

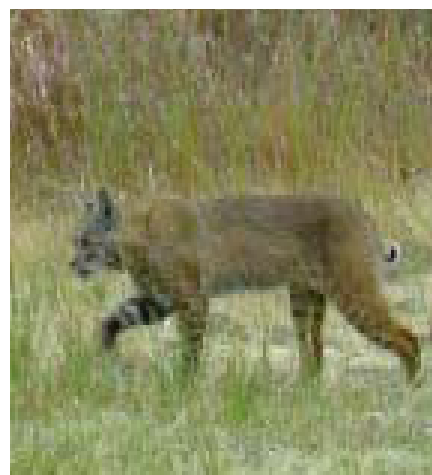


***Ina Road to Grant Road
Design Concept Study***

**Final Report
June 2011**

Prepared for:
City of Tucson Department of Transportation
Pima County Department of Transportation
Town of Marana Department of Public Works

Prepared By:
Kittelson & Associates, Inc.



FINAL DESIGN CONCEPT REPORT

SILVERBELL ROAD

INA ROAD TO GRANT ROAD

JUNE 2011

Prepared For:

City of Tucson Department of Transportation

201 N Stone Ave
Tucson, Arizona 85701

Town of Marana Department of Public Works

11555 W. Civic Center Drive
Marana, Arizona 85653

Pima County Department of Transportation

201 N. Stone Avenue
Tucson, AZ 85701

Regional Transportation Authority

177 N. Church Avenue
Tucson, Arizona 85701

Prepared By:

Kittelson & Associates, Inc.

33 N Stone Avenue, Suite 800
Tucson, AZ 85701
(520) 544-4067

Project Manager: Jason Simmers, P.E.

Project Principal: Jim Schoen, P.E.

With:

HDR Engineering
McGann & Associates
NCS Consultants
Eco Plan
Swaim & Associates
SWCA Environmental Consultants
Kaneen Advertising and Public Relations

Project No. 9589.00



Table of Contents

Executive Summaryi

1.0 Project Overview1

2.0 Project Description2

3.0 Project Area Characteristics (Existing Conditions).....4

4.0 Traffic and Accident Analysis8

5.0 Design Standards and Criteria.....13

6.0 Major Design Features15

7.0 Environmental Conditions23

8.0 Public Involvement25

9.0 Agency Coordination.....26

10.0 Alternatives27

11.0 Cost and Budget30

12.0 Conclusions and Recommendations.....31

13.0 References.....32

Appendix A Preliminary (15%) Roadway Plans; Ina Road to El Camino del Cerro

Appendix B Preliminary (30%) Roadway Plans; El Camino del Cerro to Grant Rd

Appendix C Landscape Concept Elements

Appendix D Preliminary Project Costs

List of Figures

Figure 1 Location Map3

Figure 2 Silverbell Road Jurisdictional Limits.....4

Figure 3 Priority Wildlife Crossing Corridors7

Figure 4 Existing Daily Traffic Volumes.....9

Figure 5 Crash Data Summary10

Figure 6 Landscape Concept21

List of Tables

Table 1 Major Washes4

Table 2 2040 Traffic Projections8

Table 3 Design Criteria.....14

Table 4 Right-of-Way Requirements16

Table 5 Proposed Drainage Culverts17

Table 6 Wall Summary – Ina Road to El Camino del Cerro.....19

Table 7 Wall Summary – El Camino del Cerro to Grant Road ..19

EXECUTIVE SUMMARY

Improvements to Silverbell Road, from Grant Road to Ina Road are included in the voter approved Regional Transportation Authority (RTA) Transportation Improvement Plan. The improvements will increase roadway and intersection capacity, improve the roadway alignment and profile to enhance safety, provide dedicated facilities for bicycles and pedestrians, install drainage improvements to eliminate flooding and road closures, and provide necessary access control.

The section from Sunset Road to Grant Road is included in implementation Period 2 (2012 to 2016) of the RTA program. The section from Ina Road to Sunset Road is included in Period 4 (2022 to 2026).

Planning, preliminary engineering, and environmental studies for the 7.6 miles of Silverbell Road was conducted through a multiagency effort by the City of Tucson, Pima County, and Town of Marana. Substantial public outreach was carried out in this phase of project implementation and included frequent consultation with a Citizen’s Task Force, three rounds of public meetings, and discussions with individual property owners.

This comprehensive project development effort has produced the following recommended corridor improvements:

- Implement a 4-lane curbed roadway, with a raised landscaped median and 6-ft wide asphalt bike lanes, excluding gutter.
- Reconstruct the signalized intersections at Grant Road, Goret Road, Sweetwater Drive, and El Camino del Cerro, as well as the unsignalized intersection at Sunset Road to provide exclusive turn lanes and appropriate storage capacity.
- Pedestrian facilities will include a 10-ft wide asphalt multi-use path or concrete sidewalk on the east side of the roadway the entire length of the project. Sidewalk or compacted decomposed granite will be provided on the west side of the roadway to provide connectivity to signalized intersections for pedestrians and equestrians.
- Median openings will be provided primarily at commercial driveways and residential side streets and not at individual residential driveways. Between El Camino del Cerro and Ina Road, median openings will be spaced to provide for convenient U-turn opportunity.
- The roadway will be realigned at several locations to eliminate substandard roadway geometry.
- The roadway profile will be raised, as necessary, to accommodate the installation of drainage culverts and to bring a large portion of the roadway out of the Santa Cruz River floodplain. The roadway will need to be raised an average of 5 feet on the section north of El Camino del Cerro and 2 feet between El Camino del Cerro and Goret Road.

