SURVEYORS REPORT
State Road 91 (Florida's Turnpike)
Turnpike Widening from Osceola Parkway to Beachline
Specific Purpose Survey
Financial Project Identification (FPID) No.'s 411406-1-32-01 and 411406-4-32-01
Mile Post 247.5 to Mile Post 255.5
Orange and Osceola Counties, FL

Prepared by
Wantman Group, Inc.

Introduction

Wantman Group, Inc. (WGI), Licensed Business (LB) 7055, operating under the authority of the Florida Department of Transportation (FDOT), Florida Turnpike Enterprise (FTE) on **FPID No.'s 406411-1-32-01 and 411406-4-32-01**, was tasked with the execution of this **Specific Purpose Survey** in support of production of the project entitled "Turnpike Widening from Osceola Parkway to Beachline" in Osceola and Orange Counties, Florida. The purpose of this survey was to establish project network control, establish aerial targets for 2D/3D fixed-wing photogrammetric mapping completed by others, determination of the historical baseline of survey and depiction of existing right-of-way lines, provide 2D/3D topographic surveys and Digital Terrain Model (DTM), drainage survey, bridge detail surveys and designation and location of subsurface utilities. This is not a Boundary or Right of Way Control Survey.

Project Location

The project is located within Section 33, Township 23 South, Range 29 East, Sections 2, 3, 10, 11, 14, 23, 26, 27, and 35, Township 24 South, Range 29 East and Section 2, Township 25 South, Range 29 East in Osceola and Orange Counties, Florida. Specifically, the full project limits extend along SR 91 (Florida's Turnpike) from Mile Post 247.5 to Mile Post 255.5, and extend various distances along all adjoining side streets and interchanges.

Horizontal and Vertical Control

Primary Control

The horizontal project datum is the Florida State Plane Coordinate System, East Zone, 0901, North American Datum of 1983, 1990 Adjustment (NAD83/90). Horizontal control is predicated on National Geodetic Survey (NGS) high –order control stations and the Specific Purpose Survey completed for FPID 411488-1-22-01, by URS Corporation, Inc. and dated November 2002. This survey is hereby incorporated into the current survey by reference. Eight (8) new poured in place concrete monuments with 3 ½" FDOT Aluminum Disc were set at approximate one mile intervals throughout the project limits. An additional two (2) 5/8" rebar with cap stamped "LB 6839" were recovered as described from FPID 411488-1-22-01 and included as network control.

Final coordinate values were determined for all primary control points via Static GPS survey. The network geometry and session plan conformed to the standards for "C Order Control," as outlined in the Federal Geodetic Control Committee's publication "Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques," 1984. The network was constrained to NGS control stations "R 354," "95_064," "GIS 212 LEON R PRICE," and "L 715" as well as points "OR19" and "OS25" per FPID 411488-1-22-01. All GPS vectors were post-processed using Novatel GrafNET version 8.50. The final

least squares network adjustment was performed using FDOT's VectorNT least squares adjustment, with vector errors weighted according to FDOT standards for primary survey control. The final linear accuracy of the network is 1/344,448, which exceeds FDOT's requirement of 1/100,000 for primary survey control.

Secondary Control
WGI set 61 aerial targets to control the fixed-wing photogrammetric survey within the project limits. All aerial targets are either 2 1/2" MAG nail with washer stamped "LB 7055" or 5/8" rebar with cap stamped "LB 7055." Horizontal values for all secondary control were established using Real-Time Kinematic (RTK) GPS techniques, holding project primary control as fixed. A minimum of two independent observations were recorded from a minimum of two base stations, and no more than three miles separated the RTK rover from the RTK base for any given observation. Final horizontal values were determined via an appropriately weighted least squares network adjustment using FDOT's VectorNT lease squares adjustment.

Vertical Control
The vertical datum is the North American Vertical Datum of 1988 (NAVD88). All control was elevated to the project datum using differential leveling techniques. National Geodetic Survey (NGS) vertical benchmarks "R 354" (NAVD88 elevation 107.50'), "L 715 019" (NAVD88 elevation 93.58'). The raw closure of said leveling runs met the requirement of .05*√ of the distance of the run in miles per Chapter 5J-17 (Standards of Practice) of Florida's Administrative Code.

