

MASH TEST 5-12 EVALUATION OF TxDOT T80SS BARRIER WITH SOUNDWALL





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Cooperative Research Program

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Transportation (TxDOT) T80SS ba guidelines included in the American <i>Manual for Assessing Safety Hardw</i> Test 5-12, which involves a 36000V traveling at 50 mi/h and 15 degrees	rrier with soundwall according to the n Association of State Highway and T <i>vare (MASH)</i> . The crash test was perf V vehicle weighing 79,300 lb impacti	safety-performance evaluation Transportation Officials (AASHTO) Formed in accordance with <i>MASH</i> ng the longitudinal barrier while
This report provides details the crash test, and a performance as Test 5-12 longitudinal barrier evalu	on the TxDOT T80SS barrier with so sessment of the TxDOT T80SS barri ation criteria.	oundwall, a description and results of er with soundwall for <i>MASH</i>

The TxDOT T80SS barrier with soundwall met the performance criteria for *MASH* Test 5-12 for longitudinal barriers.

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

This report is not intended for construction, bidding, or permit purposes. The engineer in charge of the project was Roger P. Bligh, P.E. #78550.

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The results of the crash testing reported herein apply only to the article tested.

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TABLE OF CONTENTS

List of Figure	es	X
List of Table	S	X
Chapter 1.	Introduction	1
1.1. Backgi	round	1
1.2. Object	ive	1
Chapter 2.	System Details	3
2.1. Test A	rticle and Installation Details	3
2.2. Design	Modifications during Tests	3
2.3. Materi	al Specifications	3
Chapter 3.	Test Requirements and Evaluation Criteria	7
3.1. Crash'	Test Performed/Matrix	7
3.2. Evalua	tion Criteria	7
Chapter 4.	Test Conditions	9
4.1. Test Fa	acility	9
4.2. Vehicle	e Tow and Guidance System	9
4.3. Data A	cquisition System	9
4.3.1.	Vehicle Instrumentation and Data Processing	9
4.3.2.	Anthropomorphic Dummy Instrumentation 1	.1
4.3.3.	Photographic Instrumentation Data Processing 1	.1
Chapter 5.	MASH Test 5-12 (Crash Test No. 440861-4) 1	3
5.1. Test D	esignation and Actual Impact Conditions 1	3
5.2. Weath	er Conditions 1	3
5.3. Test V	ehicle 1	3
5.4. Test D	escription1	4
5.5. Damag	ge to Test Installation	4
5.6. Damag	ge to Test Vehicle 1	5
5.7. Vehicl	e Instrumentation 1	5
Chapter 6.	Summary and Conclusions 2	21
6.1. Assess	ment of Test Results	21
6.2. Conclu	1sions	21
Chapter 7.	Implementation 2	23
References	2	25
Appendix A.	Details of T80SS Barrier with Soundwall 2	27
Appendix B.	Supporting Certification Documents 3	51
Appendix C.	MASH Test 5-12 (Crash Test No. 440861-4) 5	57
C.1. Vehicl	e Properties and Information5	;7
C.2. Sequer	ntial Photographs	58
C.3. Vehicle	e Angular Displacements	51
C.4. Vehicle	e Accelerations	52

LIST OF FIGURES

Figure 2.1.	Details of TxDOT T80SS Barrier with Soundwall.	4
Figure 2.2.	TxDOT T80SS Barrier with Soundwall prior to Testing	5
Figure 3.1.	Target CIP for MASH Test 5-12 on TxDOT T80SS Barrier with	
	Soundwall.	7
Figure 5.1.	TxDOT T80SS Barrier with Soundwall/Test Vehicle Geometrics for	
-	Test No. 440861-4.	13
Figure 5.2.	Test Vehicle before Test No. 440861-4.	14
Figure 5.3.	TxDOT T80SS Barrier with Soundwall after Test No. 440861-4	16
Figure 5.4.	Field Side of TxDOT T80SS Barrier with Soundwall after Test No.	
C	440861-4.	17
Figure 5.5.	Test Vehicle after Test No. 440861-4.	18
Figure 5.6.	Interior of Test Vehicle after Test No. 440861-4.	18
Figure 5.7.	Summary of Results for MASH Test 5-12 on TxDOT T80SS Barrier with	
2	Soundwall.	19

LIST OF TABLES

Page

Test Conditions and Evaluation Criteria Specified for MASH TL-5	
Longitudinal Barriers.	7
Evaluation Criteria Required for MASH TL-5 Longitudinal Barriers.	8
Events during Test No. 440861-4.	14
Performance Evaluation Summary for MASH Test 5-12 on TxDOT T80SS	
Barrier with Soundwall.	22
	Test Conditions and Evaluation Criteria Specified for <i>MASH</i> TL-5 Longitudinal Barriers Evaluation Criteria Required for <i>MASH</i> TL-5 Longitudinal Barriers Events during Test No. 440861-4 Performance Evaluation Summary for <i>MASH</i> Test 5-12 on TxDOT T80SS Barrier with Soundwall.

Chapter 1. INTRODUCTION

1.1. BACKGROUND

Noise barriers, or soundwalls, are structures designed to abate noise in areas neighboring a highway. Sound sources in the highway environment include vehicle engine and exhaust noise, tire-pavement noise, and aerodynamic noise, which vary by vehicle type and speed. There are many types of soundwall designs. Concrete soundwalls work by redirecting the travel of sound away from a location.

When a soundwall is needed across a bridge structure, design options become more limited. When a truck impacts a bridge rail, the lean of the truck over the top of the bridge rail defines what is referred to as the working width or zone of influence. It is typically impractical and cost prohibitive to locate a bridge-mounted soundwall outside the working width of the bridge rail due to the additional deck width that would be required. If the soundwall is located inside the barrier working width, it must be designed to accommodate the associated vehicle impact loads.

Vehicle impact conditions for the design of longitudinal barriers such as bridge rails are prescribed in *MASH*. *MASH* defines six different test levels that increase in impact severity. TxDOT wished to evaluate the impact performance of a concrete soundwall mounted on top of a concrete bridge rail supported on a cantilevered deck to *MASH* Test Level 5 (TL-5) impact conditions. Such a design can provide a cost-effective, crashworthy solution when a bridge-mounted soundwall is needed.

1.2. OBJECTIVE

The purpose of the test reported herein was to assess the performance of the TxDOT T80SS barrier with soundwall according to the safety-performance evaluation guidelines included in *MASH*. The crash test was performed in accordance with *MASH* Test 5-12, which involves a 36000V tractor-van trailer vehicle weighing 79,300 lb impacting the longitudinal barrier while traveling at 50 mi/h and 15 degrees.

This report provides details on the TxDOT T80SS barrier with soundwall, a description and results of the crash test, and a performance assessment of the TxDOT T80SS barrier with soundwall for *MASH* Test 5-12 longitudinal barrier evaluation criteria.

Chapter 2. SYSTEM DETAILS

2.1. TEST ARTICLE AND INSTALLATION DETAILS

The test installation was 120 ft long and consisted of a steel-reinforced concrete deck, barrier parapet, and soundwall. The 30-inch-wide, 12-inch-thick deck cantilever was anchored to the foundation wall. The single-slope parapet was 42 inches tall, 12 inches wide at top, and 20 inches wide at bottom, with a continuous slope on the traffic side. The field side of the single-slope parapet had a 1½-inch inset from the deck to a height of 19½ inches. The soundwall was 9 inches wide and 54 inches tall, bringing the total height of the parapet soundwall system to 96 inches from grade. The soundwall was centered on the top of the single-slope parapet, providing an offset of 1½ inches from the top traffic and field side corners of the parapet to the faces of the soundwall.

There was a single 2-inch-wide joint through the deck, parapet, and soundwall 30 ft downstream from the end of the installation. This joint was reinforced with four 1-inch-diameter rebar dowels. One end of each dowel was cast into the concrete, and the other side was in a PVC sleeve to allow movement across an expansion joint. Two dowel bars were in the parapet and two were in the sound wall.

Figure 2.1 presents the overall information on the TxDOT T80SS barrier with soundwall, and Figure 2.2 provides photographs of the installation. Appendix A provides further details on the TxDOT T80SS barrier with soundwall. Drawings were provided by the TTI Proving Ground, and construction was performed by MBC Management and supervised by TTI Proving Ground personnel.

2.2. DESIGN MODIFICATIONS DURING TESTS

No modifications were made to the installation during the testing phase.

2.3. MATERIAL SPECIFICATIONS

The specified compressive strength of the concrete used in the support wall, deck, parapet, and soundwall was 4000 psi. The average compressive strengths of the concrete were as follows:

- North of Joint Support wall: 5,620 psi at 91 days of age on June 30, 2021.
- South of Joint Support wall: 5,530 psi at 86 days of age on June 30, 2021.
- North of Joint Deck: 5475 psi at 91 days of age on June 30, 2021.
- South of Joint Deck: 5,530 psi at 86 days of age on June 30, 2021.
- Barrier North of Expansion Joint: 4,953 psi at 35 days of age on May 19, 2021.
- Barrier South of Expansion Joint: 6,897 psi at 76 days of age on June 30, 2021.
- Soundwall North of Expansion Joint: 5,533 psi at 71 days of age on June 30, 2021.
- Soundwall South of Expansion Joint: 5,306 psi at 69 days of age on June 30, 2021.

Appendix B provides material certification documents for the materials used to install/construct the TxDOT T80SS barrier with soundwall.



Figure 2.1. Details of TxDOT T80SS Barrier with Soundwall.



Figure 2.2. TxDOT T80SS Barrier with Soundwall prior to Testing.

Chapter 3. TEST REQUIREMENTS AND EVALUATION CRITERIA

3.1. CRASH TEST PERFORMED/MATRIX

Table 3.1 shows the test conditions and evaluation criteria for *MASH* TL-5 for longitudinal barriers. This report presents testing of the TxDOT T80SS barrier with soundwall in accordance with *MASH* Test 5-12 evaluation criteria. The target critical impact point (CIP) for *MASH* Test 5-12 was determined using the information provided in *MASH* Section 2.3.2.1 and *MASH* Table 2-8. Figure 3.1 shows the target CIP for *MASH* Test 5-12 on the TxDOT T80SS barrier with soundwall, which was 12 inches downstream of the centerline of the joint in the deck, parapet, and soundwall.

Table 3.1. Test Conditions and Evaluation Criteria Specified for MASH TL-5Longitudinal Barriers.

Test Article	Test	Test	Imp Condi	act tions	Evaluation
	Designation	venicie	Speed	Angle	Criteria
	5-10	1100C	62 mi/h	25°	A, D, F, H, I
Longitudinal Barrier	5-11	2270P	62 mi/h	25°	A, D, F, H, I
	5-12	36000V	50 mi/h	15°	A, D, G



Figure 3.1. Target CIP for MASH Test 5-12 on TxDOT T80SS Barrier with Soundwall.

MASH also recommends performing Test 5-10 with the 1100C passenger car and Test 5-11 with the 2270P pickup truck. However, based on the acceptable impact performance of a single-slope barrier of similar profile in previous testing with both design passenger vehicles, these tests were not considered necessary (2, 3). The 1100C passenger car would not interact with the added soundwall. While the pickup truck might have some minimal contact with the offset soundwall, the face of the soundwall is continuous with no edges or surfaces to create snagging.

The crash tests and data analysis procedures were in accordance with guidelines presented in *MASH*. Chapter 4 presents brief descriptions of these procedures.

3.2. EVALUATION CRITERIA

The appropriate safety evaluation criteria from Tables 2-2 and 5-1 of *MASH* were used to evaluate the crash tests reported herein. Table 3.1 lists the test conditions and evaluation criteria

required for *MASH* Test 5-12, and Table 3.2 provides detailed information on the evaluation criteria. An evaluation of the crash test results is presented in Chapter 6.

Evaluation Factors	Evaluation Criteria
Structural Adequacy	A. Test article should contain and redirect the vehicle or bring the vehicle to a controlled stop; the vehicle should not penetrate, underride, or override the installation although controlled lateral deflection of the test article is acceptable.
	D. Detached elements, fragments, or other debris from the test article should not penetrate or show potential for penetrating the occupant compartment, or present undue hazard to other traffic, pedestrians, or personnel in a work zone.
Occupant Risk	Deformations of, or intrusions into, the occupant compartment should not exceed limits set forth in Section 5.2.2 and Appendix E of MASH.
	<i>G.</i> It is preferable, although not essential, that the vehicle remain upright during and after the collision.

Table 3.2. Evaluation Criteria Required for MASH TL-5 Longitudinal Barriers.

Chapter 4. TEST CONDITIONS

4.1. TEST FACILITY

The full-scale crash test reported herein was performed at the TTI Proving Ground, an International Standards Organization (ISO)/International Electrotechnical Commission (IEC) 17025-accredited laboratory with American Association for Laboratory Accreditation (A2LA) Mechanical Testing Certificate 2821.01. The full-scale crash test was performed according to TTI Proving Ground quality procedures, as well as *MASH* guidelines and standards.

