Questions & Answers

FHWA PMEUG Software Training Webinar #1

| Training Topic | Question | Response  (Note: Shaded cells reflect responses given in the webinar, while unshaded cells contain responses to questions that went unanswered during the webinar) |
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| Topic #1—Design of AC Overlays on Existing Flexible Pavement | 2 questions about the existing HMA layer:  (1) you've modeled the ex HMA as 1 layer, but there are almost always more than 1 different type of existing HMA layer present, so which layer do we use to represent the existing HMA layer?  (2) Once that's determined, what are the inputs for the existing HMA - assume new properties (level 1) or guesstimate existing using level 3 inputs? | Ideally, use as few layers as possible. PMED is limited to three individual asphalt layers. However, if the individual asphalt layers are similar (e.g., stiffness), model them as a single layer. However, if they are significantly different (e.g., stiffness order of magnitude different), model as separate layers. Combine thin layers (< 1.5-inch) with other layers. Use weighted average (by thickness) for combined layer volumetric properties. |
| How was the existing pavement characterized structurally? | A Level 2 analysis was performed, in which the structural condition of the pavement was characterized using distress information (e.g., fatigue cracking amount and severity, rutting) collected from a condition survey. A Level 3 analysis, in which the pavement is structurally characterized using a 1-to-5 scale structural rating, was described but not performed. |
| What is the difference between bottom-up cracking and bottom-up cracking + reflective? | Bottom-up cracking is the predicted fatigue cracking in the asphalt overlay. Bottom-up + reflective cracking accounts for fatigue cracking at the bottom of the asphalt overlay layer plus reflective cracking in the overlay resulting from the continued bottom-up fatigue cracking in the underlying asphalt layer. |
| Linda, this relates to our conversation Monday (Justin Moderie). The design example is being driven by reflective cracking, but Pavement ME doesn't address how much cracking remains in the existing surface after a 2" mill. If it's bottom up, Virginia's model isn't capturing it. If it's top down, it's probably removed anyhow. Comments? | Correct. Reflective cracking is the primary issue with the Virginia example (using the global calibration coefficients). The amount of existing transverse cracking is a PMED input and the amount of reflective cracking is determined based on fracture mechanics (see MEPDG MOP, Section 5.3.5). As you note, if the depth of milling reaches the bottom of the top-down crack, in the field it is removed; however, PMED, for this example, still predicts reflective cracking. As discussed, the sections used to globally calibrate the reflective cracking models did not have significant performance between mill and overlay and simple overlay. As with any predicted distress model, if the predicted distress doesn’t match the agency field experience, it certainly may require model verification and local calibration. |
| For existing AC, does the binder PG reflect original binder at construction or aged binder like that extracted from RAP? | Existing AC layer properties for rehabilitation input Level 2 should be the same as for new AC layers (i.e., no aging). The existing AC layer properties for rehabilitation input Level 1 should be the same as for new AC layers except for the AC dynamic modulus. |
| Okay thanks! So, you need to estimate the existing HMA properties. This can be quite a difficult task - specs change over time (i.e., Marshall to SuperPave). This seems like it would take extensive review of historical records to sort out. Correct? | Yes. Level 1 testing is expensive, as is digging up old records. Level 2 and 3 do provide a lower level of effort for quantifying the existing asphalt layer. However, the majority of agencies are able to provide Level 2 input values. |
| Considering that the changes to the level of distresses were small with the different overlays and the different grades of PGACs, which one would you recommend? | Certainly, the 12 inches of existing is sufficient in fatigue (bottom-up fatigue predicted to be 0). Based on my experience, the 2-inch mill and fill plus a 4-inch overlay seems excessive (minimize reflective cracking, but at a high cost both in material and roadside feature adjustments). Also, IRI for the existing pavement doesn’t indicate the transverse cracking is causing a ride issue (IRI below 80, transverse cracking 2979 ft/mi prior to the overlay). If the DOT has shown good performance with a 2-inch mill and fill in these types of situations, I’d recommended that option. The 2-inch no mill is usually not an option due to maintaining in slopes and other roadside features and if any slope correction is needed. |
| How to consider a HMA overlay design in an area where the elevation is limited (such as curb and gutter)? | This is a difficult one. It certainly is a balance between maintaining curb height and expanding overlay options beyond mill and fill to meet intended traffic and preferred performance life. If allowable, and design determines need for added structure, remove existing to accommodate thicker asphalt layer thickness, cold in-place recycle, or full-depth reclamation. |
| So that now that we are going away from ESALS and SN, how do you decide how much is ok? Your example showed the extremes 2 - 6 inches with little change in the values. | As noted above, in these types of situations, you need to be able to quantify what has worked and not worked. If the agency finds a 2-inch mill and fill has too short a performance, going to a thicker overlay will more than likely delay reflective cracking, but the thickness will depend on other factors (e.g., cost, appurtenance adjustment), as well as other agency successful methods for mitigating reflective cracking (e.g., asphalt rubber interlayer, geotextile) |