Final coordinate values and the relationship of all Project Survey Control to the SR 91 Baseline of Survey are depicted in the Project Survey Control Sheets (CTLSRD00.DGN) included in the digital submittal for the project.

2D/3D Topographic Survey

Aerial Cartographics of America, Florida Licensed Business 6748 provided mid-altitude fixed-wing photogrammetric survey throughout the project limits. 2D mapping of all surface features to 800' left and right of the SR 91 Baseline of Survey was performed via the photogrammetric survey, along with all elevations on soft ground within unobscured areas. All pavement elevations were collected by WGI using terrestrial LiDAR techniques constrained to established project controls. All soft ground elevations and location of obscured areas were provided by WGI using either RTK GPS techniques or traditional radial methods from established project controls using a 1" Topcon Total station and TDS data collection system. Sufficient elevations were obtained and all identifiable breaks in terrain were located so as to facilitate the creation of a Digital Terrain Model (DTM) throughout the project. Topographic details and the project DTM are included with the digital submittal in the files TOPORD01.DGN (surface topography), TOPORD02.DGN (bridges), GDTMRD01.DGN / GDTMRD01.TIN (ground DTM), and GDTMRD02.DGN / GDTMRD02.TIN (bridge DTM). Surveys completed using various methods were combined and merged by WGI.

Terrestrial LiDAR (3-Dimensional Laser Scanning)
All elevations and features lying within the SR 91 travel lanes on on/off ramps were collected remotely using terrestrial LiDAR (high definition 3-Dimensional laser scanning). All terrestrial LiDAR was collected using a Leica C-10 time of flight scanner. The stated positional accuracy of the C-10 scanner is 6mm x 4mm at a range of 300 meters or less. All data for this project was collected from a distance of 250 feet or less.
All control established as part of the project was held as fixed horizontally and vertically, with additional control being set and located as needed to adequately constrain the scans to the project horizontal and vertical datums. Fixed elevation tripods were used as target mounts at each target and / or control station location. Leica Cyclone Register version 8.2 was used to register and adjust the scan worlds using an appropriately weighted least squares network adjustment. The mean absolute error (XYZ) of the registered and adjusted scan worlds to enabled control was 0.018, with a maximum 3-dimensional

residual of 0.084 for 310 independent scan worlds. 3-dimension horizontal and vertical root mean square for points contained in the combined registered scans, or "point cloud," is 0.026 feet.

WGI then extracted all features and elevations lying within the SR 91 travel lanes. Feature extraction was completed using Leica Cyclone "Virtual Surveyor" version 8.2. Cross sections were extracted from the registered point cloud at 50 foot intervals.

Roadway Cross Sections
Cross sections were obtained at approximate 1,000' intervals throughout the limits of the project for quality control purposes and to verify the DTM data. These cross sections were directly compared to the DTM generated by the photogrammetrist, and the results of the comparison are included with the digital submittal in the file COMPARE.TXT.

Drainage Survey

A drainage survey was performed on all existing drainage structures within the project limits. Approximately 400 drainage structures and all pipe connectivity were included. Rim elevations, pipe size, material, invert elevation, connectivity, and flow line locations are depicted in the DREXRD01.DGN file included with the digital submittal for the project.

Utility Survey

WGI performed a Quality Level B (utility designating) subsurface investigation throughout the Final Design portion of the project limits, per ASCE 38-02 "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data." Toneable subsurface utilities were designated using passive frequencies (60Hz, 60 Hz x 5, 60Hz x 9+4 KHz), low (4KHz – 15KHz) and high (15 KHz – 38KHz) radio frequencies and generally prescribed geophysical prospecting techniques. Non-toneable utilities were designated using multichannel Ground Penetrating Radar (GPR). Utilities were marked in accordance with the American Public Works Association utility marking uniform color code. Utility designations were located via RTK GPS methods or traditional radial methods from established project controls using a 1" Topcon Total station and TDS data collection system. The two-dimension utility locations are depicted in the UTEXRD01.DGN file included with the digital submittal for the project.

