MEMORANDUM

DATE: 2/28/2018

TO: Mr. Finley Vinson, City of Conway Street & Engineering Director

FROM: Dustin Tackett, Project Manager
Garver , LLC

SUBJECT: Paving Type Recommendation **Markham St.**
AHTD Job No. 080566
Markham St. Jump Start Impvts. (Conway) (S)
Route: N/A Section: N/A
County: Faulkner

The attached pavement design for the above mentioned project is submitted for approval. The following information is a summary of the pavement design.

Comparison of Alternatives:

Description	Alt. No. 1	Alt. No. 2	Alt. No. 3
ACHM Surface Course (1/2")	2.0	2.0	2.0
ACHM Surface Course (1/2")	0.0	2.0	2.0
ACHM Binder Course (1")	3.0	3.0	3.0
ACHM Base Course (1 1/2")	0.0	5.0	0.0
Agg. Base Course (Class 7)	11.0	0.0	6.0
Total Thickness (in.) =	16.0	12.0	13.0
Calculated Structural Number	3.74	4.88	3.92
Required Structural Number	3.74	3.74	3.74
Estimated Cost	$383,112.87	$517,123.22	$389,170.50

Traffic Volume:

2017 ADT	5000
2037 ADT	5800
PERCENT TRUCKS	2%

Comments:

Alternative No. 3 is submitted as the recommended alternative. Alternative 3 provides two lifts of surface course which allows completed sections to be opened to traffic prior to final project completion. The final lift of surface course also ensures an aesthetically uniform finish once all stages of construction are complete. In addition, Alternative No. 3 is among the thinnest alternatives which provides additional clearance over shallow storm sewer infrastructure. The difference in cost is approximately 2% higher when compared to the lowest estimated cost of Alternative No. 1.

Recommended Alternative:

Alternative **3** submitted for approval:

APPROVED

City of Conway

Date

1993 AASHTO Pavement Design
Flexible Pavement Design
Structural Number Analysis

AHTD Job No. 080566
Markham St.

INPUTS	
Design Traffic, w18 (ESAL)	375,950
Reliability, R (%)	80
Standard Deviation, So	0.45
Subgrade Modulus, MR (psi)	3025
Initial Serviceability	4.5
Terminal Serviceability	2.5
Performance, ΔPSI	2

Design Structural Number, SN	**3.74**

JOB NO. 080566
Markham St.
Alternative #1

LAYER	MATERIAL DESCRIPTION	STRUCTURAL COEFFICIENT*	THICKNESS (INCHES)	CALCULATED SN
1	ACHM SURFACE COURSE (1/2")	0.44	2	0.88
2	ACHM BINDER COURSE (1")	0.44	3	1.32
3	AGGREGATE BASE COURSE (CLASS 7)	0.14	11	1.54
		TOTAL	16	3.74

SN REQUIRED FOR DESIGN: 3.74 CALCULATED SN 3.74

TOTAL ROADWAY LENGTH (STA.) **24.50**

COST ESTIMATE FOR ONE STATION

ITEM	AVG. WIDTH (feet)	DEPTH (inches)	QUANTITY	UNIT	PRICE	COST
MAIN LANES						
ACHM Surface Course (1/2")	30.05	2.00	36.73	Ton	$82.00	$3,011.86
ACHM Binder Course (1")	30.05	3.00	55.09	Ton	$77.00	$4,241.93
Aggregate Base Course (Class 7)	35.05	11.00	250.00	Ton	$25.00	$6,250.00
Tack Coat	60.1	.05 gal/sq.yd.	33.39	Gal.	$2.81	$93.83
					SUB-TOTAL:	$13,597.62
					+15% E & C:	$2,039.64
					TOTAL:	**$15,637.26**

24.5 STATIONS X $ 15,637.26 $ 383,112.87

BASIS OF ESTIMATE:

* STRUCTURAL COEFFICIENTS FROM AHTD ROADWAY DESIGN PLAN DEVELOPMENT GUIDELINES PAGE A-1

JOB NO. 080566
Markham St.
Alternative #2

LAYER	MATERIAL DESCRIPTION	STRUCTURAL COEFFICIENT*	THICKNESS (INCHES)	CALCULATED SN
1	ACHM SURFACE COURSE (1/2")	0.44	2	0.88
2	ACHM SURFACE COURSE (1/2")	0.44	2	0.88
3	ACHM BINDER COURSE (1")	0.44	3	1.32
4	ACHM BASE COURSE (1 1/2")	0.36	5	1.80
		TOTAL	12	4.88

