MLA Geotechnical "put us to the test"

A Division of MLA Labs, Inc.

October 6, 2022

**The Lookout Development Group, Inc.**
1789 S. Bagdad Road, Suite 104
Leander, Texas 78641
Attn.: Mr. Mike Siefert, P.E.

Re: Geotechnical Investigation
Pavement Recommendations - Addendum
**George's Ranch**
Boerne, Texas
Engineer's Job No.: 21201100.010

Dear Mr. Siefert,

As requested by Mr. Bo Wiseheart, E.I.T. of Cude Engineers, we have reviewed the borings for the original report for this project with respect to determining concrete pavement thickness recommendations. Pavement thickness sections were developed using the computerized pavement analysis software program called "*Municipal Rigid Pavement Design System*" (MRPS).

## RECOMMENDATIONS - PAVEMENT THICKNESS SECTIONS

Concrete paving shall consist of thickness as given in Table 1. Concrete pavement shall meet the requirements of Section 404.2800 of the Kendall County's "Development Rules and Regulations" [(1)]. The concrete should develop a minimum 28-day flexural strength of 500 psi with 4 to 6 percent entrained air.

Contraction, control, and expansion joint details should be determined in accordance with guidelines published by the American Concrete Institute, the Portland Cement Association [(2)], or accepted local practice that has been proven to work satisfactorily in similar circumstances. Contraction joint spacing should not exceed 20 feet on center without engineering consultation.

Full depth, full width isolation joints with bituminous fiber or preformed joint filler should be installed at all rigid structure interfaces.

**TABLE 1 : Recommended Rigid Pavement Section Thickness, Inches**

| Street Classification | Subgrade Material | JRPCC, inches | CLB, inches |
|---|---|---|---|
| Residential Collector (1000 ADT) | Subgrade PI < 20 | 6 | - |
| | Subgrade PI > 20 | 6 | - |

**Notes:**

- Abbreviations: CLB - Crushed Limestone Base, JRPCC - Jointed, Reinforced Portland Cement Concrete
- Inadequate drainage of the pavement system will accelerate pavement distress and result in increased maintenance costs. Adequate drainage should be provided for the pavement system. Adequate drainage consists of a curb and gutter or a shoulder and bar ditch system. The final pavement cross section and drainage should be reviewed by the geotechnical engineer.
- These pavement thickness designs are intended to transfer the load from the anticipated traffic conditions. Deep seated soil swelling or settlement of fill materials may cause long wave surface roughness.
- The recommendations above are intended to reduce maintenance costs and increase the serviceable lifespan of the pavement system.

All other recommendations as contained in our original report dated July 2021 shall apply.

## REFERENCES

1. Kendall County's "Development Rules and Regulations", Latest Adopted Revision.
2. Design and Construction of Joints for Concrete Streets, Portland Cement Association, Arlington Heights, Illinois, 1992.

If you have any questions or comments, please contact our office.

Sincerely,

**MLA Geotechnical** TBPE FIRM # F-2684
**Geotechnical Engineering and Construction Materials Testing**
*"put us to the test"*

Timothy R. Weston, P.E.
President

10/6/22

Enclosures: Appendix D - MRPS

# APPENDIX D

# MRPS COMPUTER OUTPUT

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MM     MM  RRRRRRRR   PPPPPPPP     SSSSS      11
MMM   MMM  RRRRRRRRR  PPPPPPPPP   SSSSSSS    111
MMMM MMMM  RR     RR  PP     PP  SS     SS  1111
MMMMMMMMM  RR     RR  PP     PP  SS           11
MM MMM MM  RRRRRRRRR  PPPPPPPPP   SSSSSS      11
MM  M  MM  RRRRRRRR   PPPPPPPP     SSSSSS     11
MM     MM  RR     RR  PP                SS    11
MM     MM  RR     RR  PP          SS    SS    11
MM     MM  RR     RR  PP           SSSSSSS   111111
MM     MM  RR     RR  PP            SSSSS    111111
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MUNICIPAL RIGID PAVEMENT DESIGN SYSTEM
VERSION 1.0, SEPTEMBER 1983

NOTICE --

THIS COMPUTER PROGRAM REPRESENTS AN ADAPTATION OF THE ORIGINAL TEXAS STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION RIGID PAVEMENT DESIGN SYSTEM (RPS-3) FOR THE DESIGN AND CONSIDERATION OF LIFE-CYCLE COSTS OF MUNICIPAL STREETS AND THOROUGHFARES IN AUSTIN, TEXAS. THIS PROGRAM WAS DEVELOPED BY ARE, INC (512/327-3520) FOR SOLE USE BY THE CITY OF AUSTIN. BECAUSE OF THE NATURE OF THE DEVELOPMENT OF THE MRPS-1 PROGRAM AND CERTAIN BUILT-IN REGIONAL FACTORS, USE BY ANY OTHER CITY OR AGENCY REQUIRES A THOROUGH UNDERSTANDING OF THE PROGRAM OPERATION AND ITS INHERENT ASSUMPTIONS.

