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Transportation Engineering and Research

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19 July 2011

Mr. Keith Fulton
The Wyoming Department of Transportation
5300 Bishop Blvd.
Cheyenne, WY 82009

RE: Quarterly Progress Report #15
Update to "A Guide to Standardized Highway Lighting Pole Hardware"

Dear Mr. Fulton:
This letter is the fifteenth quarterly progress report for the project Update to A Guide to Standardized Highway Lighting Pole Hardware sponsored by the Wyoming Department of Transportation and covering the period between April 1, 2011 and June 30, 2011. The following paragraphs summarize the progress in the project during this time period.

Task 1: Determination of Standardized Lighting Poles and Hardware

This task is complete.

Task 2: Prototype Guide Development

This task is largely complete. The prototype Luminaire Support Guide is on-line at: http://guides.roadsafellc.com/luminaireGuide/index.php and is fully functional.

Task 3: Final Guide Development
Data Solicitation
The project team continued assembling new materials into the database. Two luminaire manufactures and three breakaway luminaire base manufactures have submitted data, drawings and photos of their systems and components to the research team:

- Luminaire systems
  - Hapco
  - Valmont
- Breakaway bases
  - Akron Foundry

- Transpo
- Hapco

Currently, the Guide includes luminaire configurations corresponding to eleven FHWA Acceptance Letters: LS-15, LS-23, LS-27, LS-29, LS-32, LS-35, LS-45, LS-55, LS-64, LS-65 and LS-66.

The research team began soliciting data from manufacturers starting in late summer of 2010. Several luminaire manufacturers were contacted via e-mail and also by phone. An Excel worksheet was provided to the manufactures to use as a template for assembling the data. Most of the manufacturers responded with interest in getting their products included; however, almost all have mentioned concern regarding required effort and low availability of staff.

We think the real concern is whether or not the Guide will be used. The manufacturers don't want to expend their resources providing/generating content for the Guide if it will not affect their marketing. Once one manufacturer adds materials it is viewed as a competitive advantage so everyone else follows along. Prior TF13 guides have shown that the guides become essentially industry standard for where to look for information; so there is a significant benefit to being in the Guide.

Meetings

The TF13 Spring meeting was held in Cleveland, Ohio on May 25th and 26th in conjunction with the TRB AFB20 mid-year meeting. Dr. Plaxico attended the meeting and made a presentation to the Sign and Luminaire Subcommittee regarding progress on the project. A summary of the meeting is provided below and a copy of the presentation is included as Attachment A to this report.

The presentation covered the following topics:

- Objectives
- Project Status
- Guide Content
- Overview of the Guide
  - Search Options
  - System Nomenclature
    - General Systems
    - Specific Systems
  - Search Criteria
    - General Systems
    - Specific Systems
    - Components
  - System Information and Web-Page Format
- Wind-Speed and EPA
- Proposed Revisions to the Guide
- Data Collection Efforts
- Issues

There was overall general agreement with the Guide's functionality and format; however, there were two primary issues that the research team brought up for discussion with the group – one of which did not get resolved at the meeting. The issues are listed below and are discussed in more detail in the following paragraphs.

- Overwhelming number of possible system configurations
- EPA calculations
  - Level of effort required for calculations
  - Lack of consistency in design parameters
  - Competitive disadvantage for manufacturers who provide conservative EPA calculations (i.e., inadvertently penalizing them for specifying conservative load limits).

Overwhelming number of possible system configurations

Many luminaire system manufacturers provide custom designs for their clients; this is particularly true for aluminum pole manufacturers. Although these manufacturers may have a finite selection of luminaire arms and frangible-bases, the potential variations on pole length/mounting height are quite numerous. To prevent manufacturers from submitting an unlimited amount of pole configurations to the database, the research team proposed to limit the mounting heights of the systems in the Guide to 12 ft, 14 ft, 16 ft, 18 ft, 20 ft, 25 ft, … and in length increments of 5 ft thereafter, up to the maximum height configuration. This received general agreement from all at the meeting.

EPA Calculations

A particular concern for several luminaire manufactures is the effort required to calculate the EPA values for each system configuration. Some manufacturers do not have detailed catalogs with the information readily available and the labor required to generate these materials is not insignificant. Further, an issue raised by Valmont is that some manufacturers may use more conservative estimates for the design parameters than others. For example, if two or more manufacturers offer the exact luminaire system configuration, the one that shows higher EPA values (e.g., likely based on a less conservative design) may have a competitive advantage over other manufacturers. It is understandable that manufacturers would want to provide conservative EPA values since they must stand behind their own designs, but it is also understandable that they do not want to be penalized for it.