- Install pipe or box culverts at 71 of the 73 existing drainage crossings. Short span bridges are recommended at two large wash crossings. The recommended culvert sizes will accommodate the 100-year storm. To mitigate the impact of the wider roadway on wildlife, some culverts located within five priority crossing corridors are recommended to be slightly upsized.w2w
- Bus pullouts will be constructed at existing transit stops at the Grant Road intersection. Right-of-way will be reserved at existing signalized intersections to accommodate future bus stops.
- Roadway lighting is recommended on the section from Goret Road to Grant Road. Intersection lighting will be provided at the signalized intersections and is recommended at several unsignalized intersections.
- The recommended landscape concept for the corridor is intended to support a De Anza Trail theme and includes the use of native and drought tolerant vegetation, water harvesting techniques, native materials that blend with the surrounding area, and the placement of interpretive nodes and seating areas along the multi-use path located between Silverbell Road and the Santa Cruz River. It is anticipated that the public art component of the roadway improvements will support the proposed theme.

Rendering Illustrating Roadway Improvements Looking Northbound at DeGreen Street

Existing Roadway



With Roadway Improvements



Silverbell Road is designated as an environmentally sensitive corridor in the Sonoran Desert Conservation Plan. The corridor is dominated by archeological sites that cannot be avoided. In order to minimize impacts to archeological sites, minimum lane and median widths and maximum fill and cut slopes allowable by the City of Tucson, Pima County, and Town of Marana are used to reduce the roadway footprint. In addition, sloped inlets will be used at a majority of the drainage culverts to reduce the amount the roadway needs to be raised. Even with these measures, a substantial amount of field recovery will be required prior to utility relocation or roadway construction work. The corridor has been designated as an Archeological District in order to simplify the clearance process through the State Historic Preservation Office. The field recovery work will begin at the south end of the project and proceed north, allowing construction activities to closely follow.

Of the 73 drainage crossings, 58 are proposed to be jurisdictional waters of the U.S. Considering that the impact on several crossings will likely exceed ½ acre, coupled with the archeological clearance process which will be led by the U.S. Army Corps of Engineers, it is expected that an individual Section 404 permit will be required for several construction segments. It is recommended that the individual permit application process, which will require an alternatives assessment be initiated immediately upon approval of the jurisdictional delineation by the Corps.

The recommended roadway alignment is intended to minimize right-of-way impacts to private property, however, a substantial amount of public and private right-of-way acquisition will still be required, particularly on the section from Ina Road to El Camino del Cerro. The vast majority of private right-of-way required on this section is from one property owner – California Portland Cement. Acquisitions will include roadway right-of-way, slope easements, and drainage easements. Right-of-way and easement requirements will be fine tuned in final design.

Existing overhead and underground utilities will be impacted, potentially significantly. Widening of the roadway and shifting of the alignment in some areas will require that power poles be relocated. Placing overhead lines (power and communications) underground is not a requirement of the roadway widening nor is it planned by TEP or the communications providers. Water, gas, and communications lines will be impacted by the drainage culverts that will be installed. The depth of the 42” water main and 24” reclaimed water main are being verified by Tucson Water to determine the impacts of the proposed roadway improvements and the need to lower or replace these lines.

Funding currently committed for the widening of Silverbell Road includes \$42.7 million of RTA funds and \$14.4 million from the City of Tucson, Pima County, and the Town of Marana, for a total of \$57.1 million. The estimated project cost for the 7.6 miles based on current (2010) construction prices, including final design, archeological recovery/environmental clearance, 404 permitting, construction, and construction engineering/administration is \$103 million. Funds will be requested from the RTA for implementation of the proposed wildlife crossing enhancements (estimated at \$1 million). Additional local and/or regional funding will be required to complete the project.

1.0 PROJECT OVERVIEW

Improvements to Silverbell Road, from Grant Road to Ina Road (7.6 miles) are included in the voter approved Regional Transportation Authority (RTA) Transportation Improvement Plan. The improvements specified in the RTA plan include:

- Widen the section from Grant Road to Sunset Road (4.7 miles) to provide 4 travel lanes, bike lanes in both directions, curb, a raised landscaped median, and ADA-accessible sidewalks.
- Widen the section from Sunset Road to Ina Road (2.9 miles) to provide two travel lanes, bike lanes in both directions, a two-way center turn lane, and ADA-accessible sidewalks.
- Install drainage culverts to eliminate flooding and road closures at dip crossings.
- Add exclusive right and left-turn lanes and intersection improvements at Grant Road, Goret Road, Sweetwater Drive, El Camino del Cerro, Sunset Road, Orange Grove Road, and Ina Road.

These improvements are to be constructed in Periods 2 and 4 of the RTA plan implementation schedule. The section from Grant Road to El Camino del Cerro will be constructed between 2012 and 2016, while the section from El Camino del Cerro to Ina Road will be constructed between 2022 and 2026.

A separate project in the RTA plan will extend Sunset Road from Silverbell Road across the Santa Cruz River to I-10. The Sunset Road extension project is scheduled for RTA Implementation Period 3 (2017-2021)

The planning and preliminary engineering phase of the Silverbell Road improvement project began in April 2009. This Design Concept Report (DCR) documents the results of this project phase. The intent of this project is to improve roadway safety and capacity, eliminate roadway closures associated with flooding, and provide facilities to encourage and support multi-modal (bike, pedestrian, and transit) travel in a cost effective manner. A primary project goal is to avoid environmental impacts where possible and minimize and/or mitigate unavoidable impacts.

Development of the design concept was based on the following engineering analyses and environmental investigations, as well as public input and comment that were provided through a Citizen’s Task Force, public open houses, and meetings with individual property owners and other stakeholders.

- Traffic Engineering Study
- Drainage Studies: Existing Hydrologic and Hydraulic Conditions; Proposed Cross Drainage Improvements, and Pavement Drainage
- Geotechnical Investigation
- Environmental Studies: Biological Evaluation, Cultural Resource Survey, Wildlife Linkage Assessment, Visual Resource Analysis, Noise Study, Jurisdictional Delineation of the Waters of the U.S., Hazardous Materials Review

2.0 PROJECT DESCRIPTION

A location map for the proposed project is provided in Figure 1. The proposed improvements associated with this project include the complete reconstruction and widening of Silverbell Road from Ina Road to Grant Road/Ironwood Hills Drive. The project is approximately 7.6 miles in length and the project limits extend from just south of Ina Road to approximately 250 feet south of Grant Road/Ironwood Hills Drive. Each side street and driveway intersections within the project limits will also be reconstructed to tie in to the new elevation of Silverbell Road.