The test facilities of the TTI Proving Ground are located on The Texas A&M University System RELLIS Campus, which consists of a 2000-acre complex of research and training facilities situated 10 mi northwest of the flagship campus of Texas A&M University. The site, formerly a United States Army Air Corps base, has large expanses of concrete runways and parking aprons well suited for experimental research and testing in the areas of vehicle performance and handling, vehicle-roadway interaction, highway pavement durability and efficacy, and roadside safety hardware and perimeter protective device evaluation. The site selected for construction and testing of the TxDOT T80SS barrier with soundwall was at the end of an out-of-service runway. The runway consists of an unreinforced jointed-concrete pavement in 12.5-ft × 15-ft blocks nominally 6 inches deep. The runways were built in 1942, and the joints have some displacement but are otherwise flat and level.

4.2. VEHICLE TOW AND GUIDANCE SYSTEM

The vehicle was placed in ninth gear for the *MASH* 5-12 test. With the vehicle idling, the clutch was remotely engaged to allow the truck to be pushed to speed. Once at speed, within the power band of the gear, the clutch was remotely released. The accelerator was then remotely depressed, and the vehicle accelerated under its own power to the required speed. A steel cable for guiding the test vehicle was tensioned along the path, anchored at each end, and threaded through an attachment to the front wheel of the test vehicle. The vehicle was released and ran unrestrained just prior to impact with the installation. The vehicle remained freewheeling (i.e., no steering or braking inputs) until it cleared the immediate area of the test site.

4.3. DATA ACQUISITION SYSTEM

4.3.1. Vehicle Instrumentation and Data Processing

The test vehicle was instrumented with a self-contained onboard data acquisition system. The signal conditioning and acquisition system is a 16-channel Tiny Data Acquisition System (TDAS) Pro produced by Diversified Technical Systems Inc. The accelerometers, which measure the x, y, and z axis of vehicle acceleration, are strain gauge type with linear millivolt output proportional to acceleration. Angular rate sensors, measuring vehicle roll, pitch, and yaw rates, are ultra-small, solid-state units designed for crash test service. The TDAS Pro hardware and software conform to the latest SAE J211, Instrumentation for Impact Test. Each of the 16 channels is capable of providing precision amplification, scaling, and filtering based on transducer specifications and calibrations. During the test, data are recorded from each channel at a rate of 10,000 samples per second with a resolution of one part in 65,536. Once data are

recorded, internal batteries back up the data inside the unit in case the primary battery cable is severed. Initial contact of the pressure switch on the vehicle bumper provides a time zero mark and initiates the recording process. After each test, the data are downloaded from the TDAS Pro unit into a laptop computer at the test site. The Test Risk Assessment Program (TRAP) software then processes the raw data to produce detailed reports of the test results.

Each of the TDAS Pro units is returned to the factory annually for complete recalibration and to ensure that all instrumentation used in the vehicle conforms to the specifications outlined by SAE J211. All accelerometers are calibrated annually by means of an ENDEVCO[®] 2901 precision primary vibration standard. This standard and its support instruments are checked annually and receive a National Institute of Standards Technology (NIST) traceable calibration. The rate transducers used in the data acquisition system receive calibration via a Genisco Rateof-Turn table. The subsystems of each data channel are also evaluated annually, using instruments with current NIST traceability, and the results are factored into the accuracy of the total data channel per SAE J211. Calibrations and evaluations are also made anytime data are suspect. Acceleration data are measured with an expanded uncertainty of ± 1.7 percent at a confidence factor of 95 percent (k = 2).

TRAP uses the data from the TDAS Pro to compute the occupant/compartment impact velocities, time of occupant/compartment impact after vehicle impact, and highest 10-millisecond (ms) average ridedown acceleration. TRAP calculates change in vehicle velocity at the end of a given impulse period. In addition, maximum average accelerations over 50-ms intervals in each of the three directions are computed. For reporting purposes, the data from the vehicle-mounted accelerometers are filtered with an SAE Class 180-Hz low-pass digital filter, and acceleration versus time curves for the longitudinal, lateral, and vertical directions are plotted using TRAP.

TRAP uses the data from the yaw, pitch, and roll rate transducers to compute angular displacement in degrees at 0.0001-s intervals, and then plots yaw, pitch, and roll versus time. These displacements are in reference to the vehicle-fixed coordinate system with the initial position and orientation being initial impact. Rate-of-rotation data are measured with an expanded uncertainty of ± 0.7 percent at a confidence factor of 95 percent (k = 2).

Placement of the electronic instrumentation in the 36000V vehicle is described below and shown in **Error! Reference source not found.**:

- (A) The front accelerometers were placed on the truck frame rail 19.0 inches rearward of the front axle, 20.0 inches to the left of the longitudinal centerline, at height of 26.0 inches above ground surface.
- (B) The accelerometers and rate transducers at the rear of the tractor were placed 106.0 inches rearward of the front axle, on the longitudinal centerline, at a height of 32.0 inches above ground surface.
- (C) The rear accelerometers were placed inside the trailer on the floor 695.0 inches rearward of the front axle, on the longitudinal centerline, at a height of 49.0 inches above ground surface.

4.3.2. Anthropomorphic Dummy Instrumentation

MASH does not recommend or require use of a dummy in the 36000V vehicle, and no dummy was placed in the vehicle.

4.3.3. Photographic Instrumentation Data Processing

Photographic coverage of the test included three digital high-speed cameras:

- One placed overhead with a field of view perpendicular to the ground and directly over the impact point.
- One placed upstream from the installation at an angle to have a field of view of the interaction of the rear of the vehicle with the installation.
- A third placed with a field of view parallel to and aligned with the installation at the downstream end.

A flashbulb on the impacting vehicle was activated by a pressure-sensitive tape switch to indicate the instant of contact with the TxDOT T80SS barrier with soundwall. The flashbulb was visible from each camera. The video files from these digital high-speed cameras were analyzed to observe phenomena occurring during the collision and to obtain time-event, displacement, and angular data. A digital camera recorded and documented conditions of each test vehicle and the installation before and after the test.

Chapter 5. MASH TEST 5-12 (CRASH TEST NO. 440861-4)

5.1. TEST DESIGNATION AND ACTUAL IMPACT CONDITIONS

MASH Test 5-12 involves a 36000V vehicle weighing 79,300 lb \pm 1100 lb impacting the CIP of the longitudinal barrier at an impact speed of 50 mi/h \pm 2.5 mi/h and an angle of 15 degrees \pm 1.5 degrees. The CIP for *MASH* Test 5-12 on the TxDOT T80SS barrier with soundwall was 12 inches \pm 12 inches downstream of the centerline of the expansion joint. Figure 3.1 and Figure 5.1 depict the target impact setup.



Figure 5.1. TxDOT T80SS Barrier with Soundwall/Test Vehicle Geometrics for Test No. 440861-4.

The 36000V vehicle weighed 80,030 lb, and the actual impact speed and angle were 50.4 mi/h and 14.3 degrees. The actual impact point was 20.9 inches downstream of the centerline of the expansion joint. Minimum target impact severity (IS) was 404 kip-ft, and actual IS was 415 kip-ft.

5.2. WEATHER CONDITIONS

The test was performed on the afternoon of July 1, 2021. Weather conditions at the time of testing were as follows: wind speed: 5 mi/h; wind direction: 187 degrees (vehicle was traveling at a heading of 350 degrees); temperature: 90°F; relative humidity: 66 percent.

5.3. TEST VEHICLE

Figure 5.2 shows the 2013 International 8600 tractor with 1988 Great Dane 7311TCHL53 trailer used for the crash test. The vehicle's test inertia weight was 80,030 lb, and its gross static weight was 80,030 lb. The height to the lower edge of the vehicle bumper was 14.0 inches, and height to the upper edge of the bumper was 29.5 inches. The height to the center of gravity of the vehicle's ballast was 73.0 inches. Table C.1 in Appendix C.1 gives additional dimensions and information on the vehicle. The vehicle was directed into the installation using a cable guidance system, and was released to be freewheeling and unrestrained just prior to impact.



Figure 5.2. Test Vehicle before Test No. 440861-4.

5.4. TEST DESCRIPTION

Table 5.1 lists events that occurred during Test No. 440861-4. Figures C.1 and C.2 in Appendix C.2 present sequential photographs during the test.

Time (s)	Events
0.0000	Vehicle impacts the soundwall
0.0280	Vehicle begins to redirect
0.1630	Front corner of the trailer contacts the soundwall
0.1720	Left front tire lifts off the pavement
0.7230	Vehicle travels parallel with the soundwall
0.7700	Right rear corner of the trailer contacts the soundwall
1.3370	Vehicle loses contact with the soundwall

Table 5.1. Events during Test No. 440861-4.

For longitudinal barriers, it is desirable for the vehicle to redirect and exit the barrier within the exit box criteria (not less than 65.6 ft for heavy vehicles). The test vehicle exited within the exit box criteria defined in *MASH*. The vehicle rode off the end of the TxDOT T80SS barrier with soundwall. After loss of contact with the barrier, the brakes were applied, and the vehicle came to rest 239 ft downstream of the point of impact and 34 ft toward the traffic side of the soundwall.

5.5. DAMAGE TO TEST INSTALLATION

Figure 5.3 and Figure 5.4 show the damage to the TxDOT T80SS barrier with soundwall. The downstream section of the soundwall had spalled concrete at the joint. There was gouging and scuffing of the concrete at impact and upstream and downstream of impact. There were minor cracks in the deck at the joint. There were also minor cracks on the field side of the soundwall downstream from the joint. Two of the vertical cracks ran from the top to the bottom of the barrier and were measured at 32 inches and 44 inches downstream from the center of the joint. A third vertical crack ran from the middle of the barrier to near the bottom and was measured at 108 inches downstream from the center of the joint. There was one 93-inch-long horizontal crack, which began at the downstream edge of the joint and was measured at

54 inches from the underside of the deck. There was some deflection of the soundwall at the joint. The soundwall on the upstream side of the expansion joint had a permanent deflection of $\frac{1}{8}$ inch at 12 inches from the top of the wall. The soundwall on the downstream side of the expansion joint had a permanent deflection of $\frac{5}{8}$ inch at a location $\frac{37}{2}$ inches from the top, $\frac{1}{4}$ inch at a location $\frac{44}{2}$ inches from the top, and $\frac{1}{4}$ inch at a location $\frac{5}{2}$ inches from the base of the soundwall. The downstream section of the deck at the joint was $\frac{1}{2}$ inches below the section upstream of the joint at 2 inches toward the traffic side from the toe of the single-slope parapet. Working width* was 20.4 inches, and height of working width was 94.9 inches. Maximum dynamic deflection during the test was 1.9 inches, and there was no permanent deformation observed.

5.6. DAMAGE TO TEST VEHICLE

Figure 5.5 shows the damage sustained by the vehicle. The front bumper, left front axle spring assembly, hood, right door, right front tire and rim, right front outer tandem tire and rim, right fuel tank (deformed only; no visible cuts or holes; no leaks), right side steps, right front corner of the trailer, and right rear upper corner of the trailer were damaged. The windshield had cracks radiating upward and inward from the lower right corner. Maximum exterior crush to the vehicle was 18.0 inches in the front plane at the right front corner at bumper height. No occupant compartment deformation or intrusion was observed. Figure 5.6 shows the interior of the vehicle.

5.7. VEHICLE INSTRUMENTATION

Data from the accelerometers were digitized for informational purposes only and are reported in Figure 5.7. Figure C.3 in Appendix C.3 shows the vehicle angular displacements, and Figures C.4 through C.12 in Appendix C.4 show acceleration versus time traces. Figure 5.7 summarizes pertinent information from the test.

^{*} Per *MASH*, "The working width is the maximum dynamic lateral position of any major part of the system or vehicle. These measurements are all relative to the pre-impact traffic face of the test article." In other words, working width is the total barrier width plus the maximum dynamic intrusion of any portion of the barrier or test vehicle past the field side edge of the barrier.



Figure 5.3. TxDOT T80SS Barrier with Soundwall after Test No. 440861-4.



Note: Cracks outlined with black marker for visualization.

Figure 5.4. Field Side of TxDOT T80SS Barrier with Soundwall after Test No. 440861-4.



Figure 5.5. Test Vehicle after Test No. 440861-4.



Figure 5.6. Interior of Test Vehicle after Test No. 440861-4.



TR No. 0-7086-R4

Chapter 6. SUMMARY AND CONCLUSIONS

6.1. ASSESSMENT OF TEST RESULTS

The crash test reported herein was performed in accordance with *MASH* Test 5-12, which involves a 36000V tractor-van trailer impacting the TxDOT T80SS barrier with soundwall at a nominal impact speed and angle of 50 mi/h and 15 degrees. Table 6.1 provides an assessment of the test based on the applicable safety evaluation criteria for *MASH* Test 5-12 for longitudinal barriers.

6.2. CONCLUSIONS

The TxDOT T80SS barrier with soundwall met the performance criteria for *MASH* Test 5-12 for longitudinal barriers.

