federal contractor relocation and development. James Madison University and the City are working closely for a technology-based economy to thrive in the area. The University produces a very talented work pool, but Harrisonburg does not currently offer the types of careers that would keep graduates in the area.

Part of the technology development work is focused on fast-tracking the business approval process. The process is available online, and often the necessary permits and licenses can be approved in about two and a half hours. The city is also able to offer incentive packages for incoming members to HIC and HDTZ, including the availability of student interns and faculty research. They also provide the right kind of technology for the incoming members, funding vehicles, and research and development.

The technologies and businesses attracted to the area will require a different kind of workforce. Dr. Barnes said that in his opinion, workforce development equals economic development. Key issues include how to remain competitive, and how to keep pace with technology advancement. The answer lies in a flexible training infrastructure. This includes a practice-oriented educational environment, where learning is conducted through hands-on experience, in a compressed timeframe, and in an integrated environment.

Part of the focus in the Harrisonburg efforts are on growing and clustering small companies. Dr. Barnes stated that incentives often deal with large companies, but that small companies need to be supported as well. An accelerator may help companies cluster together. Further information about workforce development and Harrisonburg's initiatives can be found in the July 19 meeting materials.

After Dr. Barnes' presentation, the Advisory Committee returned to the topic of underground transmission lines, the focus of the first Emerging Technology Issues meeting. The Advisory Committee was fortunate to have Pamela Katz, P.E., chairman of the Connecticut Siting Council, attend the meeting to share Connecticut's experience with approving underground transmission lines. The Connecticut Siting Council is the government entity charged with reviewing and approving transmission lines in Connecticut, similar to the role of the State Corporation Commission in Virginia. The Council is a quasi-judicial entity, consisting of nine appointed members. The Council reviews the applications and information submitted regarding the applications, and issues decisions. They have the power to override local planning and zoning commissions.

The Council recently conducted extensive work on two transmission line applications that ultimately lead to a recommendation to place about 30 miles of line underground, and 50 miles overhead. The application process was lengthy, resulting in voluminous numbers of documents, and was often controversial. Documents concerning the application (Docket 272) are available on the Council's website at www.ct.gov/csc. Because Connecticut examined many of the same types of questions that the Advisory Committee is seeking to review, Ms. Katz shared the benefit of her experiences with the Advisory Committee.

Phase I involved the upgrade of transmission lines in five towns over 20 miles. The key issue of contention was the visibility of the transmission line. The Utility company ultimately reached a compromise with the towns that the Connecticut General Assembly urged the Siting Council to accept. The compromise buried half of the 20-mile line, which will be in service in December 2006. The utility company worked with engineers to build shorter, less visible towers from the remaining 10 miles of the line.

Phase II involved 22 Connecticut towns in a 60-mile proposal. The main concern was not visibility, as in Phase I, but concern over the potential link between electromagnetic fields radiating from overhead lines and cancer in children. Concerned citizens wanted the proposed lines to be buried underground because of this health concern. Experts called in on this issue could not agree on the health risks posed by electromagnetic field, as there have not to date been any definitive studies linking them to cancer. The Connecticut Department of Health recommended the World Health Organization's approach of "prudent avoidance." Such an approach might include split phasing of overhead lines, where the lines cancel each other out. This would increase the costs by $1 million per mile of line.

During the application review process, the Connecticut General Assembly passed special legislation that would require all new transmission lines to be placed underground, unless proven to be unfeasible. In using underground lines, issues concerning voltage stability and harmonics become issue. After consulting with experts, the Connecticut Siting Council came to the conclusion that burying a 20-mile stretch of line was the feasible limit in order to maintain reliability. In the end, it recommended that 20 miles through urban areas with more narrow right of ways should be buried, and that 40 miles would be overhead.

Based on these experiences, Ms. Katz made five recommendations to the Advisory Committee as it reviews similar issues. Underlying each is the advice to proceed cautiously, and look at all alternatives -- not just underground alternatives.

1. In reviewing whether a particular line can or should be built underground, do not hire an expert on underground transmission lines. Instead, hire an expert who can look at the situation objectively to determine whether it is feasible to build a line from point A to point B. She cautioned that the use of underground lines is very sensitive to location, and our power grids in the United States are not designed for undergrounding like those in Europe and elsewhere.

2. Do not adopt or recommend legislation that would require all new transmission lines to be underground. In Connecticut, this created numerous technical issues. She suggests that the better approach is to look at the issue on a case-by-case basis, and use underground lines only when absolutely necessary.

3. Review options available for less visible overhead lines. In the Connecticut Phase I proposal, the Siting Council was able to develop some new options after pressing the utility company about the design of the overhead lines. For example, some lines can be lower with a slightly wider right-of-way.

4. Consider the construction implications of using underground lines. In urban areas, the lines can be built under streets, instead of on right of ways. A down side to this, however, is that Connecticut received complaints about traffic and noise in connection with the Phase I underground construction.

5. Be aware of reliability issues involving use of underground transmission lines. Connecticut brought in experts to address this issue. Technology has improved such that the reliability of the line itself is no longer a problem. However, splicing the lines together is still problematic and creates weak points. In addition, concerns about repairing the lines still exists, and Connecticut will not have any experience or data about this until the lines are in place for a few years. Because of these potential liabilities, Connecticut recommended to install a double circuit.

