**Overview of Load Rating Procedure using the THMPER System**

A summary of the load rating procedure employed for the Northampton County bridges is provided in Figure 1 below. The only difference between this procedure and conventional load rating procedures is the use of an FE model (i.e. refined model) as opposed to the single-line girder approximation to estimate member demands. The results of the THMPER testing come into the process to validate that the FE model developed to estimate member demands is representative of the actual performance of the bridge in question. Once validated, any load-carrying mechanisms that the owner does not want to rely on long-term are removed from the model prior to estimating member demands. In the case of the Northampton County bridges, the mechanisms removed following validation were composite action, longitudinal restraints at the boundaries, the stiffness of the concrete encasement of the girders, and the stiffness of the barriers.

**Summary of Load Rating Procedure**

Calculation of Member Capacity

Calculation of Member Demands

Construct and error screen an element-level FE model of the bridge

Validate the FE model through comparison with THMPER results

Perform THMPER Testing to obtain frequencies and mode shapes

Remove load-carrying mechanisms that may not be reliable long-term (e.g. frozen bearings, participation of barriers, etc.)

Compute member capacities as per AASHTO

Compute member dead load, superimposed dead load, and live load demands as per AASHTO

Computation of rating factor based on member demands and capacities

Figure 1. Summary of load rating procedure using the THMPER System

**Bridge 041 – Load Rating Summary**

Table 1 provides a summary of the bridge parameters and refined load rating results for Northampton County Bridge 041.

Table 1. Summary of Bridge Parameters and Refined Load Rating Results for Bridge 041

|  |  |  |
| --- | --- | --- |
| **Global Bridge Parameters** | | |
| Bridge type | Steel Multi-Girder | Girder encased in concrete |
| Number of Spans | 2 | Simple spans |
| Span Length | 41.5 ft. | Both spans |
| Skew | 40o | Based on PennDOT classification |
| Out-to-Out Width | 300 in. |  |
| Road Width | 270 in. |  |
| Girder Spacing | 40.2 in. |  |
| Number of Girders | 8 |  |
| Number of Lanes | 2 |  |
| **Deck Details** | | |
| Deck Thickness | 13.25 in. |  |
| Wearing Surface | 2.75 in. | In addition to deck thickness |
| Curb Height | 7 in. |  |
| Deck Offset | -7.75 in.\* | Top of girder to bottom of deck |
| **Girder Details** | | |
| Flange thickness | 0.7075 in. |  |
| Flange width | 9 in. |  |
| Web thickness | 0.5204 in. |  |
| Web depth | 25.585 in. |  |
| Girder Moment of Inertia | 2927.7 in4 |  |
| Encasement width | 15 in. |  |
| Encasement depth | 22 in. |  |
| **Material Properties** | | |
| Steel Fy | 30,000 psi | Per AASHTO suggestion |
| Concrete f'c | 2,500 psi | Per AASHTO suggestion |
| Concrete Modulus | 2,850,000 psi |  |
| Weight of Concrete | 150 pcf |  |
| Weight of Steel | 490 pcf |  |
| **LRFD Rating Summary (Strength I Limit State)** | | |
| Max Int/Ext Unfactored DL Moment | 2280 kip-in / 2124 kip-in |  |
| Max Int/Ext Unfactored LL Moment | 1308 kip-in / 1380 kip-in | Includes dynamic load allowance |
| Unfactored Moment Capacity | 7236 kip-in | Assuming non-composite behavior as per AASHTO |
| Inventory Rating | 2.44 |  |
| Operating Rating | 3.16 |  |
| \*Negative deck offset indicates the top flange of the girder is embedded in the deck | | |