There was another concern related to how maximum EPA is calculated. The maximum fixture EPA for a particular system configuration is dependent upon the weight and location of the fixture, which is not known prior to discussions with the client (e.g., State DOT). Values shown in manufacturers' catalogs, as well as those in this Guide, use a somewhat "generic" fixture weight and an assumed center of gravity location of the fixture to compute EPA. This, nonetheless, provides a means of comparing the "strength" of one system to another in each manufacture's catalog. Unfortunately, there is no standard value for fixture weight and its value may range from as low as 20 lb to as high as 300 lb. It is often listed in catalogs as *maximum fixture weight* which is

not to be confused with the maximum fixture weight that the luminaire system can sustain; rather, it is simply the fixture weight used to calculate the maximum EPA values. Hence, a higher fixture weight reduces the maximum EPA values and *vice versa*.

The group was asked:

- Does fixture weight have significant influence on EPA calculations when compared to wind loading?
  - Are light-weight LED type Luminaires becoming more commonplace in the industry?
  - Should we request that all EPA calculations be made using a standard fixture weight?
- Do we want to standardize the fixture location used for computing EPA in the Guide? For example, should we mandate that EPA values in the Guide be computed based on a specified location of the center of gravity of the fixture, i.e., (Δx, Δy) relative to the mount point. This issue was not resolved at the meeting.

We gathered from the group's comments that fixture weight had only secondary effects in the EPA calculations, thus slight differences in assumed weight would have negligible effect on the EPA values. However, neither of these issues was resolved.

The group was also asked:

- Would the Guide be useful without showing EPA information?
- Is providing EPA values a serious hurdle for manufacturers?

There was agreement among the group that standardization of some of the design parameters was needed to insure consistency in the published EPA values; however, when the group was asked to vote on whether or not to exclude EPA values from the Guide completely, it was a unanimous vote for exclusion. It should be noted that the manufacturers (Hapco, Valmont and Shakespeare) were the only ones that voted (manufacturers are the ones who will have to generate the EPA values). Even though the manufacturers voted unanimously to remove EPA calculations from the Guide, they did all agreed to provide that information if asked to.

Development of Automated EPA Calculations

As discussed in the April 2011 quarterly report, the research team considered developing an automated procedure within the Guide (or to be used by the "Gate Keeper" of the Guide) to calculate the maximum fixture EPA's for each system. The basic idea being that if all EPA values in the Guide were computed using the same calculation procedures and with the same fixture weight(s) then a direct comparison of the systems could be made.

It was determined, however, that the development of such a program would require extensive effort, and would be beyond the scope of this project. Also, the required detail for each component of the system may not be easily obtained from manufacturers, particularly the proprietary components. Discussions with Valmont confirmed that they would rather compute the EPA results themselves than to have a third party make those calculations.

Task 4: Final Report

This task has not been initiated as yet.

Planned Activities for July – September 2011

Webinar

At the previous TF13 meeting it was decided that an informal webinar should be conducted to demonstrate the functionality of the on-line Guide, inviting only a few select participants (e.g., alpha test the Guide using lighting engineers). The alpha testing should help identify problems and general concerns with the Guide, in order that they could be addressed and corrected before going on-line with the webinar to a much broader audience. We would like to schedule this informal webinar in early August if possible, as we feel that this task is quickly becoming the critical path in getting the project to completion.

The guidance on the Guide's development has come largely from feedback at the TF13 meetings and primarily from manufacturers, as the Guide has a direct impact upon them. We think it is important to remember that the primary users of the Guide will be State Lighting Engineers. It would be very helpful for a few Lighting Engineers (e.g., possibly State engineers from the pooled fund sponsors) to use the Guide; maybe go through an exercise for identifying lighting hardware for a current or past project and provide feedback on what is helpful and what is not. If the content and function of the Guide is helpful, then it will be used; if it is being used, then manufacturers will supply whatever is required in order to remain competitive. So, any decisions about content and function should be made based on how the Guide will be used.

The webinar is tentatively scheduled for early August. The research team will provide possible dates to Mr. Gregg Fredrick and Mr. Keith Fulton, who will then schedule the meeting according to availability of the selected participants.

Data Solicitation

The research team will continue to communicate with luminaire pole manufacturers and State DOTs to gather data for the on-line guide and to identify areas for improvement in the Guide.