The majority of the widening of Silverbell Road will be to the east of the existing roadway to minimize the impact on existing slopes and right-of-way on the west side. The vertical roadway profile will be raised significantly along much of the roadway between Ina Road and El Camino Del Cerro to accommodate new cross-drainage structures as well as to raise the roadbed above the 100-year floodplain. From El Camino Del Cerro to Grant Road the vertical profile of Silverbell Road will more closely follows the existing road profile except where it is necessary to raise the roadway to accommodate new cross-drainage structures.

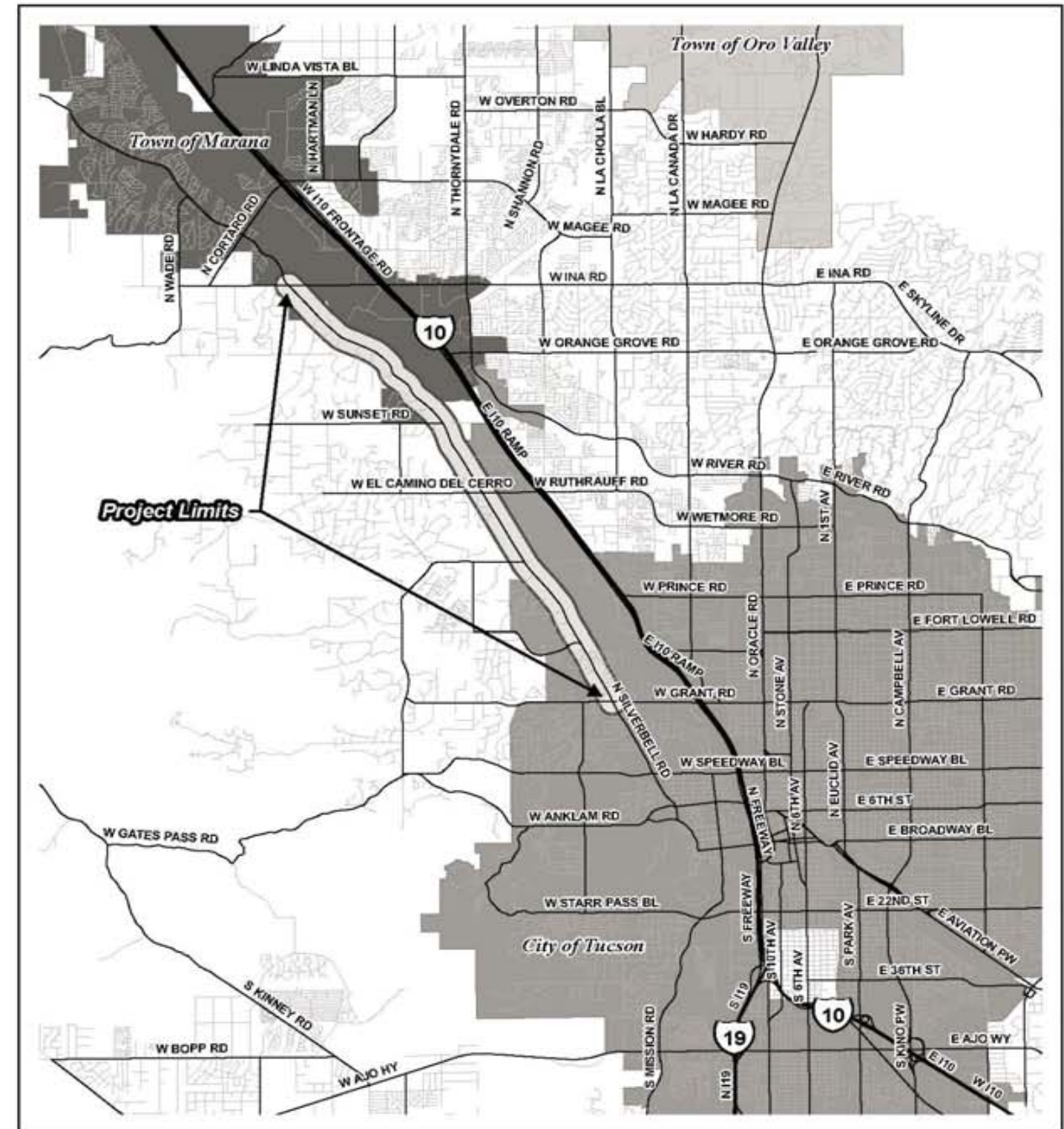
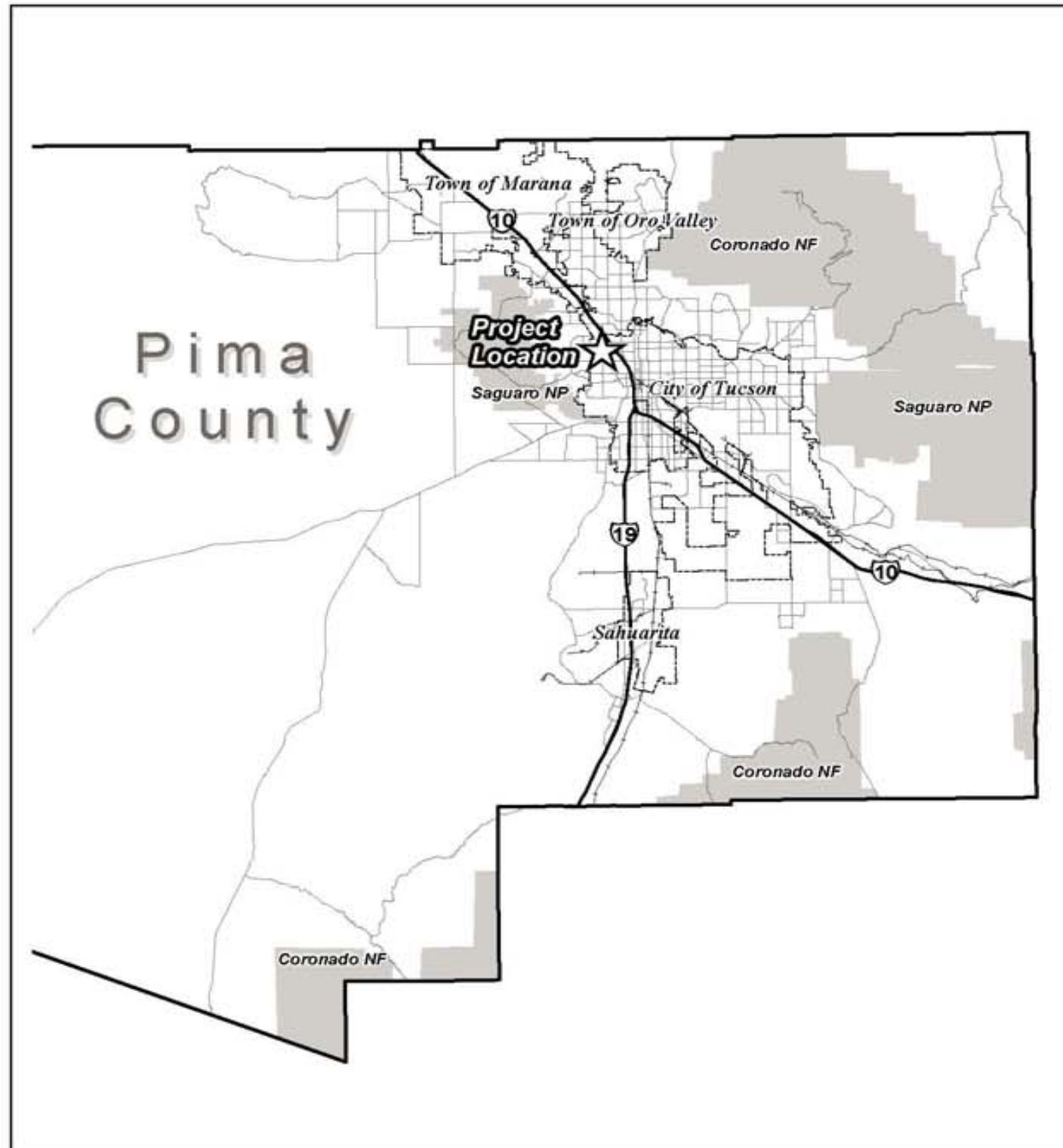
The existing right-of-way width varies along the corridor from 60 to 150 feet. The widened roadway will require a right-of-way width of at least 150 feet, with up to 200 feet needed in some sections to accommodate fill slopes. Slope easements will be needed at some locations and drainage easements will be needed at many of the drainage crossings.