SN REQUIRED FOR DESIGN: 3.74 CALCULATED SN 4.88

TOTAL ROADWAY LENGTH (STA.) **24.50**

COST ESTIMATE FOR ONE STATION

ITEM	AVG. WIDTH (feet)	DEPTH (inches)	QUANTITY		PRICE	COST
MAIN LANES						
ACHM Surface Course (1/2")	30.05	2.00	36.73	Ton	$82.00	$3,011.86
ACHM Surface Course (1/2")	30.05	2.00	36.73	Ton	$82.00	$3,011.86
ACHM Binder Course (1")	30.05	3.00	55.09	Ton	$77.00	$4,241.93
ACHM Base Course (1 1/2")	35.15	5.00	107.40	Ton	$74.00	$7,947.60
Tack Coat	90.15	.05 gal/sq.yd.	50.08	Gal.	$2.81	$140.72
					SUB-TOTAL:	$18,353.97
					+15% E & C:	$2,753.10
					TOTAL:	**$21,107.07**

24.5 STATIONS X $ 21,107.07 $ 517,123.22

BASIS OF ESTIMATE:

* STRUCTURAL COEFFICIENTS FROM AHTD ROADWAY DESIGN PLAN DEVELOPMENT GUIDELINES PAGE A-1

JOB NO. 080566
Markham St.
Alternative #3

LAYER	MATERIAL DESCRIPTION	STRUCTURAL COEFFICIENT*	THICKNESS (INCHES)	CALCULATED SN
1	ACHM SURFACE COURSE (1/2")	0.44	2	0.88
2	ACHM SURFACE COURSE (1/2")	0.44	2	0.88
3	ACHM BINDER COURSE (1")	0.44	3	1.32
4	AGGREGATE BASE COURSE (CLASS 7)	0.14	6	0.84
		TOTAL	13	3.92

SN REQUIRED FOR DESIGN: 3.74 CALCULATED SN 3.92

TOTAL ROADWAY LENGTH (STA.) **24.50**

COST ESTIMATE FOR ONE STATION

ITEM	AVG. WIDTH (feet)	DEPTH (inches)	QUANTITY	UNIT	PRICE	COST
MAIN LANES						
ACHM Surface Course (1/2")	30.05	2.00	36.73	Ton	$82.00	$3,011.86
ACHM Surface Course (1/2")	30.05	2.00	36.73	Ton	$82.00	$3,011.86
ACHM Binder Course (1")	30.05	3.00	55.09	Ton	$77.00	$4,241.93
Aggregate Base Course (Class 7)	35.05	6.00	136.25	Ton	$25.00	$3,406.25
Tack Coat	90.15	.05 gal/sq.yd.	50.08	Gal.	$2.81	$140.72
					SUB-TOTAL:	$13,812.62
					+15% E & C:	$2,071.89
					TOTAL:	**$15,884.51**

24.5 STATIONS X $ 15,884.51 $ 389,170.50

BASIS OF ESTIMATE:

* STRUCTURAL COEFFICIENTS FROM AHTD ROADWAY DESIGN PLAN DEVELOPMENT GUIDELINES PAGE A-1

18K EQUIVALENT AXLE LOADS

JOB NUMBER: 080566 COUNTY: Faulkner
JOB TITLE: Markham St. Jump Start Improvements
LOCATION: Markham St.
Conway

	% TRUCKS	TOTAL VEHICLES	PASSENGER VEHICLES	COMMERCIAL VEHICLES
2017 ADT	2	5000	4900	100
2037 ADT	2	5800	5684	116
AVERAGE ADT	2	5400	5292	108

DD = .60 F-FACTOR = 3.826 SN = 4 SI= 2.50

SINGLE AXLES

WEIGHT GROUP	# OF AXLES	18K EQ
UNDER 2,000	24	0.00
2,001- 4,000	39	0.12
4,001- 6,000	17	0.22
6,001- 8,000	20	0.82
8,001-10,000	26	2.67
10,001-12,000	24	5.04
12,001-14,000	15	5.63
14,001-16,000	8	5.27
16,001-18,000	3	3.42
18,001-20,000	2	2.79
20,001-22,000	3	5.71
22,001-24,000	0	1.20
24,001-26,000	0	0.71
26,001-28,000	0	0.47
28,001-30,000	0	0.25
30,001-32,000	0	0.16
32,001-34,000	0	0.20
34,001-36,000	0	0.26
36,001-38,000	0	0.00
38,001-40,000	0	0.00
TOTALS	181	34.94