WGI then performed a Quality Level A (utility test holes) subsurface investigation, per ASCE 38-02 "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data," at locations specified by the design engineer of record. Non-destructive vacuum excavation techniques were utilized to excavate and expose utility facilities in these locations. Facility depth, material, type, size, configuration of non-encased multiconduit systems, and direction were physically measured and recorded. This information is detailed in the Microstation files UTVHRD01.DGN, and UTVHRD02.DGN, as contained in the digital submittal for the project.

Bridge Survey

High definition laser scanning was utilized to capture precise 3D data, clearance information and obscured area topographic data for the following bridges:

- Osceola Parkway over SR 91 (924121 / 924171)
- SR 91 over CSX Railroad (750060 / 750262)
- CR 527 over SR 91 (750006)
- Town Center Boulevard over SR 91 (754122 / 754104)
- SR 417 over SR 91 (750438 / 750439)
- Wetherbee Road over SR 91 (754094)
- SR 91 over CSX Railroad "B" / Sunrail (750061 / 750263)
- Exit 234 Ramp over SR 91 (750063)

Bridge details were not extracted from the scan data following the January scope modifications. Only bridge clearances were provided in the digital submittal. The registered point clouds containing the bridge scans are on file at WGI's Corporate Headquarters, and available upon request until 1 August 2026.

Historic Baseline of Survey

The intent of this survey was to re-establish the historic Baseline of Survey and existing limited access right-of-way lines for SR 91 from Osceola Parkway to Beachline. The historic baseline of survey and existing right-of-way within the project limits is depicted per the following right-of-way maps:

- Section 75004-2501 (SR 91 at Beeline Connector)
- Section 75301-6445-452 (SR 91 at SR 417 Interchange)
- Section 97775-2324 (RW Control Survey Map, SR 91 in Orange County)
- Section 97920-2342 (SR 91 at Dart Boulevard)
- Section 75000-2609 (SR 91 from Orange Blossom Trail to Dixie)
- Section 75040 (SR 91 from Orange Osceola Line to SR 482)
- Orange County Right-of-Way Map for Taft-Vineland Road

Recorded plats, existing Project Network Control sheets, construction plans, and bridge as-built plans were also used to determine the location of the SR 91 Baseline of Survey.

WGI field crews recovered 31 section corners and approximately 130 RW and baseline reference points for this project. Of these points, approximately 80% were found to be within acceptable tolerances of their intended position (0.00 to 0.2') and harmonized well with record data.

Commencing at the south end of the project, few RW monuments were recovered. However, several reference points were recovered as described in RW Map for Section 97920-2342. These references were used to generate a best fit solution for Tangent 1 of the project. Construction plans for SR 91 (Contract No. 11.1) indicate several 6"x6" monuments which were recovered and agreed with the best fit solution calculated from the references. This first tangent proceeds northwesterly for approximately 1.9 miles to a point of curvature. This PC was substantiated with the recovery of a 6"x6" concrete monument per the SR 91 construction plans and was held as the PC of Curve #1.

Curve #1 was established by maintaining the PC location as per the recovered 6"x6" monument, and holding the FDOT RW Map radius. The out bearing defining the curve delta was established by holding a recovered 3"x3" monument which corresponded well to the calculated map position of the PT of the next curve, Curve #2.

Curve #1

Computed Curve Data		Historical Curve Data
R = 7,639.44' Δ = 13° 42' 38" L = 1,828.09'		R = 7,639.44' Δ = 13° 41' 33" L = 1,825.67'

Tangent 2 is little more than a mile and was established using a best fit solution through several recovered RW monuments, holding the radius of Curve #1, and holding the above mentioned 3"x3" concrete monument as the PT for Curve #2 and RW Map radius for Curve #2. As such the tangent is the product of the two curves. Curve #2 was established by holding the PT as per above, holding the RW Map radius, and bearing as calculated for tangent #2.