The proposed roadway improvements include:

- Two travel lanes and a bicycle lane in each direction, with a 20’ raised, landscaped median. The outside edge of pavement will be delineated with vertical curb or curb and gutter for the entire corridor.
- Pedestrian facilities will include a 10-foot wide asphalt multi-use path along the east side of Silverbell Road from Ina Road to Burlwood Way and A 6-foot wide concrete sidewalk on the east side of Silverbell Road from Burlwood Way to Grant Road and on the west side from Goret Road to Grant Road. ADA compliant curb access ramps will be provided at all side street and driveway crossings
- An equestrian path along the west side from El Camino Del Cerro to Avenida Albor and on both sides from Neosha Street to Goret Road. At-grade signalized equestrian crossings will be provided at Sweetwater Drive and Goret Road.
- Median openings that allow full left-turn and U-turn movements will be provided at side streets serving multiple residences and at major commercial or public (i.e. Christopher Columbus Park) driveways. Median openings at individual residential driveways are not provided. Additional U-turn bays are provided where access spacing requirements permit;

- Exclusive right-turn lanes will be provided at signalized intersections, the Christopher Columbus Park entrance, and the Safeway Center driveway just north of Grant Road. A continuous northbound right-turn bay is proposed between Belmont Road and Abington Road to provide access to residences on the east side of Silverbell Road;
- Accommodations for new or future bus pull-outs and bus stops have been incorporated in the design of the project.
- The existing signalized intersections along the project, including El Camino Del Cerro, Sweetwater Drive, Goret Road, and Grant Road will be reconstructed with additional turn lanes and/or increased vehicle storage and upgraded traffic signals. The existing T-intersection at Sunset Road will require left and right-turn lanes and potentially future signalization. The extension of Sunset Road to I-10 (and eventually River Road) is currently being planned and will necessitate an additional signalized intersection on Silverbell Road. The preferred location for the connection of the Sunset Road extension with Silverbell Road is approximately 1,500 feet south of the existing Sunset Road intersection. This will create split T-intersections on Silverbell Road.
- Retaining walls will be used along the corridor to reduce impacts on the existing slopes on the west side of Silverbell Road as well as reducing right-of-way impacts and costs.
- Drainage culverts will be installed at 71 existing at-grade crossings, including nine FEMA washes. Proposed cross-drainage structures include reinforced concrete box culverts (RCBC), reinforced concrete pipe (RCP) and several short bridges. Cross-drainage structures within wildlife corridors will be sized to accommodate and facilitate wildlife movement.
- Pavement runoff will be collected with curb inlet catch basins and conveyed by short sections of storm drain to drainage outlets or to tie into the new proposed cross-drainage structures.
- Existing overhead electric lines running within Silverbell Road will need to be relocated to new poles. Other overhead communication lines will be undergrounded. Existing underground utilities, including potable water, reclaimed water, sewer, gas, and fiber optic lines will need to be relocated or adjusted, as necessary, as part of the roadway improvements.
- Landscaping within the median and shoulders will be designed to enhance the visual quality of the roadway and encourage wildlife to travel through the drainage culverts while minimizing at-grade crossing. Landscaping will utilize drought-tolerant, low water-use plants approved by the City of Tucson, Pima County, and Marana. Temporary irrigation will be provided initially and water harvesting techniques will be employed as much as possible. A Public Art Program will be established for the corridor.