	Table 6.1. Performance Evaluation Summary for <i>h</i>	IASH Test 5-12 on TxDOT T80SS Barrier with	Soundwall.
Tes	t Agency: Texas A&M Transportation Institute	Test No.: 440861-4	est Date: 2021-07-01
	MASH Test 5-12 Evaluation Criteria	Test Results	Assessment
Str	<u>uctural Adequacy</u>		
A.	Test article should contain and redirect the vehicle or	The TxDOT T80SS barrier with soundwall	
	bring the vehicle to a controlled stop; the vehicle	contained and redirected the 36000V vehicle.	
	should not penetrate, underride, or override the	The vehicle did not penetrate, underride, or	Pass
	installation although controlled lateral deflection of	override the installation. Maximum dynamic	
	the test article is acceptable.	deflection during the test was 1.9 inches.	
Oc	cupant Risk		
D.	Detached elements, fragments, or other debris from	No detached elements, fragments, or other debris	
	the test article should not penetrate or show potential	from the soundwall were present to penetrate or	
	for penetrating the occupant compartment, or present	show potential for penetrating the occupant	
	an undue hazard to other traffic, pedestrians, or	compartment, or present hazard to others in the	Dage
	personnel in a work zone.	area.	1 (CCD
	Deformations of, or intrusions into, the occupant	No occupant compartment deformation or	
	compartment should not exceed limits set forth in	intrusion was observed.	
	Section 5.2.2 and Appendix E of MASH.		
5	It is preferable, although not essential, that the vehicle $\frac{1}{2}$	The 36000V vehicle remained upright during and	D
	remain upright during and after collision.	after the collision event.	r'ass

TR No. 0-7086-R4

Chapter 7. IMPLEMENTATION*

Based on the results of the testing and evaluation reported herein, the TxDOT T80SS barrier with concrete soundwall is considered suitable for implementation as a *MASH* TL-5 barrier system. The *MASH* matrix for TL-5 longitudinal barriers consists of three tests: Tests 5-10, 5-11, and 5-12. *MASH* Test 5-12 was performed under this project and successfully met all *MASH* evaluation criteria.

MASH also recommends performing Test 5-10 with the 1100C passenger car and Test 5-11 with the 2270P pickup truck. However, based on the acceptable impact performance of a single-slope barrier of similar profile in previous testing with both design passenger vehicles, these tests were not considered necessary (2, 3). The 1100C passenger car would not interact with the added soundwall. While the 2270P pickup truck might have some minimal contact with the offset soundwall, the face of the soundwall is continuous with no edges or surfaces to create snagging.

Statewide implementation of this barrier and soundwall combination can be achieved by TxDOT's Bridge Division through development of a standard detail sheet. The barrier details provided in Appendix A can be used for this purpose.

^{*} The opinions/interpretations identified/expressed in this section of the report are outside the scope of TTI Proving Ground's A2LA Accreditation.

REFERENCES

- 1. AASHTO. *Manual for Assessing Roadside Safety Hardware, Second Edition.* American Association of State Highway and Transportation Officials, Washington, DC, 2016.
- 2. FHWA Safety Roadway Departure Eligibility Letter B-339 (https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/barrie_ rs/pdf/b339.pdf).
- 3. W. F. Williams, R. P. Bligh, and W. L. Menges. *MASH Test 3-11 of the TxDOT Single Slope Bridge Rail (Type SSTR) on Pan-Formed Bridge Deck*. Report FHWA/TX-11/9-1002-3, Texas A&M Transportation Institute, College Station, TX, March 2011.


APPENDIX A. DETAILS OF T80SS BARRIER WITH SOUNDWALL









TR No. 0-7086-R4

	exas A&M ansportation stitute	QF 7.3-01 Samj	Concrete pling	Doc. No. QF 7 .3-01	Revision Date: 2020-0 7- 29
Quality	y Form	Revised by: B.L. Griffi Approved by: D. L. Ku	th hn	Revision: 7	Page: 1 of 1
Project No:	440861-04	Casting Date:	3/31/2021	Mix Design (psi):	4000
Name of Technician Taking Sample	Terr	acon	Name of Technician Breaking Sample	Terr	acon
Signature of Technician Taking Sample	Terr	acon	Signature of Technician Breaking Sample	Terr	acon
Load No.	Truck No.	Ticket No.	Locat	ion (from concrete	e map)
Т1	6678594	7212		100% of wall	
Т2	6678665	7211	110 feet o	f deck starting from	the North
Т3	6678983	7165	10 fee	t of deck from Joint	North
Load No.	Break Date	Cylinder Age	Total Load (lbs)	Break (psi)	Average

APPENDIX B. SUPPORTING CERTIFICATION DOCUMENTS

		BILLING			TICKET NO
	Ма	rtin Mari	etta		6678594
Martin	1	503 LBJ Freew	/av		
Mariet	ita r	Suite 400			
		Janas, 17 1923	54		
TO JOB	ARRIVE JOB SITE	BEGIN POUR	FINISH POUR	LEAVE JOB SIT	E ARRIVE PLANT
A Long day	A DU .		:	:	:
OB AT CUSTOMER	S REQUEST	GAL. CUST	OMER SIGNATURE		
EN YES	NO BY	GAL X			
		DELI	VERY OF THESE	MATERIALS IS S	SUBJECT TO THE
ENGTH. ANY W	ATER ADDED IN E	XCESS HERE	OF AS ACCEPTE	DNS ON THE RE	VERSE SIDE RE ABOVE.
ND DELIVERY ADDR	RESS	PLANT	TRUCK ORI	DER NO. SLUMP	P.O. #/JOB/LOT
IENT YAN TX 77807	7	617	7212 201	6 5.00	TTI-THRIE BEAM
		CHARLES	BALANGA		03/31/21
		782823	100138	3 10.00	20.00
PRODUCT CO	DE DESC TXDOT CLASS S	RIPTION		UNIT PRI	CE AMOUNT
NSTRUCTIONS TT LEONARD RE ND ROUND ABC	D, RIGHT 47, LEFT I DUT TO GATE, CUS	NTO RELLIS, TOMER TO MEET	ΓΥΟυ	SALES TAX TOTAL	
SE ALKALI BURN	S. E.		FOR OFFICE U	SE ONLY FOR	M:
river 16114 ix Code SD60S Oty Required Ib 18266 lb Ib 14375 lb Ib 1734 lb Oty 228 or Num Batches Design W/C: 0.453	User D user 6 Returned Batched 18240 lb 14340 lb 5680 lb 1730 lb 2 228 oz 1 Water/Cement: 0.45	isp Ticket 1 678594 Qty 1 % Var% Moisture -0.14% 0.80% M -0.24% 4.00% M -0.25% -0.21% 0.00% 4 T Design	Num Ticket 91404 Mix Age ctual Wat 17 gl 89 gl 207 gl 309.2 gl A	ID Time 11:31 Seq Loa D 925	Date 3/31/21 ad ID 574
	TO JOB TO JOB TO JOB CONTROL STONERS (withheld from batch EN YES BEFO TER ADDED TO CENGTH. ANY M JUMP IS AT CUS NO DELIVERY ADDE TENT YAN, TX 77807 PRODUCT CO SOS PRODUCT CO SOS NSTRUCTIONS HT LEONARD RE ND ROUND ABC SE ALKALI BURN ON REVERSE SID Priver 16114 1228 CO DY Required 18226 ID 18226 ID 18226 ID 18226 ID 18226 ID 1734 ID STOD ID 18226 ID 18226 ID 1734 ID 1973 ID 1974 ID 1974 ID 1974 ID 1974 ID 1975	Maritin Marietta Marietta 1 Marietta 1 Marietta 1 Marietta 1 Marietta 1 Marietta 1 Imaria 1 Marietta 1 Imaria 1 Imaria <td< td=""><td>Martin Marie Marietta Martin Marie Suite 400 Dallas, TX 7523 TO JOB ARRIVE JOB SITE BEGIN POUR : : : OB AT CUSTOMER'S REQUEST (withheld from batch) GAL CUSTO (withheld from batch) PRODUCT COT THIS CONCRETE WILL ENGTH. ANY WATER ADDED IN EXCESS JUMP IS AT CUSTOMER'S RISK. DELIVERY (WITHHELD TO THIS CONCRETE WILL ENGTH. ANY WATER ADDED IN EXCESS JUMP IS AT CUSTOMER'S RISK. DELIVERY ADDRESS (USTOME 7028233) ND DELIVERY ADDRESS PLANT 1477 YAN, TX 77807 PLANT 177 NOS TXDOT CLASS S NSTRUCTIONS MT LEONARD RD, RIGHT 47, LEFT INTO RELLIS, ND ROUND ABOUT TO GATE, CUSTOMER TO MEET SE ALKALI BURNS. DN REVERSE SIDE. PRIVEY USEY DISP TICKET SE ALKALI BURNS. DN REVERSE SIDE. Priver USEY DISP TICKET 16114 USEY 19266 Ib 18240 Ib 19266 Ib 18240 Ib</td><td>BILLING Martin Marietta Solute 400 Dallas, TX 75234 Job 1 Site 400 Job 1 Si</td><td>BILLING Martin Marietta Jo3 LBJ Freeway Suite 400 Dallas, TX 75234 Dallas, TX 75234 Distriction TO JOB ARRIVE JOB SITE DE ARRIVE JOB SITE BEGIN POUR TO JOB ARRIVE JOB SITE Dallas, TX 75234 Distriction Gal (withheid from batch) Gal DE LIVERY OF THESE MATER DEFORE AFE WATER DELEVERY ADDRESS DELIVERY OF THESE MATERIALS IS 3 TER ADDED TO THIS CONCRETE WILL TERMS AND CONDITIONS ON THE RE TERN AND CONDITIONS ON THE RE DESCRIPTION TXDOT CLASS S DIATOT CLASS S NO REVERSION TXDOT CLASS S NO REVERSION SALES TAX TO ADOUND ABOUT TO GATE, CUSTOMER TO MEET YOU TOTAL SEE ALKALI BURNS: FOR OFFICE USE ONLY FOR TITIVER USER DISP TICKET NUM TICKET ID TIME TACOT CLASS S FOR OFFICE USE ONLY FOR TADOT CLASS S FOR OFFICE USE ONLY FOR SEALKALI BURNS: FOR OFFICE USE ONLY FOR TATE SER SALES TAX</td></td<>	Martin Marie Marietta Martin Marie Suite 400 Dallas, TX 7523 TO JOB ARRIVE JOB SITE BEGIN POUR : : : OB AT CUSTOMER'S REQUEST (withheld from batch) GAL CUSTO (withheld from batch) PRODUCT COT THIS CONCRETE WILL ENGTH. ANY WATER ADDED IN EXCESS JUMP IS AT CUSTOMER'S RISK. DELIVERY (WITHHELD TO THIS CONCRETE WILL ENGTH. ANY WATER ADDED IN EXCESS JUMP IS AT CUSTOMER'S RISK. DELIVERY ADDRESS (USTOME 7028233) ND DELIVERY ADDRESS PLANT 1477 YAN, TX 77807 PLANT 177 NOS TXDOT CLASS S NSTRUCTIONS MT LEONARD RD, RIGHT 47, LEFT INTO RELLIS, ND ROUND ABOUT TO GATE, CUSTOMER TO MEET SE ALKALI BURNS. DN REVERSE SIDE. PRIVEY USEY DISP TICKET SE ALKALI BURNS. DN REVERSE SIDE. Priver USEY DISP TICKET 16114 USEY 19266 Ib 18240 Ib 19266 Ib 18240 Ib	BILLING Martin Marietta Solute 400 Dallas, TX 75234 Job 1 Site 400 Job 1 Si	BILLING Martin Marietta Jo3 LBJ Freeway Suite 400 Dallas, TX 75234 Dallas, TX 75234 Distriction TO JOB ARRIVE JOB SITE DE ARRIVE JOB SITE BEGIN POUR TO JOB ARRIVE JOB SITE Dallas, TX 75234 Distriction Gal (withheid from batch) Gal DE LIVERY OF THESE MATER DEFORE AFE WATER DELEVERY ADDRESS DELIVERY OF THESE MATERIALS IS 3 TER ADDED TO THIS CONCRETE WILL TERMS AND CONDITIONS ON THE RE TERN AND CONDITIONS ON THE RE DESCRIPTION TXDOT CLASS S DIATOT CLASS S NO REVERSION TXDOT CLASS S NO REVERSION SALES TAX TO ADOUND ABOUT TO GATE, CUSTOMER TO MEET YOU TOTAL SEE ALKALI BURNS: FOR OFFICE USE ONLY FOR TITIVER USER DISP TICKET NUM TICKET ID TIME TACOT CLASS S FOR OFFICE USE ONLY FOR TADOT CLASS S FOR OFFICE USE ONLY FOR SEALKALI BURNS: FOR OFFICE USE ONLY FOR TATE SER SALES TAX