| Rehabilitation Level pop-up window says "Select Yes if the moduli of the existing pavement layers are being obtained through nondestructive testing/backcalculation (Level 1 inputs). Otherwise, select No."  (1) How does this impact the ME inputs/functionality?  (2) What type of data (and format) is needed? | (1) It is related to how the program determines the undamaged/damaged modulus. For Level 2, the damage is a function of pavement condition (e.g., alligator cracking) and for level 3, based on typical properties from general condition rating (i.e., excellent to very poor).  (2) Level 1 uses imported FWD deflection and backcalculated modulus data to calculate the damaged modulus master curve of the existing AC layer. Loading frequency and test temperature are also required for this calculation. The BcT tool can be used to perform the backcalculation analyses and create the FWD Import file. Level 2 requires detailed condition survey (percent of pavement area exhibiting the predominant severity level of fatigue cracking), which is in turn used to estimate the damaged modulus. Level 3 requires general pavement condition rating, which is then used to estimate the damaged modulus. |
| Existing HMA has all the same inputs as "New" HMA. During the meeting, it was suggested that the existing HMA should use inputs with values as representative as possible to estimate that existing layer (and not use “New” HMA input values). That said, it seems like this will be a very burdensome task to the agencies to estimate various types of past HMA products, with records that are incomplete or missing altogether. Furthermore, we used to use various Marshall mix types, but now use various Superpave types and over time we’ve adjusted their requirements, such as air voids, etc. In addition, the corresponding binder grade/type may be difficult to determine. Therefore, due to these added complexities on top of each other, I have concern that this will be extremely difficult to standardize or provide guidelines on. However, is there something that you’d recommend or a method to use to help us streamline this seemingly difficult task and/or estimate input values for existing HMA for which we may be unsure of what it exactly is? | A search of past records and conducting laboratory testing to quantify existing asphalt layers is time consuming and can be expensive. Other options are to conduct FWD/backcalculation (Level 1), detailed condition survey to quantify distress (Level 2) or use typical values (general condition). |
| Topic #2—Design of AC Overlays on Existing Composite Pavement | Do you recommend using average or weighted average distress values as input values? | If there is a significant difference in performance from one section to the next, consider segmenting the analysis. However, if similar from one section to the next, use a weighted average. |
| Are you using statewide average truck data or are these site-specific values? | Linda and Kelly verbalized Justin Schenkel’s response in the webinar; the response being “clusters and PTRs.” Justin also noted that this has been a continual problem for Michigan, and that calibration helps. |
| I may have missed it but what drives the thermal cracking? | According to the MOP, Section 5.2.4, thermal cracking is based on fracture mechanics and is a function of change in crack depth and stress intensity due to cooling and AC mix fracture parameters (stiffness [E], mean annual air temperature, tensile strength, indirect tensile creep). Kelly noted PG binder plays a significant role. |
| How do we model ex JRCP overlay (or composite with JRCP)? | You cannot directly model JRCP using PMED, it is not one of the included pavement types. You could possibly model as a stiff unbound layer or JPCP; however, neither one is quite right. I’d also recommend confirming AC overlay thickness with other similar successful projects. |
| How to consider the existing distresses (rutting, cracking etc.) in the existing 3" AC layer over PCC? In your case, seems treating the existing AC layer as new AC layer, which seems not the real situation? Thanks! | The existing 3-inch layer is not treated as a new AC layer. Layer properties were based on information provided from agency for each pavement layer. |
| Has anyone tried a Binder Rich Intermediate Course (BRIC) over concrete pavement? | New Jersey DOT has been using BRIC since 2012, with several projects using BRIC as an intermediate layer in composite pavement. The agency constructed some BRIC test sections around 2016. The study indicated the performance of BRIC is dependent on the surface course overlying the BRIC layer, with an SMA/BRIC combination performing significantly better than a dense-graded HMA/BRIC combination.  A study by the University of Florida found: “…a mixture designed by lowering the compaction effort, reducing the design air void content, and coarsening the gradation as reflected by a minimum EFT criterion, resulted in a more cost-effective approach for interlayer mixtures to mitigate reflective cracking (Design and Evaluation of Hot Mix Asphalt [HMA] Mixtures Used as Interlayer to Mitigate Near-Surface Reflective Cracking [RC] in Flexible Pavement (ufl.edu).  Caltrans has had success with a 1.5- to 2.5-inch rubber modified HMA + 3.0-inch HMA over pretty out-of-shape (cracking, faulting) JPCP. |
| Can the use of stress absorbing membrane interlayer be considered in PMED for AC overlay composite pavements? | PMED does not include the ability to directly evaluate a stress absorbing membrane interlayer (SAMI). Geo-grid and geo-textiles have been included, but the sections used for global calibration of the reflection cracking models did not show any consistent difference between these geo materials and a simple asphalt overlay. Also, the minimum AC layer thickness for global calibration of the reflection cracking model was 1.5 inches; so modeling of a SAMI as anything thinner would be a stretch at best. |