In responding to questions from the Advisory Committee, Ms. Katz indicated that cost was not a relevant factor in the Connecticut cases. The legislation mandating the use of underground lines eliminated the cost as a deciding factor as to whether or not to proceed. However, using the underground lines was definitely more expensive than an overhead approach. Generally, the Connecticut Siting Council is the sole authority in making a decision as to where and how to place a transmission line. However, due to the legislation, the Council's discretion was only left to determine what was technically feasible.

Following a lunch break, Don Koonce, consulting engineer for transmission systems, Dominion Energy, addressed the Advisory Committee. At the May 18 Advisory Committee meeting, several of the members had questions about the costs of underground and overhead transmission lines. Mr. Koonce's presentation focused on following up with answers to these questions. A variety of specific cost analysis information compiled by Dominion Energy is available with the July 19 meeting materials.

Generally, Mr. Koonce explained that several factors can drive up the costs of underground lines. This includes the terrain of the location where the line will be buried, such as rocky terrain, or under an existing street. Another factor in the cost is the capacity of the lines. For example, three or four underground cables might be necessary to achieve the capacity of an overhead line. In responding to a question, Mr. Koonce said he was not able to translate the cost of an overhead line into an estimated rate increase. This is because in the instances where Dominion has used underground transmission lines, that has been the less expensive alternative. For example, underground lines were used in Crystal City, where the cost to acquire the right-of-way for an overhead line would have been very expensive.

In response to Dominion's presentation, Ms. Katz indicated that she thought their estimates for the cost of underground cable might be low. In Connecticut, they found that many things occurred that were not anticipated, thereby driving up the costs.

Dominion Energy arranged for Mr. Tom Priestly with CH2M Hill Consulting to address the Advisory Committee concerning the affect of overhead utilities on property values. Like Mr. Koonce's presentation, Mr. Priestly was asked to address some questions posed by the Advisory Committee at its prior meeting. In preparing his analysis, Mr. Priestly undertook a literature review of research concerning utilities and property values. He said that his research indicated that the proximity of a transmission line to property is not a major factor in determining property value, and that the neighborhood, the size of a lot, the square footage of a building, and other improvements also play a role in the property value. He suggested that the impact on a single family home is small, if there is any impact at all. He did caution, however, that in some specific cases where a single family home is immediately adjacent to a tower or when towers are placed on vacant rural land suitable for development, the impact of the utility could be greater.

In response to Mr. Priestly's presentation, members of the Advisory Committee posed several questions. For example, members would be interested to learn if the time it takes to sell a home is longer if it is located next to a transmission line. In addition, members would be interested to compare the value of an open space with a power line with an open space without a similar line. One member asked if the negative affect of a transmission line would be lessened if other assets -- such as broadband -- were placed with the line. Finally, members asked if there were any studies related to the impact of transmission lines on commercial property values. Mr. Priestly indicated that he was not aware of any.

The final presentation of the meeting was from Dr. Richard Wakefield, Vice President of Transmission and Regulatory Services for KEMA, Inc. KEMA was one of the consulting experts involved with the Connecticut cases. KEMA's role in Connecticut was to help determine how much of the proposed line could be built underground, bounded only by technological feasibility and not economics, due to the recent changes in the Connecticut law. Dr. Wakefield's presentation focused on providing objective information as to what factors must be considered in examining whether use of underground transmission lines is a viable option in any given circumstance.

Dr. Wakefield began by explaining that routing alternatives to a proposed route are often considered in order to negate the need for an underground line. The assumption with transmission lines used to be that underground lines were only used in highly-urban areas; however, as special interest groups have begun to learn about underground lines, the issue now arises more frequently. Generally, voltage and AC/DC affect how big a given system will be. In examining the costs of that systems, one has to consider all costs, and not just the costs per mile. For example, the use of underground lines may also necessitate the need for conversion stations where the line changes from underground to overhead, and special surge protectors may be necessary.

Another key issue is capacitance. An underground line has ten times more capacitance than an overhead line. Unlike an overhead line, with which switches are used to control voltage, you cannot switch underground cables on and off. Harmonic and transient performance issues also drive feasibility. Responses to different frequencies can cause harm to electronic systems. Furthermore, impedance is an issue. Impedance impedes the flow of current, so voltages build up in the system. The amount of impedance will vary depending on the length of a proposed line, taking into account all of the other relevant factors.

Dr. Wakefield indicated that underlying this analysis is the fact that results will be very case specific. All of the issues will be relevant in any situation, but the importance of the various factors may depend based on the specific situation. There is no bright line rule as to how many miles of transmission lines may be placed underground. Reliability of the line is an increasingly important issue, because in a technology-based society, loss of power has major economic impact and power failures are increasingly unacceptable. He does anticipate that it will become less costly to use underground cable in the future, and that it will be used more often.

In concluding the meeting, Delegate May indicated that he would like to follow-up with some data concerning the reliability of overhead lines.

The meeting was adjourned. The next meeting is scheduled for September 12, 2005 at 10:00 a.m.