Figure 1: Location Map



3.0 PROJECT AREA CHARACTERISTICS
(EXISTING CONDITIONS)

3.1 SURROUNDING TOPOGRAPHY AND TERRAIN

Silverbell Road from Ina Road to Grant Road is located between the Santa Cruz River basin and the base of the Tucson Mountain foothills. To the east of the roadway the terrain is flat; to the west the terrain is primarily rolling hills. The roadway winds along the edge of the foothills following the existing terrain and frequently dropping down at drainage crossings.

3.2 EXISTING ROADWAY

Silverbell Road is classified as an urban principal arterial. It's cross section generally consists of two lanes with left and right-turn lanes provided at some driveways and side streets. Lane width varies from 11 to 12 feet. Sidewalks are provided near the Grant Road intersection. Six-foot paved shoulders exist between Goret Road and Grant Road. Paved shoulders vary in width from 4 to 6 feet from Goret Road to Sunset Road. North of Sunset Road and nearly to Ina Road, paved shoulders are one foot wide. A short frontage road runs along the east side of Silverbell Road from just north of Belmont Road to south of Silver Ridge Lane. Seventeen residences utilize this frontage road to access Silverbell Road. There are 5 signalized intersections and 93 unsignalized driveways and sides streets along this section of the corridor. The current speed limit on Silverbell Road is 45 mph from Ina Road to El Camino del Cerro, 45 mph daytime/40 mph nighttime between El Camino del Cerro and Grant Road, and 40 mph south of Grant Road.

The vertical roadway alignment generally follows the existing rolling terrain with many at-grade drainage crossings. Based on a review of the AASHTO controlling design criteria for Silverbell Road, there are four horizontal curves and 20 vertical curves that do not meet sight distance requirements. The AASHTO design review is included in the traffic report.

As shown in Figure 2, sections of Silverbell Road are within three jurisdictions. The southern section from Grant Road to nearly Sunset Road (4.4 miles) is within the City of Tucson, 2 miles are within Pima County, and 1.2 miles are in the Town of Marana. Approximately 2 miles of the roadway, generally from Sunset Road to north of Orange Grove Road, are designated as a scenic route by Pima County. The entire length of Silverbell Road from Grant Road to Ina Road is defined as environmentally sensitive by the Sonoran Desert Conservation Plan based on cultural resources and wildlife habitat.

3.3 DRAINAGE

The upstream watershed is located within the Tucson Mountains in which runoff flows southwest to northeast into the adjacent Santa Cruz River. Seventy-five drainage basins contribute to 73 drainage crossings within the project limits. Culverts of different sizes and capacities exist at 13 crossings. The majority of runoff crosses the existing roadway in dip sections, several reinforced with cutoff walls at the downstream edge of the road. In addition, a number of constructed channels and berms located along the roadway convey flows to drainage crossings. Flooding and road closures during modest rainfall events are common.

Ten of the wash crossings carry 100-year peak discharges in excess of 1,000 cfs. Nine of the crossings are FEMA delineated Zone A or AE floodplains. Refer to Table 1. Silverbell Road itself is located within portions of the 100-year Zone AE floodplain of the Santa Cruz River and at several locations Silverbell Road is located on the fringe or within the 100-year floodway.