TANDEM AXLES

WEIGHT GROUP	# OF AXLES	18K EQ
UNDER 2,000	0	0.00
2,001- 4,000	1	0.00
4,000- 6,000	2	0.00
6,001- 8,000	3	0.01
8,001-10,000	6	0.05
10,001-12,000	6	0.11
12,001-14,000	6	0.20
14,001-16,000	8	0.43
16,001-18,000	8	0.69
18,001-20,000	7	0.98
20,001-22,000	7	1.40
22,001-24,000	7	2.09
24,001-26,000	8	3.05
26,001-28,000	8	4.17
28,001-30,000	7	5.16
30,001-32,000	8	6.87
32,001-34,000	8	8.39
34,001-36,000	5	7.53
36,001-38,000	4	7.10
38,001-40,000	3	6.65
40,001-42,000	1	3.50
42,001-46,000	1	2.78
46,001-48,000	1	2.13
48,001-50,000	0	1.43
50,001-52,000	0	0.97
52,001-54,000	0	0.75
54,001-56,000	0	0.51
56,001-58,000	0	0.33
58,001-60,000	0	0.19
TOTALS	116	67.49

S/A 18K EAL= 35 T/A 18K = 67 AUTO 18K = 1
TOTAL 18K EAL= ***103***
WORKED BY: DLT
*WORKED USING AxDist1 FOR ALL MAIN ROADS AND SN OF 4

103 * 0.5 * 20 * 365 = 375,950

A Moisture-Density Relationship (Proctor) test was performed on a representative bulk sample obtained near the Boring 3 location. This test was performed in accordance with AASHTO T-99 methods. Pavement subgrade support properties were evaluated by performing one (1) California Bearing Ratio (CBR) test (AASHTO T-193). For the CBR test, the specimen was molded at approximately the optimum water content and 95 percent of the maximum dry density as determined by the corresponding laboratory Proctor tests.

The graphical results of the Proctor and CBR tests are presented in Appendix C.

GENERAL SITE and SUBSURFACE CONDITIONS

Site Conditions

The Markham Street project alignment is located south of Hendrix College in Conway, Arkansas. This alignment includes approximately 2600 linear ft of roadway between Van Ronkle Street and Spruce Street. The terrain is generally flat with a slight fall to the south. The existing roadway is a two-lane street which is classified as a "minor arterial" street by City of Conway criteria. The existing pavements are Portland cement concrete with an asphalt concrete overlay. The existing pavements are considered to be in fair to poor condition. The primary mode of distress in the pavement is reflection cracking. Surface drainage is considered fair to poor.

Subsurface Conditions

The results of the cores indicate that total pavement thickness ranges from 8.13 to 12.5 in. with an average thickness of 9.0 inches. The total pavement thickness includes both asphalt concrete and Portland cement concrete. The asphalt concrete thickness was found to range from 1.13 to 1.63 in. with an average thickness of 1.3 inches. Portland cement concrete thickness was found to range from 7.0 to 11.0 in. with an average thickness of 7.7 inches. Subbase was not encountered below the existing pavement. At the Core 4A location, we believe that a full-depth pavement repair was previously performed. The concrete of the repair was apparently placed on stone backfill.

The subgrade is on-site fill comprised of soft to stiff brownish gray, olive gray, brown and gray silty clay and clay with a variable content of shale and sandstone fragments. The subgrade soils typically classify as A-4, A-6, and A-7-6 by the AASHTO classification system. The underlying natural soils, which extend to 6-ft depth, consist of firm to very stiff silty clay with highly weathered shale seams. Below 4- to 6-ft depth is moderately hard highly weathered shale. The shale extends to the boring termination depth of 10 feet.

Subgrade Support

As noted, the results of the borings indicate that the subgrade soils are on-site fill comprised of soft to firm silty clay and clay with a variable content of shale and sandstone fragments. In general, the results of the borings indicate very poor to poor subgrade support. The laboratory California Bearing Test (CBR) indicates CBR values ranging from 7.9 for a moisture content near optimum and a CBR of 5.9 for a saturated condition. These data indicate fair subgrade support for a properly-prepared subgrade. Recommendations for subgrade preparation are discussed in the Subgrade Preparation and Site Grading section of this report.

For design of pavements on a properly-prepared subgrade, or for use in evaluation of the existing pavements, the following parameters are recommended.

California Bearing Ratio (CBR):	5
Resilient modulus (k):	3800 lbs per sq in.
R Value:	10
Modulus of subgrade reaction (k):	100 lbs per sq in. per in.