	Martir Mariet	Ma 1 ta r	BILL rtin I 503 LBJ Suite Suite Sallas, 1	ING Marie Freewa 400 TX 75234				TICKET NO. 6678665
LOAD TIME	TO JOB	ARRIVE JOB SITE	BEGIN	POUR	FINISH F	POUR LE	AVE JOB SITE	ARRIVE PLANT
11:46	12:02	12:27	12	35			:	:
WATER ADDED ON ALLOWABLE WATER TEST CYLINDER TAK CYLINDER TAKEN ADDITIONAL WA REDUCE ITS ST	A CUSTOMER'S (withheld from batch) KEN YES BEFO TER ADDED TO RENGTH. ANY W	REQUEST NO BY RE AFTER WATER THIS CONCRETE	GA GA WILL EXCESS	L. CUSTO L. X DELIV TERM HERE	VERY OF 1	TURE THESE MAT ONDITIONS CEPTED B	TERIALS IS S ON THE REV SIGNATUR	UBJECT TO THE /ERSE SIDE /E ABOVE.
OF SPECIFIED S CUSTOMER NAME A MBC MANAGEN 3100 SH 47, BR	LUMP IS AT CUS IND DELIVERY ADDR MENT IYAN, TX 77807	TOMER'S RISK.		PLANT 617 DRIVER NA LARRY JA CUSTOMEI 782823	TRUCK 7211 ME NTZEN R NUMBER	ORDER 2016 PROJECT 100138	NO. SLUMP 5.00 CUM. QTY 20.00	P.O. #JOB/LOT TTI-THRIE BEAM DATE 03/31/21 ORDERED QTY 20.00
SPECIAL DELIVERY I RIGHT 2818, RIGI STRAIGHT AROU THERE	NSTRUCTIONS HT LEONARD RD ND ROUND ABOI	, RIGHT 47, LEFT JT TO GATE, CUS	INTO REI	LLIS, TO MEET	YOU	SALES	STAX	
DANGER! MAY CAU SEE WARNINGS (ISE ALKALI BURNS ON REVERSE SIDE				FOR OFF	ICE USE ON	ILY FORM:	
Truck I 7211 7 Load Size M 10.00 CYDS I Material Design 17G 1812 SAND-1 1820 CMT-1/1 570 H20 258 ZY-610 23 Actual Load 40063 lb Slump: 5.00 in AGG1 SCALE B 1 ST	Driver U 177135 u 1ix Code SD60S Ady Required b 18266 b b 14375 b b 14375 b b 5700 ib b 1734 b oz 228 oz Num Batches: Design W/C: 0.453 Water in Truck: 0 lb ET 0 lb	Jser D Iser 6 Returned Batched 18280 lb 18280 lb 18280 lb 18287 lb 1734 lb 227 oz 1 Water/Cement: 0.455 0.0 gl Adjust Wa CEM1 SCALE B 1 ST	isp Ti 678665 Qty %Var%Mc 0.08% 0.04% 0.02% 0.04% 5 T ter: 0.0 10 lb	Cket N M bisture Acti .80% M .00% M Design 0 gl / Load ET 0 lb	um Tic 914 ix Age Jal Wat 18 gl 69 gl 208 gl 208 gl 309.2 gl Trim Water WAT1 SC	Actual Actual Actual Actual Actual	Time I 11:46 3 Load 92576 294.1 gl ToAd CYDS 0 lb ET (Date 3/31/21 ID 5 dd: 15.0 gl

Martin Marietta	Mai 15 D	BILLING Ttin Marie 103 LBJ Freewa Suite 400 Pallas, TX 7523	etta ^{ay}		<u> </u>	ICKET NO. 6678983
LOAD TIME TO JOB ARRIV	E JOB SITE	BEGIN POUR	FINISH P	OUR LE	AVE JOB SITE	ARRIVE PLAN
13:11 1 :24	:	:	:		:	:
ALLOWABLE WATER (withheld from batch) TEST CYLINDER TAKEN YES NO B CYLINDER TAKEN BEFORE ADDITIONAL WATER ADDED TO THIS C REDUCE ITS STRENGTH. ANY WATER	AFTER WATER	GAL. CUSTO GAL. CUSTO X MILL TERM EXCESS HERM	VERY OF T MS AND CO EOF AS AC	HESE MAT	ERIALS IS S ON THE REV Y SIGNATUR	UBJECT TO TH VERSE SIDE RE ABOVE.
OF SPECIFIED SLUMP IS AT CUSTOME CUSTOMER NAME AND DELIVERY ADDRESS	R'S RISK.	PLANT	TRUCK	ORDER	NO. SLUMP	P.O. #/JOB/LOT
MBC MANAGEMENT		617	7165	2016	5.00	TTI-THRIE BE
3100 SH 47, BRYAN, TX 77807		CHATHA	M, DEXTER			03/31/21
		CUSTOME 782823	ER NUMBER	PROJECT	CUM. QTY 22.00	22.00
2.00 DSD60S TXDO	OT CLASS S					
2.00 DSD60S TXDO SPECIAL DELIVERY INSTRUCTIONS RIGHT 2818, RIGHT LEONARD RD, RIG STRAIGHT AROUND ROUND ABOUT TO	HT 47, LEFT O GATE, CUS	INTO RELLIS, STOMER TO MEE	TT YOU	SALE	S TAX	
2.00 DSD60S TXDO SPECIAL DELIVERY INSTRUCTIONS RIGHT 2818, RIGHT LEONARD RD, RIG STRAIGHT AROUND ROUND ABOUT TO THERE DANGERIMAY CAUSE ALKALI BURNS.	HT 47, LEFT O GATE, CUS	INTO RELLIS, STOMER TO MEE	TT YOU	SALE	:S TAX	
2.00 DSD60S TXD0 SPECIAL DELIVERY INSTRUCTIONS RIGHT 2818, RIGHT LEONARD RD, RIG STRAIGHT AROUND ROUND ABOUT TO THERE DANGER! MAY CAUSE ALKALI BURNS. SEE WARNINGS ON REVERSE SIDE.	HT 47, LEFT O GATE, CUS	INTO RELLIS, STOMER TO MEE	TT YOU FOR OF	SALE TOTA FICE USE C	IS TAX	:

Report Number: A1171057.0172 Service Date: 03/31/21 **Report Date:** 07/01/21 Revision 1 - 91-day results Task: PO# 440861-4



College Station, TX 77845-5765 979-846-3767 Reg No: F-3272

Client				Project			
Texas Transpo Attn: Gary Ge TTI Business 3135 TAMU	ortation Instit erke Office	ute		Riverside Campus Riverside Campus Bryan, TX			
College Static	on, TX 77843	-3135		Project Number: A1171057			
Material Inf	formatior	1		Sample Information			
Specified Str	ength: DSD60S			Sample Date: Sampled By: Weather Conditions:	03/31/21 Ethan Boult Overcast mo	Sample Time: inghouse oderate wind	1215
Supplier: Batch Time:	Martin Mar	ietta Plant:	517	Accumulative Yards: Placement Method:	10/20 Direct Disch	Batch Size (cy):	10
Truck No.:	7212	Ticket No.:	6678594	Water Added Before (gal): Water Added After (gal):	5		
Field Test I	Data	Desult	Specification	Sample Location:	35Ft east 3F	t south of metal bri	dge
Slump (in):		<u>6</u>	Not specified	Placement Location:	PO 440861	-4	
Air Content (Concrete Ten	(%): np. (F):	2.8	Not specified 40 - 95				
Ambient Ter	1р. (F):	64	40 - 95				

Laboratory Test Data

Plastic Unit Wt. (pcf):

Yield (Cu. Yds.):

ratory Te	st Data				Age at	Maximum	Compressive		
Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Test (days)	Load (lbs)	Strength (psi)	Fracture Type	Tested Bv
A	6.01	28.37		06/30/21	91	163,990	5,780	1	SLS
В	6.01	28.37		06/30/21	91	162,020	5,710	3	SLS
С	6.01	28.37		06/30/21	91	152,710	5,380	4	SLS
					Aver	age (91 days)	5,620		
D					Hold				
Cure: Outsi	ide Plastic Lic	ls	Final Cu	ire: Field Cu	red				
	ratory Tes Specimen ID A B C C D Cure: Outsi	ratory Test Data Specimen Avg Diam. <u>ID</u> (in) A 6.01 B 6.01 C 6.01 D Cure: Outside Plastic Lic	ratory Test Data Specimen Avg Diam. Area ID (in) (sq in) A 6.01 28.37 B 6.01 28.37 C 6.01 28.37 D Cure: Outside Plastic Lids	ratory Test Data Specimen Avg Diam. Area Date ID (in) (sq in) Received A 6.01 28.37 B 6.01 28.37 C 6.01 28.37 D D Cure: Outside Plastic Lids Final Cures	ratory Test Data Specimen Avg Diam. Area Date Date ID (in) (sq in) Received Tested A 6.01 28.37 06/30/21 B 6.01 28.37 06/30/21 C 6.01 28.37 06/30/21 D D Cure: Outside Plastic Lids Final Cure: Field Cure:	ratory Test Data Age at Specimen Avg Diam. Area Date Date Test ID (in) (sq in) Received Tested (days) A 6.01 28.37 06/30/21 91 B 6.01 28.37 06/30/21 91 C 6.01 28.37 06/30/21 91 D Aver Hold Aver D Final Cure: Field Cured Hold	ratory Test Data Age at Maximum Specimen Avg Diam. Area Date Date Test Load ID (in) (sq in) Received Tested (days) (lbs) A 6.01 28.37 06/30/21 91 163,990 B 6.01 28.37 06/30/21 91 162,020 C 6.01 28.37 06/30/21 91 152,710 D D Hold Hold Hold	Specimen Avg Diam. Area Date Date Test Load Strength ID (in) (sq in) Received Tested (days) (lbs) (psi) A 6.01 28.37 06/30/21 91 163,990 5,780 B 6.01 28.37 06/30/21 91 162,020 5,710 C 6.01 28.37 06/30/21 91 152,710 5,380 D Average (91 days) 5,620 Hold Hold Strength	Age at Maximum Compressive Specimen Avg Diam. Area Date Date Test Load Strength Fracture ID (in) (sq in) Received Tested (days) (lbs) (psi) Type A 6.01 28.37 06/30/21 91 163,990 5,780 1 B 6.01 28.37 06/30/21 91 162,020 5,710 3 C 6.01 28.37 06/30/21 91 152,710 5,380 4 D Hold D Final Cure: Field Cured

Comments: Note: Reported air content does not include Aggregate Correction Factor (ACF).

Not specified

Samples Made By: Terracon

Services: Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and test compressive strength samples (ASTM C 31, C 39, C 1231).

Start/Stop: 1100-1400

Terracon Rep.: Ethan Boultinghouse

Reported To:

Contractor:

Report Distribution:

(1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E.

147.2

(1) Texas Transportation Institute, Bill Griffith

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials. Page 1 of 3

CR0001, 11-16-12, Rey 6

Report Number: A1171057.0172 Service Date: 03/31/21 **Report Date:** 07/01/21 Revision 1 - 91-day results PO# 440861-4 Task:



College Station, TX 77845-5765 979-846-3767 Reg No: F-3272

Client				Project			
Texas Transpo Attn: Gary Ge TTI Business 3135 TAMU	ortation Instit erke Office	ute		Riverside Campus Riverside Campus Bryan, TX			
College Static	on, TX 77843	-3135		Project Number: A1171057			
Material Inf	formatior	1		Sample Information			
Specified Str	ength: DSD60S			Sample Date: Sampled By: Weather Conditions:	03/31/21 Ethan Boult Overcast mo	Sample Time: inghouse oderate wind	1240
Supplier: Batch Time:	Martin Mar 1140	ietta Plant:	517	Accumulative Yards: Placement Method:	2020 Direct Disch	Batch Size (cy): narge	10
Field Test [Data	Ticket No.:	6678665	Water Added Betore (gal): Water Added After (gal): Sample Location:	25 0 35Ft east 20	Ft south of metal br	ridge
Test		Result	Specification	-	north ending	3	-
Slump (in): Air Content ((%):	6 2.6	Not specified Not specified	Placement Location:	PO 440861	-4	
Concrete Ten	np. (F):	69	40 - 95				
Ambient Ter	1р. (F):	64	40 - 95				

Laboratory Test Data

Plastic Unit Wt. (pcf):

Yield (Cu. Yds.):

Labo	ratory Te	st Data				Age at	Maximum	Compressive		
Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Test (days)	Load (lbs)	Strength (nsi)	Fracture Tyne	Tested By
2	A	6.01	28.37		06/30/21	91	175,400	6,180	3	SLS
2	В	6.01	28.37		06/30/21	91	143,100	5,040	2	SLS
2	С	6.01	28.37		06/30/21	91	169,370	5,970	1	SLS
						Aver	age (91 days)	5,730		
2	D					Hold				
Initial	Cure: Outsi	ide Plastic Lic	ls	Final Cu	re: Field Cur	ed				

Comments: Note: Reported air content does not include Aggregate Correction Factor (ACF).

Not specified

Samples Made By: Terracon

Services: Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and test compressive strength samples (ASTM C 31, C 39, C 1231).

Start/Stop: 1100-1400

Terracon Rep.: Ethan Boultinghouse

Reported To:

Contractor:

Report Distribution:

(1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E.