| Is there any FWD testing data used to characterize the existing HMA and unbound layers? | FWD test results and backcalculation was not conducted for this example. Harold Von Quintus has provided a number of webinars on backcalculation. |
| Within the JPCP Rehabilitation tab/layer, input is required for "slabs distressed/replaced before restoration" what exactly does this mean? The use of replaced and distressed at the same time is confusing. | The “slabs distressed” refers to the percent of slabs with transverse cracks plus the percent of slabs previously repaired or replaced prior to the AC overlay, while the “replaced before restoration” refers to the percent of “slabs distressed” that were repaired prior to placement of the overlay. “Slabs distressed” minus “replaced before restoration” = percent of slabs cracked prior to the overlay (aka – percent that were not repaired).. |
| For the existing JPCP, do we use the same inputs as those used for "New" JPCP? (this question is similar to the HMA one I previously mentioned - specs change over time and this can be difficult to pin down). | For existing JPCP, the percent slabs cracked is used to compute past damage, which is used to predict future slab cracking. Elastic modulus is determined from cores tested in the laboratory or FWD/backcalculation (Level 1), estimated from compressive testing (Level 2) or estimated from historical 28-day and extrapolated to the date of construction (Level 3). |
| Does the software really distinguish the exiting AC layer over PCC and the new AC overlay? If based on current module, there has no inputs for distresses for existing AC layer over PCC. | Continued fatigue damage in the existing asphalt layers is computed using the damaged modulus based on pavement evaluation data (MEPDG MOP 12.2.7). |
| We'd appreciate seeing the poll Q results. Thx. | Kelly responded to this question thru the Questions box: Yes, we'll include the poll results with post-webinar Q&A responses. |
| Menu option - "Foundation Support":  (1) What is this and how should it be used?  (2) How is this measured/tested for? | (1) Modulus of subgrade reaction (k-value)  (2) FWD/backcalculation to determine k-value. For Level 1 analysis, the month of measurement is required with the measured k-value. For Levels 2 and 3, the k-value is internally calculated. |
| Menu option - "Existing JPCP Condition":  For ‘Transverse joint load transfer efficiency (%)’ should we assume 50% similar to that of our assumption for our Tied Shoulders’ long term load transfer efficiency? Or is there a recommended method for determining/ estimating this on an existing JPCP? | LTE determined through FWD testing or if not measured use 90% for doweled and 75% non-dowelled (MEPDG MOP Table 9-12). |
| Default JPCP layer below HMA has all of the same inputs as "New" JPCP.  Should the existing JPCP layer inputs be modified to match existing JPCP characteristics or should “New” JPCP input values be used? As I previously noted, it was made clear that for existing HMA, the expectation is to use existing HMA input values, but again, I didn’t know if this also applied to existing JPCP. If existing input values need to be determined, similar to my notation about existing HMA, how do we appropriately define these inputs given their variability and limited historical records? | FWD/backcalculation to estimate LTE, layer modulus or estimate from cores, or use an assumed value. |
| Topic #3—Design of AC Overlays on Fractured Concrete Pavement | Do all the of analysis types/design procedures provide ESALs in the output information? | Kelly responded to this question thru the Questions box: The ESALs information is not part of the PDF output file, but is contained in a separate output file, typically called "Flexible ESALs" for flexible design and "ESALs" for rigid design. |
| Number of Lanes - should it be 2 (not 4)? | The input files that were provided for the project used 4 lanes for the number of lanes in the design direction, and that is the value that was used in the demonstration. The project itself was many miles along and included stretches of 2 lanes in each direction. Closer to the city, the project includes additional lanes which may have been the basis for 4 lanes being used in the design. |
| Kelly, Will you be sharing the slides (and recording)? | Kelly responded to this question thru the Questions box: Yes, we'll send out an email containing a link to where both are posted (probably the Pooled Fund website). |
| Did you adjust the stone size of the rubblized layer or assume that of typical dense-graded agg? | The stone size was not adjusted and should have been. Not adjusting probably wouldn’t affect the overall design results because one is defining the resilient modulus. However, it could affect other aspects. |
| Do you recommend underdrain with C&S and rubblization? | It has been largely recommended to do so in the past, but agencies probably have varying opinions on this practice. In general, if it improves the drainage, it is beneficial. |
| Do you have a good web source where we can verify the climate data within ME per city? | If climate data from NCDC ground-based weather stations are being used, it is suggested that satellite-based data (NARR and/or MERRA) be used as these data sets are much more complete and include several more years of historical data. Multiple PMED designs can be performed, and the results can be compared with those using NCDC climate data. Another alternative is to do multiple designs with two different ground-based stations that should have similar climate data. It should be noted that the climatic data source should be restricted to that which was used for local calibration. |
| Do you see longitudinal crack in C&S section? | It’s possible that top-down fatigue cracking could develop, particularly with a stiff pavement structure. However, in general, reflective cracking tends to be the real challenge with these designs, as compared to fatigue cracking. |