Figure 2: Silverbell Road Jurisdictional Limits

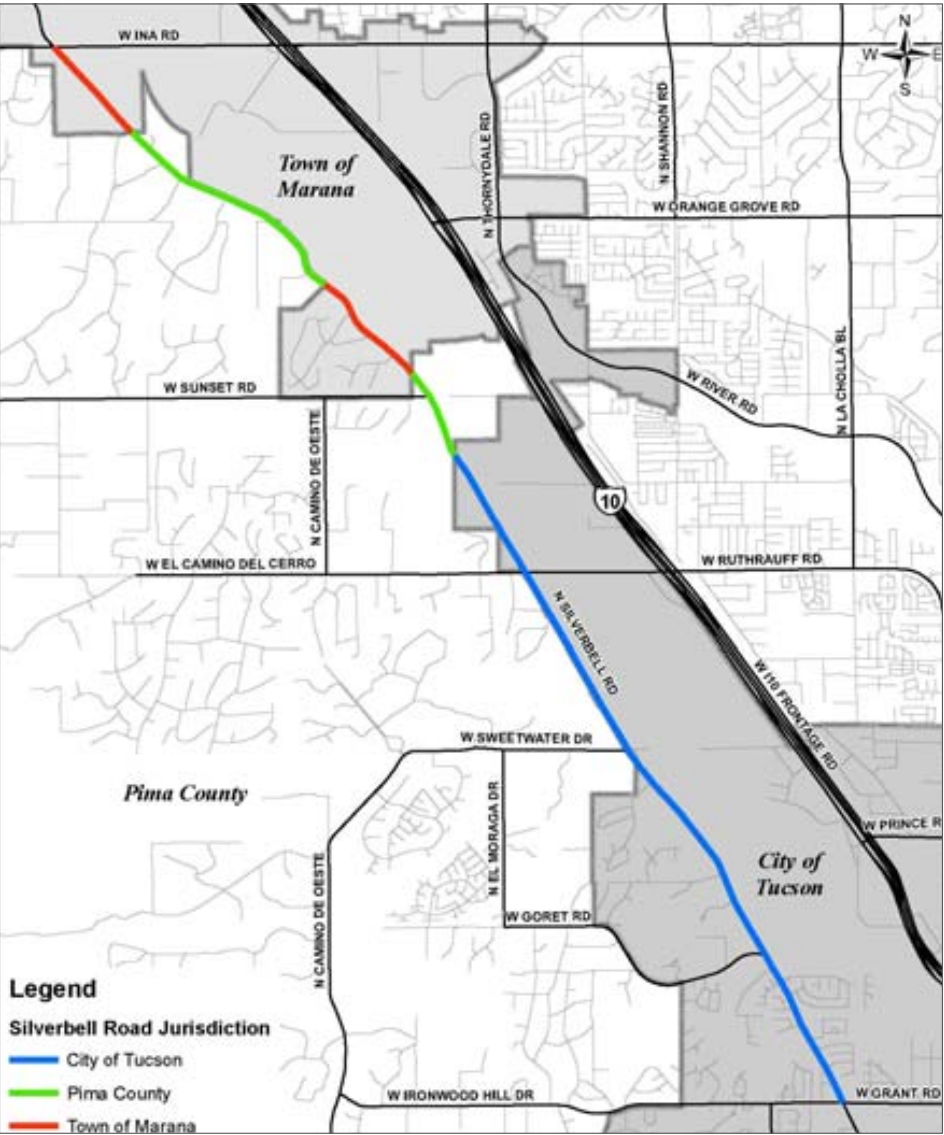


Table 1: Major Washes

POC	Name	Q100, cfs	FEMA	Culvert
100	Greasewood/ W. Speedway Wash	2900	Y	5-12'x8' CBC
104	Painted Hills Wash	1518	Y	6-10'x6' CBC
109	Camino de Oeste Wash	6471	Y	-
116	Trails End Wash	2546	Y	-
119	Roger Wash	5563	Y	-
122	Sweetwater Wash	5622	Y	-
126	Del Cerro Wash	1182	Y	-
211	Idle Hour Wash	5515	Y	-
231	Unnamed Wash	1229	N	23'x9' Arched CMP
233	Unnamed Wash	1594	Y	-

3.4 SIGNALIZATION AND LIGHTING

Five intersections are signalized – Ina Road, El Camino del Cerro, Sweetwater Drive, Goret Road, and Grant Road. There is no continuous roadway lighting along this section of Silverbell Road, although street lighting exists south of Grant Road. There are existing dusk-to-dawn luminaires located at several intersections.

3.5 UTILITIES

Subsurface utility mapping was conducted to horizontally locate existing underground utilities along Sliverbell Road. The existing 42-inch and 24-inch water lines were potholed at each drainage crossing to verify elevation. None of the existing utilities within the corridor are known to have prior rights.

Electric (Tucson Electric Power):

- Overhead distribution (46 kV and 14 kV) lines located on wooden and several steel poles run primarily along west side of Silverbell Road from Abington Road on the north to Grant Road.
- Several underground runs of distribution lines (14 KV) serve adjacent residential and commercial developments.
- A TEP substation located on the southeast corner of the Sweetwater Drive intersection is planned for removal.

Communications:

- Qwest facilities include overhead telephone lines attached to the TEP poles, underground telephone lines, and underground fiber optic cable running the length of Silverbell Road.

- Cable television (COX and Comcast) are attached to the TEP poles.
- City of Tucson fiber communications cable is attached to the TEP poles from Grant Road to Sweetwater Drive.

Gas (Southwest Gas):

- 2” and 4” gas lines run parallel to Silverbell Road on the east side and cross the roadway at side streets.

Reclaimed Water (City Of Tucson):

- A 24” pipe runs along Silverbell Road from Ina Road to El Camino Del Cerro.

Potable Water (City Of Tucson):

- A 12”CA pipe runs from Ina Road to Orange Grove Road and from El Camino del Cerro to Grant road. A 16” CA pipe ties into the 12” CA line and runs east on El Camino Del Cerro.
- A 42” concrete cylinder (CC) pipe runs along Silverbell Road from Orange Grove Road to Grant Road and then runs west on Grant Road.
- 6”, 8”, and 12” laterals tap into the 12” and 42” lines at side streets.
- A short section of 6”DI pipe runs along the west side of Silverbell Road south of Sunset Road for approximately one mile.
- A Tucson Water well is located on the east side of the existing roadway just south of the Orange Grove Road alignment.

Sewer (Pima County):

- Existing sewer facilities include several relatively short runs, including 10” lines from Sweetwater Drive to Avenida Albor and from Prichett Place to Silver Vista Place, an 8” line from Silver Mosaic Drive to Grant Road, and a force main from Avenida Albor to the Silverbell golf course. 8” and 10” sewer lines run east and west to the side streets.

3.6 ENVIRONMENT

Detailed information regarding existing environmental conditions within the corridor, potential impacts associated with the widening of Silverbell Road, environmental permitting requirements, and possible mitigation measures are included in two environmental clearance documents prepared for this project. An Environmental Screening Memorandum, following the requirements of the Pima County Roadway Design Guidelines was prepared for the northern section, Ina Road to El Camino del Cerro. An Environmental Design and Mitigation Report (EDMR) was prepared for the southern section (El Camino del Cerro to Grant Road) per City of Tucson guidelines. Environmental conditions within the corridor are summarized here.

Vegetation and Wildlife: The project is located within the Arizona Upland subdivision of the Sonoran desert scrub biotic community. Additional vegetation communities include xeroriparian along the washes and disturbed upland primarily along the existing road. Vegetative cover within the project area was estimated to range from 1 percent int the disturbed shoulder areas to 50 percent, The following species occurring within the project area are protected under the Arizona Native Plant Act: velvet mesquite, foothill and blue palo verde, whitethorn and catclaw acacia, ocotillo, fishhook barrel cactus, saguaro, and various species of cholla. No federally recognized threatened or endangered plant species were identified within the project area

The project’s proximity to the Santa Cruz River, and its position between the Tortolita, Santa Catalina and Tucson Mountains and Saguaro National Park provides critical travel and forage habitat for a variety of wildlife, including bobcat, javelina, kit fox, mule deer, Sonoran desert tortoise, cave myotis , and pocketed free-tailed bat. The project area is located between two wildlife linkages: Linkage 80 (Saguaro-Tortolita), and Linkage 87 (Tucson Mountains-San Xavier, San Robles Pass). The project area was reviewed for special status species protected under the Endangered Species Act, state protected species managed by the Arizona Game and Fish Department; and the species recognized in the Pima County Multi-Species Conservation Plan.