146.8

(1) Texas Transportation Institute, Bill Griffith

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials. Page 2 of 3

CR0001, 11-16-12, Rey 6

Report Number: A1171057.0172 Service Date: 03/31/21 **Report Date:** 07/01/21 Revision 1 - 91-day results Task: PO# 440861-4



Client			Project		X	
Texas Transportation	nstitute		Riverside Campus			
Attn: Gary Gerke			Riverside Campus			
TTI Business Office			Bryan, TX			
3135 TAMU						
College Station, TX 7	7843-3135		Project Number: A1171057			
Material Informat	tion		Sample Information			
Specified Strength:			Sample Date:	03/31/21	Sample Time:	1345
. 0			Sampled By:	Ethan Boul	tinghouse	
Mix ID: DSD60	S		Weather Conditions:	Overcast, n	noderate wind	
Supplier: Martin	Marietta		Accumulative Yards:	22/22	Batch Size (cv):	2
Batch Time: 1311	Plant:	517	Placement Method:	Direct Disc	harge	
Truck No.: 7165	Ticket No.:	6678983	Water Added Before (gal):	5	C	
			Water Added After (gal):	0		
Field Test Data			Sample Location:	35Ft East 4	5Ft south of metal b	oridge
Test	Result	Specification		north endin	g	ę
Slump (in):	6 1/2	Not specified	Placement Location:	PO 440861	-4	
Air Content (%):	3.0	Not specified				
Concrete Temp. (F):	70	40 - 95				

Laboratory Test Data

Ambient Temp. (F): Plastic Unit Wt. (pcf):

Yield (Cu. Yds.):

Set No.	Specimen ID	Avg Diam. (in)	Area (sq in)	Date Received	Date Tested	Test (days)	Load (lbs)	Strength (psi)	Fracture Type	Tested By
3	A	6.01	28.37		06/30/21	91	147,970	5,220	4	SLS
3	В	6.01	28.37		06/30/21	91	149,990	5,290	4	SLS
3	С	6.01	28.37		06/30/21	91	146,160	5,150	1	SLS
						Aver	age (91 days)	5,220		
3	D					Hold				
Initial	Cure: Outsi	ide Plastic Lic	ls	Final Cu	are: Field Cured	1				

Comments: Note: Reported air content does not include Aggregate Correction Factor (ACF).

40 - 95

Not specified

Samples Made By: Terracon

Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and Services: test compressive strength samples (ASTM C 31, C 39, C 1231).

Terracon Rep.: Ethan Boultinghouse

Reported To:

Contractor:

Report Distribution:

(1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E. (1) Texas Transportation Institute, Bill Griffith

64

147.4

Reviewed By:

Start/Stop: 1100-1400

Age at Maximum Compressive

Alexander Dunigan

Project Manager

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials. Page 3 of 3

CR0001, 11-16-12, Rev.6

	exas A&M ransportation stitute	QF 7.3-01 Sam	Concrete pling	Doc. No. QF 7.3-01	Revision Date: 2020-07-29
Quality	y Form	Revised by: B.L. Griffi Approved by: D. L. Ku	th hn	Revision: 7	Page: 1 of 1
Project No:	440861-04	Casting Date:	4/5/2021	Mix Design (psi):	4000
Name of Technician Taking Sample	Terr	acon	Name of Technician Breaking Sample	Terr	acon
Signature of Technician Taking Sample	Terr	acon	Signature of Technician Breaking Sample	Terr	acon
Load No.	Truck No.	Ticket No.	Locat	ion (from concrete	e map)
T1	7130	6687524		South Wall and	Deck
Load No.	Break Date	Cylinder Age	Total Load (lbs)	Break (psi)	Average

			BILLING				TIC 6	687524
	Martin Marie	Ma n 1! tta c	rtin Ma 503 LBJ Fre Suite 400 Dallas, TX 7	rietta eway 5234	a 			
	70.100	ARRIVE JOB SITE	BEGIN POL	JR FI	NISH POUR	LEAVE	JOB SITE	ARRIVETER
LOAD TIME	10 108	ANTICODUNE	:		:		-	
10:33								
WATER ADDED ON	JOB AT CUSTOMER	S REQUEST 5	GAL.	CUSTOMER	SIGNATURE			
ALLOWABLE WATE	R (withheld from batch		GAL.	x				IBJECT TO THE
CYLINDER TAKEN	ATER ADDED TO	ORE AFTER WATER THIS CONCRETE NATER ADDED IN	WILL EXCESS	DELIVER TERMS A HEREOF	ND CONDIT	IONS ON ED BY S	I THE REV IGNATURE	ERSE SIDE E ABOVE.
OF SPECIFIED	SLUMP IS AT CU	STOMER'S RISK.	PI A	NT T	RUCK O	RDER NO.	SLUMP	P.O. #/JOB/LOT
CUSTOMER NAME		RE35	617	7	130 2	015	5.00	DATE
3100 SH 47. B	RYAN, TX 7780	17	DRIV	VER NAME	an			04/05/21
			CUS	STOMER NU	JMBER PRO	JECT (CUM. QTY	ORDERED QTY
			782	823	1001	138 9	9.00	E AMOUNT
	STRUCTIONS							Color St.
ECIAL DELIVERY IN GHT 2818, RIGH RAIGHT AROUN	T LEONARD RD	, RIGHT 47, LEFT UT TO GATE, CUS	INTO RELLIS	S, MEET YO	DU	SALES T	ТАХ	
ECIAL DELIVERY IN GHT 2818, RIGH RAIGHT AROUN ERE NGER! MAY CAUS	E ALKALI BURNS	, RIGHT 47, LEFT UT TO GATE, CUS	INTO RELLIS	S, MEET YO	DU	SALES T	ΤΑΧ	
PECIAL DELIVERY IN GHT 2818, RIGH TRAIGHT AROUN IERE NGER! MAY CAUS EE WARNINGS Of	E ALKALI BURNS	, RIGHT 47, LEFT UT TO GATE, CUS	INTO RELLIS STOMER TO	S, MEET Y	OU FOR OFFICE	SALES T TOTAL		I:
ECIAL DELIVERY IN GHT 2818, RIGH RAIGHT AROUN IERE NGERIMAY CAUS EE WARNINGS OF ICK Dr 30 95 ICK DR 30 ICK DR 30 95 ICK DR 30 ICK DR 30 ICK DR 30 ICK DR 30 ICK D	T LEONARD RD ID ROUND ABO E ALKALI BURNS N REVERSE SIDE iver U 6950 u x Code D605 by Required 16489 lb 13005 lb 5130 lb 1450 lb 205 o lb	, RIGHT 47, LEFT UT TO GATE, CUS Ser D Iser 6 Returned Batched 16480 lb 13060 lb 5110 lb 1448 lb 204 cz	isp Tick 687524 Qty % Var% Moistu -0.0% 1.10% 0.42% 4.50% -0.39%	S, MEET YO Ret Nur Mi Mi GM Actua	OU FOR OFFICE m Ticke 9152 x Age wat 22 gi 70 gi 174 gi	SALES T TOTAL USE ONI et ID 4 Seq D	Time 10:33 Loa 926	L Date 4/5/21 d ID 94

5 1/4

1.5

72

65

147.6

Report Number: A1171057.0175 Service Date: 04/05/21 Report Date: 07/01/21 Revision 1 - 86-day results PO# 440861-4 Task:



Client				Project			
Texas Transpo	ortation Institut	e		Riverside Campus			
Attn: Gary Ge	erke			Riverside Campus			
TTI Business	Office			Bryan, TX			
3135 TAMU							
College Station, TX 77843-3135			Project Number: A1171057				
Material Inf	formation			Sample Information			
Specified Stre	ength: 4,000	psi @ 44	4 days	Sample Date:	04/05/21	Sample Time:	1138
-		. ~	-	Sampled By:	Adam Hill		
Mix ID:	DSD60S			Weather Conditions:	Partly cloud	y low wind	
Supplier:	Martin Mariet	ta		Accumulative Yards:	9/9	Batch Size (cy):	9
Batch Time:	1033	Plant:	617	Placement Method:	Direct Disch	narge	
Truck No.:	7130	Ticket No.:	6687524	Water Added Before (gal):	5	0	
				Water Added After (gal):	0		
Field Test L	Data			Sample Location:	North edge	bottom of footing	
Test		Result	Specification	Placement Location:	PO # 44086	1-4	

Laboratory Test Data

Slump (in):

Air Content (%):

Yield (Cu. Yds.):

Concrete Temp. (F):

Ambient Temp. (F):

Plastic Unit Wt. (pcf):

Labo	ratory le	st Data				Age at	Maximum	Compressive		
Set	Specimen	Avg Diam.	Area	Date	Date	Test	Load	Strength	Fracture	Tested
No.	ID	(in)	(sq in)	Received	Tested	(days)	(lbs)	(psi)	Туре	By
1	A	6.01	28.37		06/30/21	86	164,550	5,800	1	SLS
1	в	6.01	28.37		06/30/21	86	161,560	5,700	1	SLS
1	С	6.01	28.37		06/30/21	86	144,720	5,100	2	SLS
						Aver	age (86 days)	5,530		
1	D					Hold				
Initial	Cure: Outsi	ide		Final Cu	ire:					

Initial Cure: Outside

Comments: Average compressive strength of 86 day cylinders complies with the specified strength.

Note: Reported air content does not include Aggregate Correction Factor (ACF).

Samples Made By: Terracon

Services: Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and test compressive strength samples (ASTM C 31, C 39, C 1231).

Terracon Rep.: Adam Hill Reported To: Gary Gerke with TTi

Contractor:

Report Distribution:

(1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E. (1) Texas Transportation Institute, Bill Griffith

Start/Stop: 1030-1215

Reviewed By: Hexander Dunigan

Project Manager

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

CR0001, 11-16-12, Rev.6

	exas A&M ansportation stitute	QF 7.3-01 Samj	Concrete pling	Doc. No. QF 7.3-01	Revision Date: 2020-07-29	
Quality	y Form	Revised by: B.L. Griffi Approved by: D. L. Ku	th hn	Revision: 7	Page: 1 of 1	
Project No:	440861-04	Casting Date:	4/14/2021	Mix Design (psi):	4000	
Name of Technician Taking Sample	Terr	acon	Name of Technician Breaking Sample	Terr	acon	
Signature of Technician Taking Sample	Terr	acon	Signature of Technician Breaking Sample	Terr	acon	
Load No.	Truck No.	Ticket No.	Locat	ion (from concrete	e map)	
T1	7211	6713607	80 ft we	est from the expans	ion joint	
Т2	7102	6713716	The rest of	the west end of the installation		
Load No.	Brook Date	Cylinder Age	Total Load (lbs)	Brook (psi)	Average	
Load No.	bleak Date	Cynnuer Age		break (psi)	Average	

	TICKET NO. 6713607
BILLING Martin Marietta 1503 LBJ Freeway Suite 400 Dallas, TX 75234	
Marietta	JOB SITE ARRIVE PLANT
LOAD TIME TO JOB ARRIVE JOB SITE OL 10:27 10:42 10:07 11:12 GAL CUSTOMER SIGNATURE	
ALLOWABLE WATER (withheld from batch) TEST CYLINDER TAKEN YES NO BY CYLINDER TAKEN BEFORE AFTER WATER ADDITIONAL WATER ADDED TO THIS CONCRETE WILL REPORT OF THESE MATER DELIVERY OF THESE MATER HEREOF AS ACCEPTED BY S	NALS IS SUBJECT TO THE NTHE REVERSE SIDE BIGNATURE ABOVE.
REDUCE ITS STRENGTH. ANY WATER ADDED IN EXCESS OF SPECIFIED SLUMP IS AT CUSTOMER'S RISK. CUSTOMER NAME AND DELIVERY ADDRESS PLANT TRUCK ORDER NO. MBC MANAGEMENT 617 7211 2020 DRIVER NAME LARRY JANTZEN	SLUMP P.O. #/JOB/LOT 5.00 TTI-THRIE BEAM DATE 04/14/21
CUSTOMER NUMBER PROJECT 782823 100138 LOAD QUANTITY PRODUCT CODE DESCRIPTION 10.00 10.00 DSD60S TXDOT CLASS S	10.00 16.00 UNIT PRICE AMOUNT
nd or sore, obtain nomet medical plantor may sevelop an alonge dematitis which where one is a priviouship avec at moder materials.	ns into the eydor a vicu personative individuals tere contact with this of t
SPECIAL DELIVERY INSTRUCTIONS	er recommended that we
RIGHT 2818, RIGHT LEONARD RD, RIGHT 47, LEFT INTO RELLIS, STRAIGHT AROUND ROUND ABOUT TO GATE, CUSTOMER TO MEET YOU THERE TOTAL	AX
DANGERI MAY CAUSE ALKALI BURNS. SEE WARNINGS ON REVERSE SIDE. FOR OFFICE USE ONL	Y FORM:
TruckDriverUserDisp Ticket NumTicket ID7211777135user671360791808Load SizeMix CodeReturnedQtyMix AgeSeq10.00CYDSDSD60SBatched% Var% MoistureActualWat1rRG18322 lb18300 lb-0.12%1.10% M24 glCMT-UI570 lb5700 lb5685 lb-0.26%204 gl2Y-610258 lb1695 lb1706 lb0.65%204 glLoad40065 lbDesign W/C:0.44%0.44%204 gl	Time Date 10:27 4/14/21 Load ID 92979
AGG1 SCALE B 1 ST 60 lb ET 0 lb CEM1 SCALE B 1 ST 10 lb ET 0 lb WAT1 SCALE B 1 ST 60 lb ET 0 lb CEM1 SCALE B 1 ST 10 lb ET 0 lb WAT1 SCALE B 1 ST	297.4 gl ToAdd: 11.8 gl CYDS 11.8 gl 0 lb ET 0 lb