CAUTION IS RECOMMENDED IN APPLYING THIS FIRST VERSION OF THE MUNICIPAL RIGID PAVEMENT DESIGN SYSTEM. THE USER SHOULD ACCEPT ULTIMATE RESPONSIBILITY FOR THE ACCURACY OF THE INPUTS AND THE VALIDITY OF THE RESULTS.

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MRPS-1  MUNICIPAL RIGID PAVEMENT DESIGN SYSTEM, VERSION 1.0, 8/83
        ADAPTED FROM TEXAS SDHPT RPS-3 PROGRAM FOR CITY OF AUSTIN
        BY ARE INC, CONSULTING ENGINEERS, AUSTIN, TEXAS

PROBLEM       TITLE (DESCRIPTION)
21201100.010 - George's Ranch, Collector (1000 vpd)


      *****  NEW PAVEMENT  *****

      TOTAL NUMBER OF LANES IN THE FACILITY . . . . . .  2
      TOTAL NUMBER OF CONCRETE CURBS. . . . . .  2
      NUMBER OF SUBBASE TYPES . . . . . .  1
      PROJECT LENGTH (MILES). . . . . .    .30
      LANE WIDTH (FEET) . . . . . .  13.50
      CURB HEIGHT (INCHES). . . . . .   6.00
      CONCRETE CURB CONSTRUCTION COST ($/LF). . . . . .   2.00


      *****  CONCRETE SLAB  *****

      MINIMUM SLAB THICKNESS (INCHES) . . . . . .   6.00
      MAXIMUM SLAB THICKNESS (INCHES) . . . . . .  12.00
      SLAB THICKNESS INCREMENT (INCHES) . . . . . .    .50
      CONCRETE PLACEMENT COST ($/CY). . . . . .  98.00
      ADDITIONAL CONCRETE PAVEMENT COST ($/SY). . . . .    .00
      CONCRETE SALVAGE VALUE (PERCENT). . . . . .  30.00
      CONCRETE FLEXURAL STRENGTH (PSI). . . . . .  500.0
      CONCRETE TENSILE STRENGTH (PSI) . . . . . .  379.0
      CONCRETE ELASTIC MODULUS (PSI). . . . . . 3220000.
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      *****  SUBGRADE  *****

      SWELLING PROBABILITY. . . . . .   1.00
      SWELLING RATE CONSTANT. . . . . .   .12
      POTENTIAL VERTICAL RISE (INCHES). . . . . .   2.50
      SUBGRADE EXCAVATION COST ($/CY) . . . . . .   7.50
      ADDITIONAL SUBGRADE COST ($/SY) . . . . . .   .00
      SUBGRADE ERODABILITY FACTOR . . . . . .   3.00
      FRICTION FACTOR BETWEEN SLAB AND SUBGRADE . . . .   .90
      SUBGRADE K-VALUE (PCI). . . . . .  100.0


      *****  ASPHALT CONCRETE OVERLAY  *****

      MINIMUM AC OVERLAY THICKNESS (INCHES) . . . . . .   1.50
      MAXIMUM TOTAL AC OVERLAY THICKNESS (INCHES) . . .   3.00
      AVERAGE AC OVERLAY LEVEL-UP THICKNESS (INCHES). .   .50
      AC OVERLAY CONSTRUCTION COST ($/CY) . . . . . .  55.00
      ADDITIONAL OVERLAY COST ($/SY). . . . . .   .00
      AC OVERLAY SALVAGE VALUE (PERCENT). . . . . .  30.0
      TAPERING COST FOR FIRST OVERLAY ($/LF). . . . . .   .00
      EDGE MILLING COST ($/LF). . . . . .   .00
      AC OVERLAY ELASTIC MODULUS (PSI). . . . . .  40000.
      AC PRODUCTION RATE (CY/HOUR). . . . . .  40.0


      *****  DESIGN CONSTRAINTS  *****

      CONFIDENCE LEVEL (PERCENT). . . . . .  90.00
      ANALYSIS PERIOD (YEARS) . . . . . .  20.0
      MINIMUM TIME TO FIRST OVERLAY (YEARS) . . . . . .  20.0
      MINIMUM TIME BETWEEN OVERLAYS (YEARS) . . . . . .   5.0
      MAXIMUM THICKNESS OF SLAB AND SUBBASE (INCHES). .  30.00
      MAX. FUNDS AVAILABLE FOR INITIAL CONST. ($/SY). .  50.00
      DISCOUNT RATE (%) . . . . . .   5.00


      *****  PERFORMANCE  *****

      SERVICABILITY AFTER INITIAL CONSTRUCTION. . . . .   4.20
      TERMINAL SERVICABILITY. . . . . .   1.50
      SERVICABILITY AFTER AC OVERLAY. . . . . .   4.00
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      *****  MAINTENANCE  *****

      COMPOSITE LABOR WAGE ($/HOUR) . . . . . .   9.00
      COMPOSITE EQUIPMENT RENTAL RATE ($/HOUR). . . . .   6.00
      COST OF MATERIALS ($/UNIT OPERATION). . . . . .   4.00



      *****  TRAFFIC  *****

      AVERAGE DAILY TRAFFIC GROWTH RATE (% / YEAR). . .   3.50
      DIRECTIONAL DISTRIBUTION FACTOR (%) . . . . . .  50.00
      LANE DISTRIBUTION FACTOR (%). . . . . . . . . . 100.00
      PERCENT TRUCKS IN INITIAL AVERAGE DAILY TRAFFIC .   2.90
      18-KIP EQUIVALENCY FACTOR FOR AVERAGE CITY TRUCK.    .530
      INITIAL AVERAGE DAILY TRAFFIC (VEHICLES/DAY). . .   1000.