User Guide/Tutorial

The research team will continue development of a draft User's Guide after the webinar/alpha testing. The User's Guide will include information on:

- How to use the On-Line Guide
- How to submit data for inclusion into the Guide, and
- How to report errors and comments to the research team.

The tutorial may be developed in one or more formats including html, pdf , Microsoft Word, or Microsoft PowerPoint. The objective will be to have the tutorial be a stand-alone self-guided that will eventually be posted on the Guide site.

Meetings

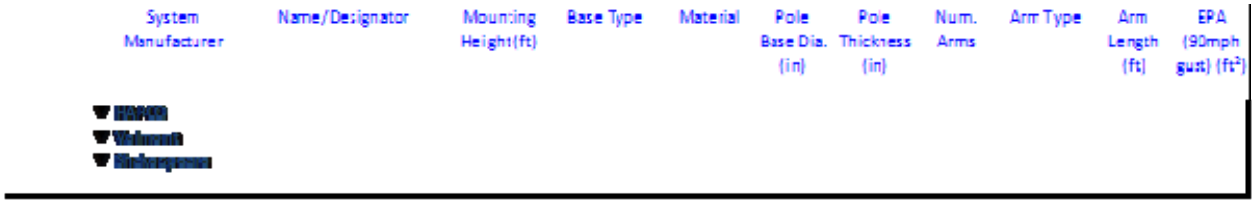
The TF13 Fall meeting will be held September 12-13 in Rapid City, SD. Dr. Plaxico or Dr. Ray will be at the meeting and will be making a presentation to the Sign and Luminaire Subcommittee regarding progress on the project. We plan to continue to encourage manufacturers to work with the research team and submit their materials so we can finalize the Guide.

Guide Updates/Revisions

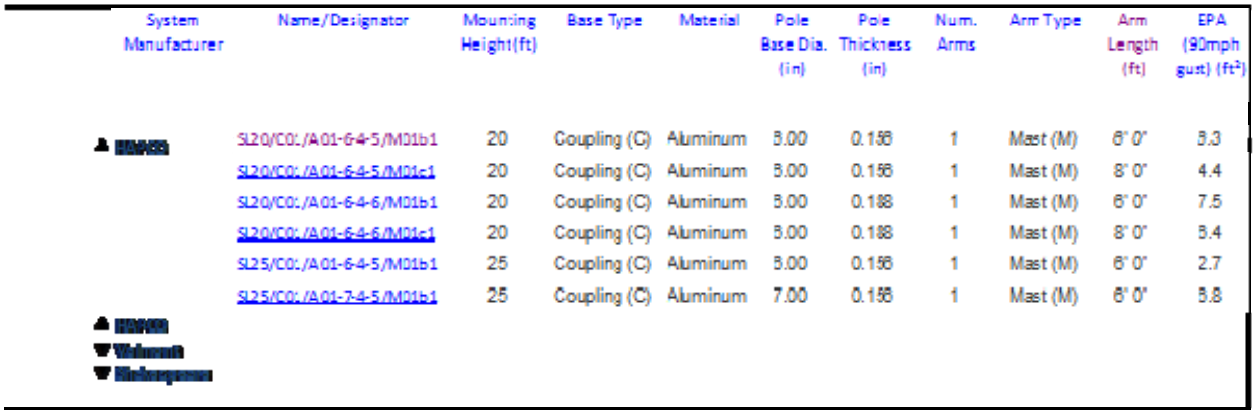
Several updates to the Guide were planned for last quarter. These revisions are still being made to the Guide and will be completed in the upcoming quarter. These were discussed in the previous quarterly report, but will be repeated here for convenience.

Currently, when a user searches for systems using the search page, the number of systems that meet their search criteria may be quite extensive. This, in a way, puts the manufacturer of the first few systems that show up in the list at an advantage. Instead of simply listing all the relevant systems that result from the search option, the Guide would first list the manufactures that provide such systems, and then the user can expand the list of systems based on individual manufacturer.

The Guide first *identifies the manufacturers* that have systems that meet the user's search criteria.



Then, the user would expand the list of systems by clicking on the manufacturer's name to see all the options available from that manufacturer as shown in the next figure.



Another improvement being implemented is a feature that will allow users to select multiple systems for a detailed side-by-side comparison. From the list of systems resulting from the user's search criteria, the user can check a box beside the systems of interest (with a max limit of 5 or so selections at a time) and the Guide will return information for the selected systems for a side-by-side comparison, as illustrated below.

In this example, three systems have been selected for comparison, indicated by the filled select boxes.