1			BILLI	NG				6713716
		Mar	tin N	lariet	ta			0/10/10
	Martin	15 IVIAI	03 LBJ	Freewav	····			
	Mariet	ta p	Suite	400				
			allas, 1	A 75234				
LOAD TIME	TO JOB	ARRIVE JOB SITE	BEGIN	POUR	FINISH F	POUR LEA	AVE JOB SITE	ARRIVE PLANI
10:46	:		Upda	tasmale		toese Lon	and in the	y set to
	OB AT CUSTOMER	S REQUEST	GAL		ER SIGNA	TURE	100000 2000	- Mary and Market
OWABLE WATER	R (withheld from batch		GAI	- x	331701 2	Turento	in term "de	T and and
T CYLINDER TA		NO BY	R	DELIVE	RY OF T	HESE MAT	ERIALS IS SI	UBJECT TO THE
DDITIONAL W	ATER ADDED TO	THIS CONCRETE	WILL	TERMS	AND CO	NDITIONS (SIGNATUR	E ABOVE.
EDUCE ITS ST	SLUMP IS AT CL	JSTOMER'S RISK.	EXCLOS	stealls an	TDUCK	ORDER N	O. SLUMP	P.O. #/JOB/LOT
USTOMER NAME	AND DELIVERY AD	DRESS	NE STY	PLANT 617	7102	2020	5.00	TTI-THRIE BEAM
ABC MANAG	EMENI BRYAN TX 778	07	121 JEL	DRIVER NAM	E	all some of		04/14/21
3100 511 41,1				Scott Goody		PROJECT	CUM. QTY	ORDERED QTY
				COSTONIER				1000
LOAD QUANT 6.00	TTY PRODUCT DSD60S	CODE DES TXDOT CLASS S	SCRIPTION	782823	to a set and the content to a set to set to a set to a set to set to a set to a set to a set to a set	100138	16.00 UNIT PRICE	AMOUNT
LOAD QUANT 6.00	ITY PRODUCT DSD60S	CODE DES TXDOT CLASS S	SCRIPTION	782823	ne a tot targa to raintao atar atar targa to targa to ta	100138	16.00 UNIT PRICE	AMOUNT
LOAD QUANT 6.00 I SPECIAL DELIT RIGHT 2818, STRAIGHT A THERE	TTY PRODUCT DSD60S VERY INSTRUCTIONS RIGHT LEONAR ROUND ROUND	CODE DES TXDOT CLASS S D RD, RIGHT 47, LEF ABOUT TO GATE, C	SCRIPTION TINTO REUSTOMER	ELLIS, TO MEET	YOU	100138 SALES TOTAL	16.00 UNIT PRICE	16.00 AMOUNT
SPECIAL DELIN RIGHT 2818, STRAIGHT A THERE DANGERI MAN SEE WARNI	VERY INSTRUCTIONS RIGHT LEONARI ROUND ROUND	CODE DES TXDOT CLASS S D RD, RIGHT 47, LEF ABOUT TO GATE, CI URNS. SIDE.	T INTO REUSTOMER	ELLIS, TO MEET	YOU	SALES TOTAL	16.00 UNIT PRICE TAX	AMOUNT
LOAD QUANT 6.00 SPECIAL DELIN RIGHT 2818, STRAIGHT A THERE DANGERI MAY SEE WARNI Truck 7102 Load Siz	TTY PRODUCT DSD60S VERY INSTRUCTIONS RIGHT LEONARI ROUND ROUND Y CAUSE ALKALL B NGS ON REVERSE Driver 968908 e Mix Code	CODE DES TXDOT CLASS S DRD, RIGHT 47, LEF ABOUT TO GATE, Cl URNS. SIDE. User user Returned	Disp T 671371 Qty	ELLIS, TO MEET icket N 6 M	YOU FOR OFF um Ti 91 ix Age	SALES TOTAL CKET ID 809 Seq D	16.00 UNIT PRICE TAX LY FORM: 10:46 4 Load 92980	16.00 AMOUNT
LOAD QUANT 6.00 I SPECIAL DELIN RIGHT 2818, STRAIGHT A THERE DANGERI MAY SEE WARNI Truck 7102 Load Siz 6.00 CY Material 1'RG SAND-1 CMT-VII H20 ZY-610	VERY INSTRUCTIONS RIGHT LEONARI ROUND ROUND Y CAUSE ALKALI B NGS ON REVERSE Driver 968908 e Mix Code DS DSD60S Design Oy Req 1812 lb 8 570 lb 3 570 lb 3 5258 lb 1 23 oz Num E	CODE DES TXDOT CLASS S TXDOT CLASS S DRD, RIGHT 47, LEF ABOUT TO GATE, CI URNS. SIDE. USET USET USET Returned bired Batched 993 lb 10990 lb 625 lb 8620 lb 420 lb 3395 lb 017 lb 1004 lb 137 cz 136 cz 136 cz	Disp T 671371 Qty % Var% -0.12% -0.08% -0.58% 0.456 T	ELLIS, TO MEET icket N 6 Moisture 1.10% M 4.00% M	YOU FOR OFF um Ti 91 ix Age ual Wat 14 gi 41 gi 120 gi 120 gi	SALES SALES TOTAL FICE USE ON Cket ID 809 Seq D Seq D	16.00 UNIT PRICE TAX LY FORM: Time D 10:46 4 Load 92980 176.1 gl To Ad CYDE	16.00 AMOUNT AMOUNT
LOAD QUANT 6.00 I SPECIAL DELIN RIGHT 2818, STRAIGHT A THERE DANGERI MAY SEE WARNI Truck 7102 Load Siz 6.00 CY Material 1'RG SAND-1 CMT-VII H20 ZY-610 Actual Load 24008 Slump: 5.00 ii AGG1 SCALE B 1	VERY INSTRUCTIONS RIGHT LEONARI ROUND ROUND Y CAUSE ALKALI B NGS ON REVERSE Driver 968908 e Mix Code DS DSD60S Design 0y Req 1812 lb 8 570 lb 8 570 lb 8 570 lb 8 570 lb 8 575 lb 1 123 oz Num E 130 lb 8 575 lb 1 123 oz Num E	CODE DES TXDOT CLASS S TXDOT CLASS S DRD, RIGHT 47, LEF ABOUT TO GATE, CI URNS. SIDE. USET USET USET Returned USET Returned USES Batched 993 Ib 10990 Ib 625 Ib 8620 Ib 420 Ib 3395 Ib 017 Ib 1004 Ib 137 cz 1 10 453 XWATE/CEMENT. 0.0 91 Adjus 0.10 J CEMI SCALE B	Disp T 671371 Qty %Var% -0.12% -0.12% -0.08% -0.73% -0.58% 0.456 T st Water: 1 ST 10 lb	ELLIS, TO MEET icket N 6 Moisture Act 1.10% M 4.00% M	YOU FOR OFF um Ti 91 ix Age ual Wat 14 gi 120 gi 120 gi 120 gi 125 gi Trim Wat WAT1 :	SALES TOTAL =ICE USE ON cket ID 809 Seq D Actual er: -1.3 gl / SCALE B 1 ST	16.00 UNIT PRICE TAX TAX Time D 10:46 4 Load 92980 176.1 gl To Ac CYDS -2 lb ET C	16.00 AMOUNT AMOUNT
LOAD QUANT 6.00 I SPECIAL DELIN RIGHT 2818, STRAIGHT A THERE DANGER! MA' SEE WARNI Truck 7102 Load Siz 6.00 CY Material 17RG SAND-1 CMT-VII H20 ZY-610 Actual Load 24008 Slump: 5.00 II AGG1 SCALE B 1	VERY INSTRUCTIONS RIGHT LEONARI ROUND ROUND Y CAUSE ALKALI B NGS ON REVERSE Driver 968908 e Mix Code DS DSD60S Design Qy Req 1812 lb 8 570 lb 8 570 lb 8 570 lb 8 570 lb 8 575 lb 1 1 23 oz Num E 1 b Design WC: n Water in Truck ST -60 lb ET 0	CODE DES TXDOT CLASS S TXDOT CLASS S DRD, RIGHT 47, LEF ABOUT TO GATE, CI URNS. SIDE. USET USET Returned Matched 933 lb 10990 lb 625 lb 8620 lb 420 lb 3395 lb 017 lb 1004 lb 137 cz 1 0453 Water/Cement 0.0 gl Adjus 0 lb CEM1 SCALE B	Disp T 671371 Qty %Var% -0.12% -0.08% -0.12% -0.6% -0.12% -0.6% -0.58% 0.456 T at Water: 1 ST 10 lb	ELLIS, TO MEET icket N 6 Moisture Act 1.10% M 4.00% M Design 0.0 gl / Load ET 0 lb	YOU FOR OFF um Ti 91 ix Age ual Wat 14 gi 120 gi 120 gi 125 gi Trim Wat WAT1:	sales TOTAL FICE USE ON Cket ID 809 Seq D Scale B 1 ST	16.00 UNIT PRICE	16.00 AMOUNT

147.5

Report Number: A1171057.0178 Service Date: 04/14/21 Report Date: 07/01/21 Revision 2 - PO # Task: PO# 440861-4



Client				Project			
Texas Transpo Attn: Gary Go TTI Business	ortation Instit erke Office	tute		Riverside Campus Riverside Campus Bryan, TX			
College Static	on, TX 77843	3-3135		Project Number: A1171057			
Material Int	formatior	ı		Sample Information			
Specified Strength:		Sample Date: Sampled By:	04/14/21 Sample Time: 1 David Carpio				
Mix ID: Supplier:	DSD60S Martin Mar	ietta		Weather Conditions: Accumulative Yards:	Cloudy, lig 10/16	ht wind Batch Size (cy):	10
Batch Time: Truck No.:	1027 7211	Plant: Ticket No.:	617 6713607	Placement Method: Water Added Before (gal):	Direct Disc 11	charge	
Field Test I	Data			Water Added After (gal): Sample Location:	0 39' North o	of South end of soun	d barrier
Test Result Specification		Specification	Dia amand I a satisma	wall	1.1		
Air Content	(%):	6 1.1		Placement Location:	Sound wal	I barrier	
Concrete Ten Ambient Ten	np. (F): 1p. (F):	78 73					

Laboratory Test Data

Plastic Unit Wt. (pcf):

Yield (Cu. Yds.):

Labo	ratory le	st Data				Age at	Maximum	Compressive		
Set	Specimen	Avg Diam.	Area	Date	Date	Test	Load	Strength	Fracture	Tested
No.	ID	(in)	(sq in)	Received	Tested	(days)	(lbs)	(psi)	Туре	By
1	A	6.00	28.27		05/19/21	35 F	137,840	4,880	5	AJH
1	в	6.00	28.27		05/19/21	35 F	142,330	5,030	5	AJH
1	С	6.00	28.27		05/19/21	35 F	153,770	5,440	5	AJH
1	D					Hold				
Initial	Cure: Outsi	ide Plastic Lic	ls	Final C	ire:					

Comments: F = Field Cured

Note: Reported air content does not include Aggregate Correction Factor (ACF).

Samples Made By: Terracon Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and Services: test compressive strength samples (ASTM C 31, C 39, C 1231). Terracon Rep.: David Carpio Start/Stop: 1015-1315 Reported To: Will Contractor: **Report Distribution:** (1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E.

(1) Texas Transportation Institute, Bill Griffith

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

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CR0001, 11-16-12, Rev.6

Report Number:	A1171057.0178					
Service Date:	04/14/21					
Report Date:	07/01/21	Revision 2 - PO #				
Task:	PO# 44086	51-4				



10/11/3			· · · · · · · · · · · · · · · · · · ·	12 010 0101	100511011 0212				
Client			Project						
Texas Transportation Instit	tute		Riverside Campus						
Attn: Gary Gerke			Riverside Campus						
TTI Business Office			Bryan TX						
3135 TAMU									
College Station, TX 77843	3-3135		Project Number: A1171057						
Material Information	ı		Sample Information						
Specified Strength:			Sample Date:	04/14/21	Sample Time:	1215			
			Sampled By:	David Carp	pio -				
Mix ID: DSD60S			Weather Conditions:	Cloudy, light wind					
Supplier: Martin Mar	ietta		Accumulative Yards:	16/16	Batch Size (cv):	6			
Batch Time:	Plant:	617	Placement Method:			-			
Truck No.:	Ticket No.:		Water Added Before (gal):	9					
			Water Added After (gal):	0					
Field Test Data			Sample Location:	9' south of	north end of sound v	vall			
Test	Result	Specification	•	barrier					
Slump (in):	6		Placement Location:	Sound wal	l barrier				
Air Content (%):	1.0								
Concrete Temp. (F):	77								
Ambient Temp. (F):	73								
Plastic Unit Wt. (pcf):	147.5								

Laboratory Test Data

Yield (Cu. Yds.):

Labo	ratory les	st Data				Age at	Maximum	Compressive		
Set	Specimen	Avg Diam.	Area	Date	Date	Test	Load	Strength	Fracture	Tested
No.	ID	(in)	(sq in)	Received	Tested	(days)	(lbs)	(psi)	Туре	By
2	A	6.00	28.27		05/19/21	35 F	128,750	4,550	5	AJH
2	в	6.00	28.27		05/19/21	35 F	142,720	5,050	4	AJH
2	С	6.00	28.27		05/19/21	35 F	134,780	4,770	5	AJH
2	D					Hold				
Initial	Cure: Outsi	ide Plastic Lid	ls	Final Cu	ire:					

Comments: F = Field Cured

Note: Reported air content does not include Aggregate Correction Factor (ACF).

Samples Made By: Terracon

Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and Services: test compressive strength samples (ASTM C 31, C 39, C 1231).