      *****  TRAFFIC DELAY  *****

      DETOUR MODEL NUMBER . . . . . .  3
      NUMBER OF OPEN LANES THROUGH RESTRICTED ZONE:
           IN OVERLAY DIRECTION . . . . . .  1
           IN NON-OVERLAY DIRECTION . . . . . .  2
      AVERAGE APPROACH SPEED TO OVERLAY ZONE (MPH). . .    40.
      AVERAGE SPEED THROUGH RESTRICTED ZONE:
           IN OVERLAY DIRECTION . . . . . .    15.
           IN NON-OVERLAY DIRECTION . . . . . .    40.
      DISTANCE TRAFFIC IS SLOWED (MILES):
           OVERLAY DIRECTION. . . . . .   1.00
           NON-OVERLAY DIRECTION. . . . . .    .00
      DETOUR DISTANCE AROUND OVERLAY ZONE (MILES) . . .    .00
      NO. OF HOURS PER DAY OVERLAY CONSTRUCTION OCCURS.   7.00
      BEGINNING TIME OF OVERLAY CONSTRUCTION. . . . . .   800.
      ENDING TIME OF OVERLAY CONSTRUCTION . . . . . .  1600.
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PROBLEM       TITLE (DESCRIPTION)
21201100.010 - George's Ranch, Collector (1000 vpd)



                ******************************************
                *                                        *
                *     OUT OF ALL OVERLAY STRATEGIES      *
                *            THAT WERE TRIED             *
                *        NO  OVERLAY  STRATEGY           *
                *        MEETS THE REQUIREMENTS          *
                *                                        *
                *    PROGRAM PARTIALLY CONTINUED         *
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SUMMARY OF DESIGNS IN INCREASING ORDER OF TOTAL COST

| | |
|---|---|
| DESIGN NUMBER | 1 |
| PAVEMENT TYPE | JCP |
| SUBBASE TYPE | 1 |
| SLAB THICKNESS | 6.00 |
| SUBBASE THICKNESS | .00 |
| INITIAL LIFE | 27.94 |
| TOTAL PERFORMANCE LIFE | 27.94 |
| SPACING TRANS. JOINTS | 40.00 |
| SPACING LONG. JOINTS | 13.50 |
| COST OF SUBG. PREPARATION | 1.250 |
| COST OF CONCRETE | 16.333 |
| COST OF CURB AND GUTTER | 1.333 |
| COST OF SUBBASE | .000 |
| COST OF JOINTS | .000 |
| INITIAL CONST. COST | 18.917 |
| COST OF EDGE TAPERING | .000 |
| COST OF EDGE MILLING | .000 |
| OVERLAY CONST. COST | .000 |
| TRAFFIC DELAY COST | .000 |
| MAINTENANCE COST | 6.682 |
| SALVAGE RETURNS | -1.847 |
| TOTAL COST PER SQ YARD | 23.752 |

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                                INITIAL DESIGN ANALYSIS

                OUT OF A TOTAL OF   13 INITIAL POSSIBLE DESIGNS,
                          0 WERE REJECTED DUE TO MAX. INITIAL THICKNESS
RESTRAINT
                OUT OF  13 DESIGNS THUS LEFT
                         12 DESIGNS WERE REJECTED SINCE THEY ARE OVERDESIGNS OF
                           INITIAL DESIGNS WHICH LAST THE ANALYSIS PERIOD
                OUT OF   1 DESIGNS THUS LEFT,
                          0 DESIGNS WERE REJECTED DUE  TO THEIR LIVES BEING LESS
                           THAN THE MINIMUM ALLOWABLE TIME  TO THE FIRST OVERLAY
                OUT OF   1 DESIGNS THUS LEFT,
                          0 DESIGNS WERE REJECTED DUE TO THE RESTRAINT OF
MAXIMUM
                           INITIAL FUNDS AVAILABLE
                OUT OF   1 DESIGNS THUS LEFT,
                          1 DESIGNS WERE ACCEPTABLE  INITIAL DESIGNS WITH LIVES
                           MORE THAN THE ANALYSIS PERIOD
                AND THUS      0 DESIGNS WERE PASSED TO THE OVERLAY SUBSYSTEM
TO
                                FORMULATE THE POSSIBLE OVERLAY STRATEGIES
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