TECHSUMMARY April 2022

State Project No. DOTLT1000329 | LTRC Project No. 20-2B

Feasibility and Performance of Low-Volume Roadway Mixture Design

INTRODUCTION

During specification meetings between the Louisiana Department of Transportation and Development (DOTD) and asphalt contractors around the state, a concern was raised regarding the payment methods for low-volume roadways. At the time, DOTD was using the "percent within limits" (PWL) model to determine payment for all roadways. The PWL model uses a statistical analysis of the roadway density to determine the total estimated percentage of the lot that meets specification; however, contractors felt that when roadway plans only call for a mill and overlay, with no base course repairs, the PWL model may lead to penalties due to lower densities that may be a result of subpar base courses. Instead of removing the PWL model altogether, DOTD decided to allow for payment to be based upon the average density of the roadway. With this change in the payment model, there were some concerns that the change in the payment model may lead to lower densities that could result in reduced performance and service life. In order to address these concerns, the Louisiana Transportation Research Center (LTRC) conducted research that resulted in a new specification and payment schedule for low ADT mixtures.

The research conducted by LTRC aimed to develop an asphalt specification that would yield mixtures with adequate impermeability at 92% density, resist rutting and cracking, and be easier to construct, thus reducing construction costs. During the course of research, an analysis was also done to determine the traffic volume criteria that would be suitable for the specification. It was determined that an ADT ≤ 1000, which covers approximately 25% of the roadways in Louisiana, would be a sensible traffic volume for the new criteria. The research developed a new specification, which allows a 0.375-in. nominal maximum aggregate size (NMAS) mix, a size previously not allowed, and a 0.5-in. NMAS mix. Additionally, the existing payment adjustment schedule for minor mixtures was revised to include the mixtures. The new specification and revised payment schedule was added to the *Louisiana Standard Specifications for Roads and Bridges* in the 2018 supplemental specifications.

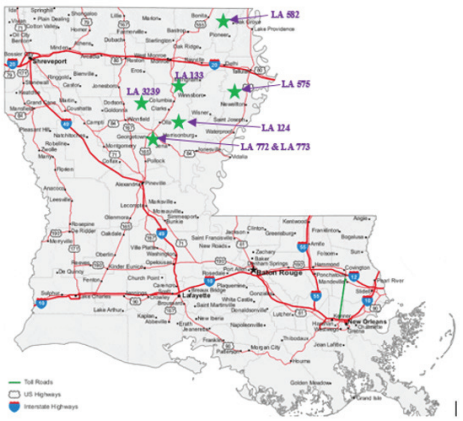

Figure 1. Approximate project locations

Project Location	Project No.	Type of Construction	Mix ID	Binder Grade	Rap (%)	NMAS (in.)
LA 772 & LA 773	H.012887	Patch and Overlay	887	PG 67-22	19	0.5
LA 124	H.012598	Patch, Asphalt surface Treatment and Overlay	598	PG 67-22	19	0.5
LA 3239	H.013574	In-Place Cement Treatment and Asphalt Concrete	574	PG 67-22	19	0.5
LA 133	H.012988	Stabilize and Overlay	988	PG 67-22	19	0.5
LA 575	H.013742	Patch and Overlay	742	PG 67-22	19	0.5
LA 582	H.010393	Asphalt Overlay	393	PG 67-22	19.1	0.5

Table 1. Asphalt mixture information

Currently, the specification is only being used by one contractor in the state and another contractor has submitted a low-volume mix design that is pending approval. As of this report, approximately 22 projects utilizing the new specification were constructed or scheduled to be constructed.

OBJECTIVE

The objective of this research was to evaluate the production practices and construction feasibility of DOTD's low-volume roadway mixture design and to analyze the performance of roadways constructed with these mixtures. The research will also serve to analyze the revised payment schedule for low ADT mainline mixtures and its effect on these roadways.

SCOPE

Several different resources were employed to achieve the objective of this study. In order to evaluate the production practices of the asphalt mix, samples were collected from various contractors for laboratory testing and an assessment of construction feasibility was made based on these findings. The performance

LTRC Report 663

Read online summary or final report:
www.ltrc.lsu.edu/publications.html

PRINCIPAL INVESTIGATORS:
Corey Mayeux, P.E.
Saman Salari, P.E.

LTRC CONTACT:
Samuel B. Cooper, III, Ph.D., P.E.
(225) 767-9164

FUNDING:
SPR: TT-Fed/TT-Reg-6

Louisiana Transportation Research Center

4101 Gourrier Ave
Baton Rouge, LA 70808-4443

www.ltrc.lsu.edu

data for the low-volume roadway pavements was obtained via window surveys, visual inspections made by the research team, and a distress survey conducted using an automatic road analyzer. Once the performance of these roadways was analyzed, a correlation was established with the revised payment schedule.

METHODOLOGY

The following tasks were planned and conducted to achieve the objective of the research project:

- Task 1 – Conduct literature review
- Task 2 – Develop experimental program
- Task 3 – Collect data and asphalt samples
- Task 4 – Conduct laboratory testing
- Task 5 – Perform data analyses
- Task 6 – Prepare draft report

In order to utilize the modified asphalt criteria and its accompanying payment method, a request must be made by the contractor; therefore, the amount of test candidates was limited to projects in which this payment method was requested. A total of six projects were identified as such. The information for the mixtures is shown in Table 1 and the project locations are shown in Figure 1. The mix IDs shown in the table are consistent throughout the report. The job-mix formulas (JMFs) for each project were compiled as well as the plant report, the roadway report, the pay report, and project design proposal. The asphalt samples were obtained at the asphalt plant on the day it was produced before being bought back to LTRC for testing. Volumetric testing was conducted to determine the air voids (AV), voids in mineral aggregate (VMA), and voids filled with asphalt (VFA). Additionally, the asphalt content was found via the ignition method using AASHTO T 308 as well as the mixture gradation. Finally, samples were prepared and subjected to the laboratory performance testing summarized in Table 2 below.

Test Method	Performance Indicator	Test Temperature (C)	Test Procedure
SCB	J_c (kJ/m^2)	25°	DOTD TR 330
LWT	Rut Depth (mm)	50°	AASHTO T 324
|E*|	Dynamic Modulus	-4.4° to 54°	AASHTO T 342

Table 2. Laboratory performance test parameters and protocols

CONCLUSIONS

The objective of this research was to evaluate the production practices and construction feasibility of DOTD's low-volume roadway mixture design and to analyze the performance of roadways constructed with these mixtures. The research also aimed to analyze the revised payment schedule for low ADT mainline mixtures and its effect on these roadways. Based on the results presented, the following conclusions may be drawn:

- The majority of the low-volume mixtures passed the SCB cracking criteria for DOTD. Significant differences were observed between design and production values. The sections will continue to be monitored for impacts on field performance.
- Most of the low-volume mixtures passed the LWT rutting criteria. Insignificant field rutting has been observed through the first summer of use.
- The average and standard deviations of the densities were deemed acceptable, according to both the average and PWL pay structures.
- Additionally, the standard deviation of the densities observed was similar to that of the conventional mixtures used by DOTD. This indicates that the mixture is capable of reaching a consistent density in a low-volume pavement structure.

RECOMMENDATIONS

Based on the outcome of this study, the authors recommend that the low-volume mixture design remain in the specifications. Additionally, the pay schedule for low-volume roads should remain in its current form.