Terracon Rep.: David Carpio Reported To: Will Contractor:

Report Distribution:

(1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E. (1) Texas Transportation Institute, Bill Griffith

Start/Stop: 1015-1315 Reviewed By: Alexander Dunigan

Project Manager

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

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CR0001, 11-16-12, Rev.6

Page 2 of 2

	exas A&M ansportation stitute	QF 7.3-01 Sam	Concrete pling	Doc. No. QF 7.3-01	Revision Date: 2020-07-29
Quality	y Form	Revised by: B.L. Griffi Approved by: D. L. Ku	th hn	Revision: 7	Page: 1 of 1
Project No:	440861-04	Casting Date:	4/15/2021	Mix Design (psi):	4000
Name of Technician Taking Sample	Terr	acon	Name of Technician Breaking Sample	Terr	acon
Signature of Technician Taking Sample	Terr	acon	Signature of Technician Breaking Sample	Terr	acon
Load No.	Truck No.	Ticket No.	Locat	ion (from concrete	e map)
т1	9019	6717070	East of the	e expansion joint ur	ntil the end
Load No.	Break Date	Cylinder Age	Total Load (lbs)	Break (psi)	Average

Ma	rtin 150	BILLING tin Mariett ³ LBJ Freeway Suite 400	a	<u>ти</u> б	CKET NO. 3717070
Ma	nella Da	llas, TX 75234			
LOAD TIME TO JOB	ARRIVE JOB SITE	BEGIN POUR F	INISH POUR	LEAVE JOB SITE	ARRIVE PLANT
11.44 :	:		1	:	
WATER ADDED ON JOB AT CUSTO ALLOWABLE WATER (withheld from TEST CYLINDER TAKEN YES CYLINDER TAKEN		GAL. CUSTOME GAL. X	Y OF THESE M	ATERIALS IS SU	
ADDITIONAL WATER ADDED REDUCE ITS STRENGTH. AN OF SPECIFIED SLUMP IS AT CUSTOMER NAME AND DELIVERY A	Y WATER ADDED IN EXC CUSTOMER'S RISK.	ESS HEREOF		BY SIGNATURE	ERSE SIDE ABOVE.
MBC MANAGEMENT 3100 SH 47, BRYAN, TX 77	807	617 90 DRIVER NAME WATTS, RODI CUSTOMER NU	NEY MBER PROJECT	CUM, OTY	P.O. #/JOB/LOT TTI-THRIE BEAM DATE 04/15/21
6.00 DSD60S SPECIAL DELIVERY INSTRUCTIONS RIGHT 2818, RIGHT LEONARD	TXDOT CLASS S RD, RIGHT 47, LEFT INT	O RELLIS,	SAL	UNIT PRICE	AMOUNT
STRAIGHT AROUND ROUND AN THERE	BOUT TO GATE, CUSTO	MER TO MEET YC	тот	AL	
SEE WARNINGS ON REVERSE SI	DE.	F	OR OFFICE USE	ONLY FORM:	
TruckDriver9019726255Load SizeMix Code6.00CYDS DSD60SMaterialDesign QtyRequired1091617Rg1812 lb10916SAND-11380 lb8580CMT-UI570 lb24023 oz1301104Load24026 lbLoad24026 lbSlump5.00 inWater in Truck:AGG1 SCALE B 1 ST -20 lbET0 lb	User Disp user 6717 Returned Q Batched % V b 10920 lb 0.044 b 3650 lb -0.244 b 3425 lb 0.155 b 1112 lb 0.733 137 oz 0.155 st 1 Water/Cement: 0.452 T 0.0 gl Adjust Water: CEM1 SCALE B 1 ST 5	D Ticket Num 7070 Dty Mix /ar% Moisture Actual % 0.40% M % 3.50% M % 0.40% M % % 0.40% M % % 0.40% M % % 0.40% M % % 0.40% M % % 0.40% M % % 0.40% M % % 0.40% M % % 0.40% M % % % 0.40% M % % % 0.40% M % % % % % % % % % % % % % % % % % %	Ticket II 91846 Age See 5 gi 36 gi 33 gi 5 gi Actual rim Water: -20 g WATI SCALE B 1 S	D Time Da 11:44 4 g Load 93017 1744 gl To Ac gl / CYDS Note: Man T 2 lb ET (ate /15/21 ID dd: 11.1 gi ual feed occured o lb

1.3

80

67

146.4

6.0

Report Number: A1171057.0180 Service Date: 04/15/21 **Report Date:** 07/01/21 Revision 2 - 76-day results Task: PO# 440861-4



Client				Project				
Texas Transpo Attn: Gary Ge TTI Business	ortation Instit erke Office	tute		Riverside Campus Riverside Campus Bryan, TX				
College Static	on, TX 77843	3-3135		Project Number: A1171057				
Material Inf	formatior	ı		Sample Information				
Specified Stre Mix ID:	ength: 4,00 DSD60S	00 psi @ 23	8 days	Sample Date: Sampled By: Weather Conditions:	04/15/21 Justin Maass Cloudy, ligh	Sample Time: s at wind	1220	
Supplier: Martin Marietta Batch Time: 1145 Plant: 617 Truck No.: 9019 Ticket No.: 6717070 Field Test Data			Accumulative Yards: 6/6 Batch Size (cy): Placement Method: Direct Discharge Water Added Before (gal): 5 Water Added After (gal): 0 Sample L coation: South west and of south wall					
Test Slump (in):		Result 6 3/4	Specification Not specified	Placement Location:	Sound wall	ing of South wat		

Laboratory Test Data

Air Content (%):

Yield (Cu. Yds.):

Concrete Temp. (F):

Ambient Temp. (F):

Plastic Unit Wt. (pcf):

Laboi	ratory les	st Data				Age at	Maximum	Compressive		
Set	Specimen	Avg Diam.	Area	Date	Date	Test	Load	Strength	Fracture	Tested
No.	ID	(in)	(sq in)	Received	Tested	(days)	(lbs)	(psi)	Туре	By
1	A	6.01	28.37		06/30/21	76 F	195,350	6,890	1	SLS
1	в	6.01	28.37		06/30/21	76 F	194,610	6,860	4	SLS
1	С	6.01	28.37		06/30/21	76 F	196,960	6,940	2	SLS
1	D					Hold				
Initial	Cure: Outsi	de Plastic Lid	ls	Final Cu	re: Field Cu	red				

Comments: F = Field Cured

Note: Reported air content does not include Aggregate Correction Factor (ACF). None

Not specified

40 - 95

40 - 95

Not specifed

Samples Made By: Terracon

Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and Services: test compressive strength samples (ASTM C 31, C 39, C 1231).

Terracon Rep.: Justin Maass Reported To: A&M contractors

Contractor: **Report Distribution:**

(1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E. (1) Texas Transportation Institute, Bill Griffith

Reviewed By:

Start/Stop: 1115-1345

Alexander Dunigan

Project Manager

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

CR0001, 11-16-12, Rev.6

	exas A&M ansportation stitute	QF 7.3-01 Sam	Concrete pling	Doc. No. QF 7.3-01	Revision Date: 2020-07-29
Quality	y Form	Revised by: B.L. Griffi Approved by: D. L. Ku	th hn	Revision: 7	Page: 1 of 1
Project No:	440861-04	Casting Date:	4/20/2021	Mix Design (psi):	4000
Name of Technician Taking Sample	Terr	acon	Name of Technician Breaking Sample	Terr	acon
Signature of Technician Taking Sample	Terr	acon	Signature of Technician Breaking Sample	Terr	acon
Load No.	Truck No.	Ticket No.	Locat	ion (from concrete	e map)
T1	7133	6723543	Soundwall, fr	rom expansion joint	t 65 feet west
Т2	9019	6723674	Soun	dwall, remaining 55	5 feet
Load No.	Break Date	Cylinder Age	Total Load (lbs)	Break (psi)	Average

			BILLING					(6723674
	Martin Marie	Mai n 15 tta d	tin Ma ⁰³ LBJ Fre Suite 40 allas, TX 7	riet eway 5234	ta 				
			11 - Ale		CINICH P(DUR	LEAVE	JOB SITE	ARRIVE PLAN
9:52	TO JOB	ARRIVE JOB SITE	BEGIN POL	R	:			:	:
LOWABLE WATER ST CYLINDER TAKEN DDITIONAL WA EDUCE ITS ST F SPECIFIED S USTOMER NAME A IBC MANAGEI 100 SH 47, BF	R (withheld from batch KEN YES BEF ATER ADDED TO RENGTH. ANY N LUMP IS AT CU IND DELIVERY ADD MENT RYAN, TX 7780 PRODUCT O	NO BY ORE AFTER WATER OTHIS CONCRETE V WATER ADDED IN E STOMER'S RISK. RESS	GAL. WILL EXCESS PLA 617 DRI WA CUS 782 CRIPTION	DELIVE TERMS HERECONT VER NAM TTS, RC STOMER 823	RY OF T S AND CO OF AS AC TRUCK 9019 ME DDNEY NUMBER	HESE M NDITIC CEPTE 201 PROJE 100138	MATER NS ON D BY S DER NO. 5	IALS IS S THE REV IGNATUR 5.00 CUM. QTY 12.00 UNIT PRIC	UBJECT TO TH VERSE SIDE RE ABOVE. P.O. #/JOB/LO TTI-THRIE BE DATE 04/20/21 ORDERED QT 12.00 CE AMOU
PECIAL DELIVERY IGHT 2818, RIC TRAIGHT ARO HERE	INSTRUCTIONS GHT LEONARD F UND ROUND AE	RD, RIGHT 47, LEFT SOUT TO GATE, CU	INTO RELLI STOMER TO	S, MEET	YOU		SALES 1	TAX	
	USE ALKALI BUR	NS.							
SEE WARNINGS	ON REVERSE SI	DE.			FOR OF	FICEU	SE ONL	Y FORM	1:
ruck 019 .00 CYDS aterial De RG 18 AND-1 13 VT-1/II 520 20 2	Driver 726255 Mix Code DSD60S sign Oty Require	User user Returned	Disp Tic 6723674 Qty	ket N	lum Ti 91 Mix Age	icket 1940 e	ID Seq D	Time 9:52 Loa	Date 4/20/21

			BILLING					(6723674
	Martin Marie	Mai n 15 tta d	tin Ma ⁰³ LBJ Fre Suite 40 allas, TX 7	riet eway 5234	ta 				
			11 - Ale		CINICH P(DUR	LEAVE	JOB SITE	ARRIVE PLAN
9:52	TO JOB	ARRIVE JOB SITE	BEGIN POL	R	:			:	:
LOWABLE WATER ST CYLINDER TAKEN DDITIONAL WA EDUCE ITS ST F SPECIFIED S USTOMER NAME A IBC MANAGEI 100 SH 47, BF	R (withheld from batch KEN YES BEF ATER ADDED TO RENGTH. ANY N LUMP IS AT CU IND DELIVERY ADD MENT RYAN, TX 7780 PRODUCT O	NO BY ORE AFTER WATER OTHIS CONCRETE V WATER ADDED IN E STOMER'S RISK. RESS	GAL. WILL EXCESS PLA 617 DRI WA CUS 782 CRIPTION	DELIVE TERMS HERECONT VER NAM TTS, RC STOMER 823	RY OF T AND CO F AS AC TRUCK 9019 ME DDNEY NUMBER	HESE M NDITIC CEPTE 201 PROJE 100138	MATER NS ON D BY S DER NO. 5	IALS IS S THE REV IGNATUR 5.00 CUM. QTY 12.00 UNIT PRIC	UBJECT TO TH VERSE SIDE RE ABOVE. P.O. #/JOB/LO TTI-THRIE BE DATE 04/20/21 ORDERED QT 12.00 CE AMOU
PECIAL DELIVERY IGHT 2818, RIC TRAIGHT ARO HERE	INSTRUCTIONS GHT LEONARD F UND ROUND AE	RD, RIGHT 47, LEFT SOUT TO GATE, CU	INTO RELLI STOMER TO	S, MEET	YOU		SALES 1	TAX	
	USE ALKALI BUR	NS.							
SEE WARNINGS	ON REVERSE SI	DE.			FOR OF	FICEU	SE ONL	Y FORM	1:
ruck 019 .00 CYDS aterial De RG 18 AND-1 13 VT-1/II 520 20 2	Driver 726255 Mix Code DSD60S sign Oty Require	User user Returned	Disp Tic 6723674 Qty	ket N	lum Ti 91 Mix Age	icket 1940 e	ID Seq D	Time 9:52 Loa	Date 4/20/21

78

70

147.6

6.0

Report Number: A1171057.0185 Service Date: 04/20/21 Report Date: 07/01/21 Revision 2 - 71-day results PO# 440861-4 Task:



College Station, TX 77845-5765 979-846-3767 Reg No: F-3272

Client				Project			
Texas Transpo Attn: Gary Ge TTI Business 3135 TAMU	rtation Insti rke Office	tute		Riverside Campus Riverside Campus Bryan, TX			
College Statio	n, TX 7784	3-3135		Project Number: A1171057			
Material Inf	ormatio	n		Sample Information			
Specified Stro Mix ID: Supplier: Batch Time: Truck No.:	ength: 4,0 DSD60S Martin Ma 0930 7133	00 psi @ 28 rietta Plant: Ticket No.:	8 days Bryan 6723543	Sample Date: Sampled By: Weather Conditions: Accumulative Yards: Placement Method: Water Added Before (gal):	04/20/21 Justin Maas Clear, light 6/12 Bucket & li 10	Sample Time: is wind Batch Size (cy): ft	1000 6
Field Test D Test Slump (in): Air Content (Data	Result 5 3/4 1.2	Specification	Water Added After (gal): Sample Location: Placement Location:	0 Center of al Sound wall of wall	l North half, upper h	alf and

Laboratory Test Data

Concrete Temp. (F): Ambient Temp. (F):

Plastic Unit Wt. (pcf):

Yield (Cu. Yds.):

Labo	ratory le	st Data				Age at	Maximum	Compressive		
Set	Specimen	Avg Diam.	Area	Date	Date	Test	Load	Strength	Fracture	Tested
No.	ID	(in)	(sq in)	Received	Tested	(days)	(lbs)	(psi)	Type	By
1	A	6.01	28.37		06/30/21	71 F	157,220	5,540	3	SLS
1	в	6.01	28.37		06/30/21	71 F	159,650	5,630	2	SLS
1	С	6.01	28.37		06/30/21	71 F	166,280	5,860	1	SLS
1	D					Hold				
Initial	Cure: Outsi	de Plastic Lid	ls	Final Cu	ire:					

Initial Cure: Outside Plastic Lids

Comments: F = Field Cured

Note: Reported air content does not include Aggregate Correction Factor (ACF). None

Samples Made By: Terracon

Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and Services: test compressive strength samples (ASTM C 31, C 39, C 1231).