Subgrade Preparation

Specific information on the roadway improvement plans has not been provided. It is understood that the existing pavements may be milled, overlain, and widened. The addition of new lanes is also anticipated. Site grading associated with the project is expected to be minor.

After any necessary pavement demolition and performing any cut, and prior to placing any fill, the subgrade should be evaluated by proof-rolling with a pneumatic-tired roller, loaded tandem-wheeled dump truck, or similar equipment. All soft or loose soil zones should be undercut and be reprocessed and re-compacted or replaced with approved fill, whichever is appropriate. Based on the results of the borings, pavement subgrade undercuts on the order of 2 to 4 ft, more or less, are anticipated for new pavement construction. We recommend that subgrade preparation, including undercutting or stabilization, extend at least 3 ft outside the pavement limits. We recommend that abandoned utilities or foundation elements in the improvement alignment be completely excavated and properly backfilled unless specifically accepted by the Owner.

In lieu of undercutting and replacing unsuitable soils, consideration may be given to using additives to improve soil workability and stabilize weak areas. Hydrated lime, quick lime, Portland cement, fly ash, or suitable alternate materials may be used as verified by appropriate testing and approved by the Engineer. Additives can be effective where the depth of unstable soils is relatively shallow. Treatment will be less effective in areas where the zone of unstable soils is deep. The optimum application rate of stabilization additive must be determined by specific laboratory tests performed on the specific subgrade soils.

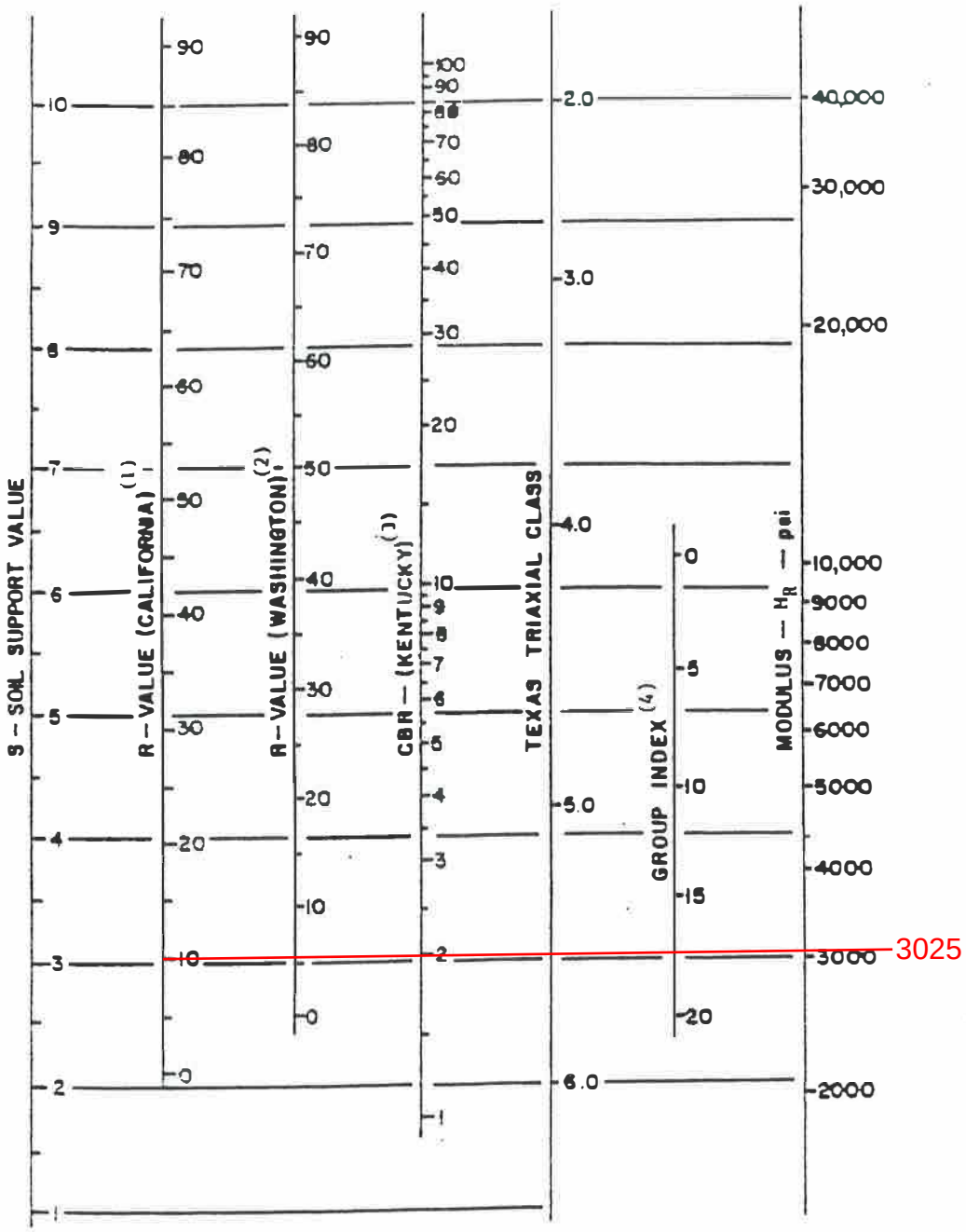
Site grading should comply with AHTD Standard Specifications Section 210. Subgrade preparation should comply with AHTD Standard Specifications Section 212.