Curve #2

Computed Curve Data		Historical Curve Data
R = 22,918.31' Δ = 5° 07' 41" L = 2,051.21'		R = 22,918.31 Δ = 5° 08' 13" L = 2,054.78'

Tangent 3 is approximately 2 miles in length and was substantiated by monumentation. Tangent 3 was developed by a best fit solution through the recovered monuments. Curve #3 was established by holding the RW Map radius, bearing for Tangent 3, and the URS PNC Sheet (FPID 411488-1-22-01) tangent bearing. Several options were considered for Tangent 4, and none fit recovered monuments better than the PNC sheet bearing.

Curve #3

Computed (PNC) Curve Data		Historical Curve Data
R = 5,729.58' Δ = 52° 31' 49" L = 5,253.03'		R = 5,729.58' Δ = 52° 32' 25" L = 5,254.03'

Tangent 4, Curve #4, and Tangent 5 were all evaluated with regard to recovered monumentation, and again the computed baseline curve and tangent geometry per the PNC sheet developed by URS for FPID 411488-1 harmonized no worse than any logical alternative. As such, the URS PNC sheet geometry was held throughout the remainder of the project limits.

Curve #4

Computed (PNC) Curve Data		Historical Curve Data
R = 7,639.44' Δ = 22° 14' 44" L = 2,966.06'		R = 7,639.44' Δ = 22° 15' 00" L = 2,966.67'

The stationing for this survey was computed in accordance with the stationing scheme developed for the Specific Purpose Survey for FPID 411488-1-22-01 by URS Corporation. The final analysis of the baseline and right-of-way lines was compared with current aerial photography, occupation, and location of existing bridges. No inconsistencies of the right-of-way lines or visible encroachments were discovered during this comparison. A baseline review meeting was held at WGI's West Palm Beach Office Location with Mike Joiner, PSM, Turnpike Surveyor on 4 October 2012. All parties concurred that the baseline solution as proposed herein met project objectives and was appropriately defensible in light of the data used to generate the solution. The final SR 91 Baseline of survey is included with the digital submittal in the form of the ALGNRD01.DGN. The final computed right-of-way file which has been referenced into the construction plans for the project is included with the digital submittal in the form of RWDTRD01.DGN. Alignment, right of way information, supporting monuments, and survey control are depicted in the project "CTL" sheets, CTLSRDXX.DGN.

Design File Index

ALIGNRD01.DGN – Project baseline of survey
CTLSRDXX.DGN – Project "CTL" sheets, depicting right of way alignment, sectional, plat, and supporting monumentation as well as project survey control
DREXRD01.DGN – existing drainage
GDTMRD01.tin – existing ground digital terrain model
GDTMRD02.tin – bridge deck digital terrain model
RWDTRD01.DGN – existing right of way
SPDTRDXX.DGN – specific topographic details, as requested by the design engineer of record
TOPORD01.DGN – existing ground topography

TOPORD02.DGN – bridge deck topography
UTEXRD01.DGN – surface evidence of subsurface utility facilities, ASCE Quality Level B utility investigation
UTVHRDXX.DGN – summary of verified utilities, ASCE Quality Level A utility investigation

Geopak Database References
jobR91.GPK – mapping database containing right of way control and parcel sketch data
jobG91.GPK – ground topography (411406-1)
job417.GPK – additional ground topography for SR 417 full interchange (411406-4)

Intended Display Scale
The digital files included with this project are intended to be displayed at a scale of 1" = 40'.

Survey date (last day of field work): 1 April 2016.

Project Field Books: Field Books 21211276 - Books 1 through 15.

Certification: (1) This survey meets all applicable requirements of the Florida Standards of Practice as contained in Chapter 5J-17 of Florida's Administrative Code, pursuant to section 472.027 of the Florida Statues. (2) This report is digitally signed and sealed digitally under FAC 5J-17.062. All other copies thereof are invalid. (3) Additions or deletions to this data by anyone other than the signing party are prohibited without written consent of the signing party. (4) This report stands together with the digital submittal for FPID 411406-1-32-01, and neither is complete or valid without the other. (5) Quality Control (QC) was conducted on this project and found to meet specifications.

Professional Surveyor and Mapper in Responsible Charge:

Samuel T. Hall
Florida Professional Surveyor and Mapper
License Number 6644

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