Wildlife Crossings: Wildlife crossing studies (10,11) of both the north and south sections of the project corridor were conducted to develop a list of species that have the potential to be impacted by this roadway widening project, characterize existing crossing locations, and identify potential opportunities to both mitigate the impacts of the roadway project and potentially enhance wildlife migration through the corridor. Five priority wildlife movement corridors were identified and are shown in Figure 3.

- Sahuaro National Park West to Santa Cruz River - ½ mile wide corridor north of Abington Road
- Idle Hour Wash – ¼ mile wide corridor
- Sunset Road – ½ mile wide corridor
- Tres Rios – ½ mile wide corridor located at the Christopher Columbus Park
- Wastewater Treatment Plant – ½ mile wide corridor located north of Sweetwater Drive

The bobcat, javelina, coyote, kit fox, mule deer, Sonoran desert tortoise, cave myotis, and pocketed free-tailed bat all have the potential to travel and forage throughout this area. For the linkage analysis, the bobcat was selected as the target species. Bobcats are less sensitive to fragmentation and have smaller dispersal distances and home ranges than mountain lions. Consequently, bobcats are valuable indicators of connectivity in developing landscapes, which is typical of the landscape surrounding this stretch of Silverbell Road. While few studies have looked at the requirements needed to mitigate the negative effects of roadways for small mammals, including lizards and snakes, potential mitigation measures were addressed in the Silverbell Road studies.

Cultural Resources: Silverbell Road parallels the Santa Cruz River, an area rich in cultural resources. Human occupation in the region spans from the Paleoindian period, which began approximately 12,000 years ago (9500–8000 BC) through the Historic period (1700–1950) to the present. The Hohokam culture developed and thrived in this area. A total of eight parcels were identified as having potentially historic buildings. The buildings have not been evaluated for National Register eligibility. The existing arched culvert located north of Abington Road may qualify as a historic structure.

A Class I literature review and a Class III survey were conducted to identify archaeological resources within the Silverbell Road project area. Thirty-nine (39) archaeological sites were recorded in the survey: fourteen sites are newly recorded; 25 previously recorded sites have been updated; and 18 of the updated sites have newly expanded boundaries and/or additional features. Nineteen of the 39 sites are prehistoric, 17 sites date to the historic period, and three sites are multi-component sites that contain both prehistoric and historical resources.

The project area overlaps an area designated in the Pima County Sonoran Desert Conservation Plan as the River Confluence Priority Archaeological Site Complex. The cultural survey revealed a nearly uninterrupted deposit of cultural resources within the Silverbell Road project area.

Hazardous Materials: A Preliminary Initial Site Assessment (PISA) was conducted in the project area under ADOT Environmental Determination Guidelines. The assessment identified two areas of potential concern. The Silverbell Jail Annex Landfill and associated groundwater contamination plume is located in the vicinity of Sweetwater Drive and is being monitored. The Shannon Road/El Camino del Cerro Water Quality Fund Site is located east of the Santa Cruz River and features a plume of volatile organic compounds that is being monitored. Since this site is located east of the Santa Cruz River, it is not considered a hazard to the Silverbell project.

Visual and Aesthetic Resources: The most striking visual feature of the roadway that remains consistent along the entire study area is the distinct difference in the visual experience between the eastern and western sides of the roadway. In general the eastern side of the road is flat and open with sweeping vistas of the Tucson basin and mountain ranges to the north, east and south. The west/southwest side of the road is more varied visually as the slopes open and close to reveal views to the Tucson Mountains. The presence of high voltage electrical power lines, industrial activities, I-10, and other disturbances in the mid-ground reduce the scenic quality of mountain views significantly. At certain points along the roadway foreground vegetation and hills to the west effectively screen undesirable mid-ground views and improve the visual quality. While the plant communities along the corridor cannot be described as pristine, the presence of native vegetation is very consistent throughout the study area especially on the west/southwest side of the roadway. As with the topography the distribution and character of vegetation seems to be divided at the roadway. The vegetation on the east/northeast side of the roadway is much more fragmented by parks, development, industry and the Santa Cruz River. The

vegetation on the west/southwest side of the roadway is much less disturbed with large patches of intact plant communities especially along drainages. The vegetation along the roadway changes in density and species composition at drainages and natural low areas.

The southern section of the project has a definite suburban feel with residential subdivisions on both sides of the roadway interspersed with some commercial development. The northern section of the corridor can be described as developed with a rural character.

3.7 LAND USE

For much of this 8-mile stretch of Silverbell Road, the zoning along the west side of the roadway is, by in large, lower density residential. South of Goret Road and just south of Ina Road, residential density levels are higher. Between Goret Road and Sweetwater Drive, much of the land along the west side is City of Tucosn owned and is zoned as open space. Along the east side of Silverbell Road, the majority of the land between El Camino del Cerro and Goret Road is City of Tucson owned and is designated for recreational use. The east side property between El Camino del Cerro and Ina Road is primarily zoned industrial with some commercial south of Ina Road and a sizeable commercial zone between Sunset Road and El Camino Del Cerro.

Planned land use within the corridor is generally consistent with the current zoning. Proposed development within the corridor includes several commercial and residential uses south of Goret Road; a residential subdivision planned by the Estes Co. on the east side between Goret Road and the wastewater treatment plant has been approved by the City; City Parks and Recreation has developed a master plan for the expansion of Christopher Columbus Park to the north past El Camino del Cerro. Several ball fields that are part of the park master plan have recently been constructed. In addition, Pima County has taken the lead on the initial planning for the reclamation of the Santa Cruz River from essentially Sweetwater Drive to Orange Grove Road between Silverbell Road and I-10. In addition to improved flood control, the intent of this long term project is to replace the current sand and gravel operations within this stretch of the river with primarily recreational uses.

Figure 3: Priority Wildlife Crossing Corridors



4.0 TRAFFIC AND ACCIDENT ANALYSIS

The traffic study prepared for Silverbell Road evaluated existing and future conditions and identified needed multi-modal capacity and safety improvements within the corridor. Key information, results, and recommendations contained in the traffic report are summarized here.