The on-site soils, free of organics and debris and when properly processed, are generally suitable for fill and backfill use. We recommend that soils classifying as A-7-5 or A-7-6 and all soils with a plasticity index (PI) in excess of 18 not be utilized within 12 in. of the plan subgrade elevation. Where the subgrade will be treated with quicklime, hydrated lime, or an approved alternate that will reduce the PI to 15 or less, this recommendation may be waived.

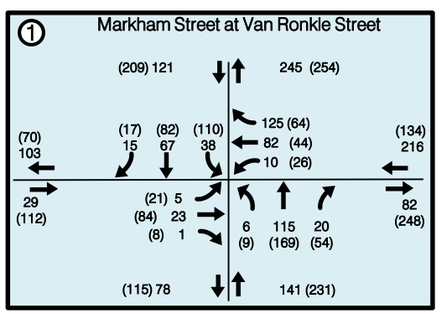
Imported materials for fill and backfill should consist of an approved silty clay/shale fragment blend fill, or approved clayey sand (SC), sandy clay (CL), or clayey gravel (GC). All fill and backfill should be placed in horizontal, nominal 6- to 8-in.-thick loose lifts. The in-place density and water content should be determined for each lift and should be tested to verify compliance with the specified density and water content prior to placement of subsequent lifts.

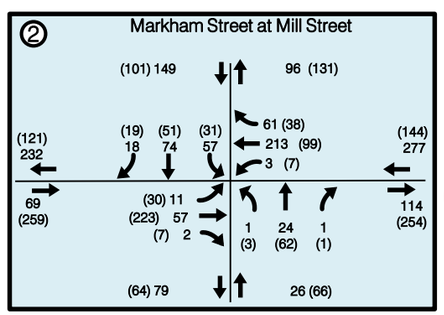
CONSTRUCTION CONSIDERATIONS

Groundwater was not encountered in the borings in May 2017. However, perched water may be present under the existing pavements, in utility line trenches, and in fractured zones of the weathered shale, particularly during wet seasons of the year. Groundwater levels will be influenced



CORRELATION CHART FOR ESTIMATING RESILIENT MODULUS





391
(398)

ADT Calculation:
8% * ADT = Peak Hour Volume
398/.08 = 5,000 vpd

N

Legend

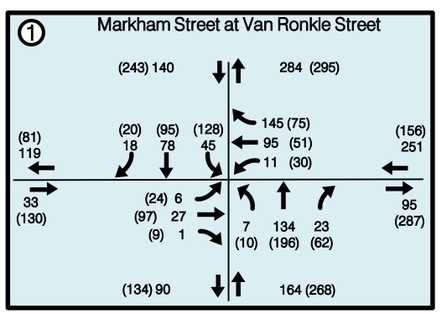
18 AM Turning Movement Count
(18) PM Turning Movement Count

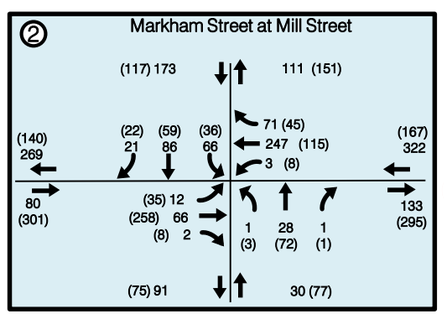
Conway
Markham Street
2017 Design
Traffic Volumes

Figure 3

June 2017

GARVER





455
(462)

ADT Calculation:
8% * ADT = Peak Hour Volume
462/.08 = 5,800 vpd

N

Legend

18 AM Turning Movement Count
(18) PM Turning Movement Count

Conway
Markham Street
2037 Design
Traffic Volumes

Figure 4

June 2017

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