Select to compare	Name/Designator	System Manufacturer	Mounting Height (ft)	Base Type	Material	Pole Base Dia. (in)	Pole Thickness (in)	Num. Arms	Arm Type	Arm Length (ft)	EPA (90mph gust) (ft^2)
◉	SL20/H01/A01-7-4-5/	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	0	N/A	0' 0"	18.0
☐	SL20/H01/A01-7-4-5/M01b2	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	2	Mast (M)	6' 0"	6.3
☐	SL20/H01/A01-7-4-5/M01c2	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	2	Mast (M)	8' 0"	5.4
◉	SL20/H01/A01-7-4-5/D01a2	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	2	Davit (D)	4' 0"	6.8
☐	SL20/H01/A01-7-4-5/D01b2	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	2	Davit (D)	6' 0"	5.9
☐	SL20/H01/A01-7-4-5/D01c2	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	2	Davit (D)	8' 0"	5.3
☐	SL20/H01/A01-7-4-5/N01	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	1	Tenon (N)	0' 0"	15.7
◉	SL20/H01/A01-7-4-5/C01d	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	2	Cross (C)	2' 9"	7.3
☐	SL20/H01/A01-7-4-5/C01t	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	3	Cross (C)	3' 5"	5.8
☐	SL20/H01/A01-7-4-5/C01q	HAPCO	20	Shoe (H)	Aluminum	7.00	0.156	4	Cross (C)	4' 0"	4.1
☐	SL20/H01/A01-7-4-6/	HAPCO	20	Shoe (H)	Aluminum	7.00	0.188	0	N/A	0' 0"	22.4

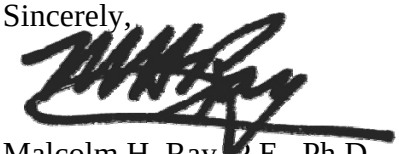
The Guide then lists detailed information for those systems in column format, as illustrated below:

	SL20/H01/A01-7-4-5/	SL20/H01/A01-7-4-5/D01a2	SL20/H01/A01-7-4-5/C01d
Acceptance:	Submitted	Submitted	Submitted
Test Specification:	Report 350	Report 350	Report 350
Manufacturer's Catalog #:	Not Provided	Not Provided	Not Provided
System Manufacturer:	HAPCO	HAPCO	HAPCO
Base Manufacturer:	HAPCO	HAPCO	HAPCO
Base Type:	Shoe (H)	Shoe (H)	Shoe (H)
Arm Type:	N/A	Davit (D)	Cross (C)
Arm Length:	N/A	4' 0" (feet)	2' 9" (feet)
Num. of Arms:	0 (arms)	2 (arms)	2 (arms)
Material:	Aluminum	Aluminum	Aluminum
Mounting Height:	20 (feet)	20 (feet)	20 (feet)
Bolt Circle Diameter:	10.00 to 11.00 (inches)	10.00 to 11.00 (inches)	10.00 to 11.00 (inches)
Pole Length:		N/A	N/A
Pole Base Diameter:	7.00 (inches)	7.00 (inches)	7.00 (inches)
Pole Top Diameter:	4.50 (inches)	4.50 (inches)	4.50 (inches)
Wall Thickness of Pole:	0.156 (inches)	0.156 (inches)	0.156 (inches)
Contact:	Mr. Joe Bowman	Mr. Joe Bowman	Mr. Joe Bowman
FHWA Acceptance Letters:	Letter LS-27	Letter LS-27	Letter LS-27
Arm Component:	None.	LAD01a	LAC01d
Pole Component:	LPA01-x-7-4-5	LPA01-x-7-4-5	LPA01-x-7-4-5
Base Component:	LBH01	LBH01	LBH01
General System:	SLH01	SLH01	SLH01
Max 3-sec gust wind speed	**Max Fixture EPA**		
90 mph	18	6.8	7.3
100 mph	13.7	4.9	5.5
110 mph	10.8	3.3	4.3
120 mph	8.8	2.5	3.5
130 mph	7.2	1.9	2.9
140 mph	6	1.5	2.4
150 mph	5	1.1	2
Fixture wieght used in calcs:	**100 lb**	**75 lb**	**50 lb**

Contractual

The total expenditure for the work performed during this reporting period was $9,665.39 leaving a total project balance of $118,798.06. The total expenditure to-date for the project is $176,201.94. The project team is beginning to wrap up the project and hope to have it complete within the next few quarters.

Sincerely,



Malcolm H. Ray, P.E., Ph.D.