Terracon Rep.: Justin Maass **Reported To:**

Contractor:

Report Distribution: (1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E.

(1) Texas Transportation Institute, Bill Griffith

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials. Page 1 of 2

CR0001, 11-16-12, Rev.6

Start/Stop: 0900-1130

Report Number: A1171057.0185 Service Date: 04/20/21 Report Date: 07/01/21 Revision 2 - 71-day results PO# 440861-4 Task:



College Station, TX 77845-5765 979-846-3767 Reg No: F-3272

Client				Project			
Texas Transpo	ortation Inst	itute		Riverside Campus			
Attn: Gary Ge	erke			Riverside Campus			
TTI Business	Office			Bryan, TX			
3135 TAMU							
College Static	on, TX 7784	43-3135		Project Number: A1171057			
Material Int	formatio	n		Sample Information			
Specified Str	ength: 4,0	000 psi @ 2	8 days	Sample Date:	04/20/21	Sample Time:	1050
				Sampled By:	Justin Maa	SS	
Mix ID:	DSD60S			Weather Conditions:	Clear, ligh	t wind	
Supplier:	Martin Ma	arietta		Accumulative Yards:	12/12	Batch Size (cy):	6
Batch Time:	0952	Plant:	Bryan	Placement Method:	Bucket &	lift	
Truck No.:	9019	Ticket No.:	6723674	Water Added Before (gal):	13		
				Water Added After (gal):	0		
Field lest I	Jata			Sample Location:	10ft from 1	North end	
Test		Result	Specification	Placement Location:	Sound wa	ll, North half, upper l	half of
Slump (in):		6			wall		
Air Content	(%):	1.3					

Laboratory Test Data

Concrete Temp. (F): Ambient Temp. (F):

Plastic Unit Wt. (pcf):

Yield (Cu. Yds.):

Labo	ratory Tes	st Data				Age at	Maximum	Compressive		
Set	Specimen	Avg Diam.	Area	Date	Date	Test	Load	Strength	Fracture	Tested
No.	ID	(in)	(sq in)	Received	Tested	(days)	(lbs)	(psi)	Туре	By
2	A	6.01	28.37		06/30/21	71 F	161,530	5,690	1	SLS
2	в	6.01	28.37		06/30/21	71 F	153,200	5,400	4	SLS
2	С	6.01	28.37		06/30/21	71 F	144,180	5,080	2	SLS
2	D					Hold				

Initial Cure: Outside Plastic Lids

Comments: F = Field Cured

Note: Reported air content does not include Aggregate Correction Factor (ACF). None

Final Cure:

Samples Made By: Terracon

Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and Services: test compressive strength samples (ASTM C 31, C 39, C 1231).

Terracon Rep.: Justin Maass **Reported To:**

Contractor:

Report Distribution:

(1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E. (1) Texas Transportation Institute, Bill Griffith

77

70

148.0

12.0

Reviewed By:

Start/Stop: 0900-1130

Hexander Dunigan Project Manager

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials. Page 2 of 2

CR0001. 11-16-12. Rev.6

	exas A&M ansportation stitute	QF 7.3-01 Sam	Concrete pling	Doc. No. QF 7.3-01	Revision Date: 2020-07-29
Quality	y Form	Approved by: B.L. Griffi Approved by: D. L. Ku	hn	Revision: 7	Page: 1 of 1
Project No:	440861-04	Casting Date:	4/22/2021	Mix Design (psi):	4000
Name of Technician Taking Sample	Terr	acon	Name of Technician Breaking Sample	Terr	acon
Signature of Technician Taking Sample	Terr	acon	Signature of Technician Breaking Sample	Terr	acon
Load No.	Truck No.	Ticket No.	Locat	ion (from concrete	e map)
T1	4280	6731090	Remai	ning section of Sou	ndwall
Load No.	Break Date	Cylinder Age	Total Load (lbs)	Break (psi)	Average

			Separate State			
	Martir	Mar 15	BILLING	tta	TICK	ET NO. 31090
	Mariet	ita D	Suite 400 allas, TX 75234	, ,		
LOAD TIME	TO JOB	ARRIVE JOB SITE	BEGIN POUR	FINISH POUR	LEAVE JOB SITE	ARRIVE PLANT
9:49	:	:		:	-	
WATER ADDED ON ALLOWABLE WATE TEST CYLINDER TA	JOB AT CUSTOMER' R (withheld from batch		GAL. CUST	OMER SIGNATURE	E MATERIALS IS	SUBJECT TO THE
CYLINDER TAKEN ADDITIONAL WA REDUCE ITS ST	TER ADDED TO RENGTH. ANY V	THIS CONCRETE VATER ADDED IN STOMER'S RISK.	WILL TER EXCESS HER	MS AND CONDI	TIONS ON THE R	EVERSE SIDE JRE ABOVE.
OF SPECIFIED S	ND DELIVERY ADDI	RESS	618	4280	2031 5.00	TTI-THRIE BEAM
MBC MANAGEN 3100 SH 47, BR	YAN, TX 7780	7	DRIVER Steven CUSTO	Albrecht	ROJECT CUM. QT	DATE 04/22/21 TY ORDERED QTY
LOAD QUANTITY	PRODUCT CC	DE DE	SCRIPTION	3 1	UNIT	4.00 PRICE AMOUNT
PECIAL DELIVERY II IGHT 2818, RIGH TRAIGHT AROU HERE	NSTRUCTIONS IT LEONARD R ND ROUND AB	D, RIGHT 47, LEF OUT TO GATE, C	T INTO RELLIS, USTOMER TO M	IEET YOU	SALES TAX TOTAL	
ANGER! MAY CAU	SE ALKALI BUR	NS. DE.	de suite	FOR OFF	ICE USE ONLY F	ORM:
SEE WARNINGS (Truck [1280 Load Size [1.00 CYDS Material Design 120 25 120 15 120 15 10	Driver 034547 4ix Code DSD60S In Qty Requirer 3 b 747 2 b 7262 3 oz 91 0 b 2280 0 b 5741 0 b 5741 Water in Truck: 40 b ET 0 b -3 b ET 0 b	User user Returned b 706 b b 706 b b 706 b b 706 b b 7190 b oz 91 oz 2270 b b 5740 b hes: 1 53 Water/Cement 0.0 gl Adjus AGG SCALE2 B	Disp Ticke 6731090 Qty % Var% Moistur -5.48% -0.22% -0.4% -0.01% 4.00% 0.455 T Desi st Water: 0.0 gl 1 ST -20 lb ET	et Num Ti 94 Mix Age Actual Wat 85 gl 2 gl M 26 gl gn 124.3 gl /Load Trim Water. 0 lb CEM SCA	cket ID Ti 95 9: Seq D Actual 113.4 G -1.5 gl / CVDS M LE B 1 ST 0 lb	me Date 49 4/22/21 Load ID 9679 gi To Add: 11.1 gi lote: Manual feed occured ET 0 lb
669				7		

1.1

73

68

149.3

Report Number:	A1171057.0	186
Service Date:	04/22/21	
Report Date:	07/01/21	Revision 2 - 69-day results
Task:	PO# 440861	-4



101 +10001-4	717-040-5707 Reg H0.1-5212					
Client	Project					
Texas Transportation Institute	Riverside Campus					
Attn: Gary Gerke	Riverside Campus					
TTI Business Office	Bryan, TX					
3135 TAMU						
College Station, TX 77843-3135	Project Number: A1171057					
Material Information	Sample Information					
Specified Strength: 4,000 psi @ 28 days	Sample Date: 04/22/21 Sample Time: 1059					
	Sampled By: David Carpio					
Mix ID: Class S	Weather Conditions: Clear, light wind					
Supplier: Martin Marietta	Accumulative Yards: 4/4 Batch Size (cy): 4					
Batch Time: 0949 Plant: 618	Placement Method: Direct Discharge					
Truck No.: 4280 Ticket No.: 6731090	Water Added Before (gal): 9					
	Water Added After (gal): 0					
Field Test Data	Sample Location: 12' North of South end ; 6' from bottom					
Test Result Specificati	on Placement Location: Sound Barrier Wall					
Slump (in): 5 1/2						

Laboratory Test Data

Air Content (%):

Yield (Cu. Yds.):

Concrete Temp. (F):

Ambient Temp. (F):

Plastic Unit Wt. (pcf):

Laboratory Test Data						Age at	Maximum	Compressive		
Set	Specimen	Avg Diam.	Area	Date	Date	Test	Load	Strength	Fracture	Tested
No.	ID	(in)	(sq in)	Received	Tested	(days)	(lbs)	(psi)	Туре	By
1	A	6.01	28.37		06/30/21	69 F	154,950	5,460	2	SLS
1	В	6.01	28.37		06/30/21	69 F	153,150	5,400	2	SLS
1	С	6.01	28.37		06/30/21	69 F	143,600	5,060	4	SLS
1	D					Hold				
Initial	Cure: Outsi	ide Plastic Lid	ls	Final C	ure: Field Cu	red				

Comments: F = Field Cured

Note: Reported air content does not include Aggregate Correction Factor (ACF).

Samples Made By: Terracon

Obtain samples of fresh concrete at the placement locations (ASTM C 172), perform required field tests and cast, cure, and Services: test compressive strength samples (ASTM C 31, C 39, C 1231).

Terracon Rep.: David Carpio Reported To: Will

Contractor:

Report Distribution: (1) Texas Transportation Institute, Gary Gerke (1) Terracon Consultants, Inc., Alex Dunigan, P.E.

(1) Texas Transportation Institute, Bill Griffith

Start/Stop: 1000-1145 **Reviewed By:** Alexander Dunigan

Project Manager

Test Methods: ASTM C 31, ASTM C143, ASTM C231, ASTM C1064

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

CR0001, 11-16-12, Rev.6

APPENDIX C. MASH TEST 5-12 (CRASH TEST NO. 440861-4)

C.1. VEHICLE PROPERTIES AND INFORMATION



C.2. SEQUENTIAL PHOTOGRAPHS















Figure C.1. Sequential Photographs for Test No. 440861-4 (Overhead and Frontal Views).

















Figure C.1. Sequential Photographs for Test No. 440861-4 (Overhead and Frontal Views) (Continued).



0.000 s



0.150 s



0.300 s



0.450 s

Figure C.2. Sequential Photographs for Test No. 440861-4 (Rear View).



0.600 s



0.750 s



0.900 s



1.050 s



C.3. VEHICLE ANGULAR DISPLACEMENTS





2021-09-30


TR No. 0-7086-R4

Figure C.5. Vehicle Lateral Accelerometer Trace for Test No. 440861-4

(Accelerometer Located at Front).





(Accelerometer Located at Front).





2021-09-30





TR No. 0-7086-R4







X Acceleration at Rear of Trailer

Figure C.10. Vehicle Longitudinal Accelerometer Trace for Test No. 440861-4 (Accelerometer Located at Rear of Trailer).





(Accelerometer Located at Rear of Trailer).

			- 🕁			
			- - -		40861-4 est Number: <i>MASH</i> Test 5-12 OT T80SS Barrier with Soundwall 113 International 8600 Tractor with 5reat Dane 7311TCHL53 Trailer 0,030 lb 0,030 lb 0,04 mi/h 4.3 degrees	0861-4
			-		Test Number: 4- Test Standard T Test Article: TxC Test Vehicle: 20 1988 G Inertial Mass: 80 Impact Angle: 1- Impact Angle: 1-	Trace for Test No. 44
			-2-	Time (s)	lage	ertical Accelerometer
					Filter 50-msec ave	igure C.12. Vehicle V
					SAE Class 60	H
(e) noiteralecceleration (g	· · · · ·	ı*			



(Accelerometer Located at Rear of Trailer).