4.1 EXISTING TRAFFIC CONDITIONS
Traffic Volumes

Existing daily traffic volumes are presented in Figure 4. Traffic flow on Silverbell Road is heavily directional during peak traffic periods; southbound in the morning and northbound in the evening. Currently, larger trucks comprise approximately 5% of traffic, with less than 1% being tractor-trailer combinations.

Crash History

Crash data summaries for the intersections and roadway segments along Silverbell Road are provided in Figure 5. For the period evaluated, crash rates at the Ina Road, Sunset Road, Sweetwater Drive, and Goret Road intersections were well below the average crash rate of 0.99 for signalized intersections in Pima County. At El Camino del Cerro, with a crash rate of 1.33, rear end and turning crashes were the most prevalent. Adding left-turn phasing on Silverbell Road at this intersection was identified as a potential measure to reduce turning crashes. At Grant Road, turning crashes were the most frequent. Improved access control on Grant Road just east and west of Silverbell would help to reduce driveway related turning crashes. The crash rate on each roadway segment, with the exception of the segment from Goret Road to Grant Road (1.91), was well below the average crash rate of 1.31 for roadway segments in Pima County. On the Goret Road to Grant Road segment, a large proportion of the crashes occurred in the northbound lane drop area that overlaps with the shopping center driveways. A fatality occurred at Neosha Drive on the Sweetwater Drive to Goret Road segment.

Alternative Modes

Transit: Weekday and weekend SunTran service is provided on Silverbell Road between St. Mary’s Road and Goret Road (Route 21). Five bus stops are located between Grant Road and Goret Road. SunTran has no current plans to expand fixed route transit service along Silverbell Road or provide express route service. There are currently seven school bus stops between Grant Road and Ina Road.

Bicycles: Silverbell Road is a favorite of bicycle enthusiasts. The sections from Grant Road to Sunset Road and from Abington Road to Ina Road are designated as a bike route, with 4-6 ft wide striped shoulders. The remaining sections have no paved shoulder and are not designated for bicycle use.

Pedestrians: Pedestrian facilities within the Silverbell Road corridor are essentially limited to graded and, in some segments, ungraded shoulders. The lack of suitable walking areas contributes to the low pedestrian demand.

Trails: Unimproved equestrian/hiking trails are designated along a section of Silverbell Road itself, in the Santa Cruz River, and in several larger washes crossing the roadway. Equestrian activity in the area primarily occurs in the Santa Cruz River.

Access: Existing access to Silverbell Road between Grant Road and Ina Road includes 5 signalized intersections, 26 residential streets, 53 residential driveways, and 14 commercial driveways

4.2 FUTURE CONDITIONS

Future (2040) traffic projections for Silverbell Road were developed using the Pima Association of Government’s regional traffic demand model. The 2040 model includes all of the RTA roadway improvements, as well as other planned improvements included in the regional transportation plan (RTP), such as widening I-10. The projections used to determine roadway and intersection capacity requirements are presented in Table 2.

Table 2: 2040 Traffic Projections

Roadway	Segment	Daily Traffic Volume (vpd)	
		Existing	2040
Ina Road	West	10,000	12,500
	East	16,500	17,300
Sunset Road	West	1,400	5,600
	East	N/A	17,000
El Camino Del Cerro	West	7,700	8,000
	East	16,800	18,100
Sweetwater Drive	West	5,000	12,300
	East	N/A	600
Goret Road	West	2,000	6,700
	East	N/A	1,400
Ironwood Hills Drive/Grant Road	West	20,300	32,000
	East	33,300	36,200
Silverbell Road	North of Ina	9,800	24,100
	Ina to Sunset	9,300	22,200
	Sunset to El Camino del Cerro	10,100	22,900
	El Camino Del Cerro to Sweetwater	15,600	29,500
	Sweetwater to Goret	11,500	21,700
	Goret to Grant	16,800	23,900
	South of Grant	21,200	23,800

4.3 RECOMMENDED IMPROVEMENTS
Roadway Capacity

Roadway capacity requirements to serve the future projected demand on Silverbell Road was determined based on the number of through lanes needed to provide Level of Service (LOS) D or better traffic flow. At LOS D, a 3-lane roadway can carry some 17,000 vpd and a 4-lane divided roadway can carry 34,400 vpd. Based on the 2040 traffic projections, a 4-lane roadway is needed on Silverbell Road between Ina Road and Grant Road.

The RTA plan identifies a 3-lane section from Ina Road to Sunset Road. A 4-lane cross section is preferred for several reasons.

- The 2040 traffic projections on the section between Sunset Road and Ina Road are 22,200 vpd. This demand level would result in LOS E or F on a 3-lane facility.
- The intersection capacity analysis indicated that two through lanes in each direction will be required at the Ina Road and Sunset Road intersections to provide adequate level of service.
- A 3-lane cross section will require deceleration lanes for right-turn traffic at side streets and driveways considering the high speed design on Silverbell Road. Frequent transitions from a 3-lane roadway to a 3-lane plus deceleration lanes or a 4-lane cross section at signalized intersections would result in a non-uniform roadway and would impact traffic flow.
- The additional capacity provided by 4-lane cross section will allow for easier and safer access onto Silverbell Road from side streets and driveways.

Intersection Capacity

Required lane configurations at signalized intersections were determined based on the capacity needed to provide LOS D or better operation. Recommended intersection lane configurations are provided in the preliminary plans included in the appendices.

Traffic Control

A new signal will be required at Sunset Road when it is extended from Silverbell Road to I-10. No additional new traffic signals are warranted based on existing traffic conditions, nor are any other signals anticipated based on future development within the corridor. A warrant study for a HAWK pedestrian signal at Introspect Drive, where the Luz Academy is located, should be performed as part of final design.

Figure 4: Existing Daily Traffic Volumes



Figure 5: Crash Data Summary

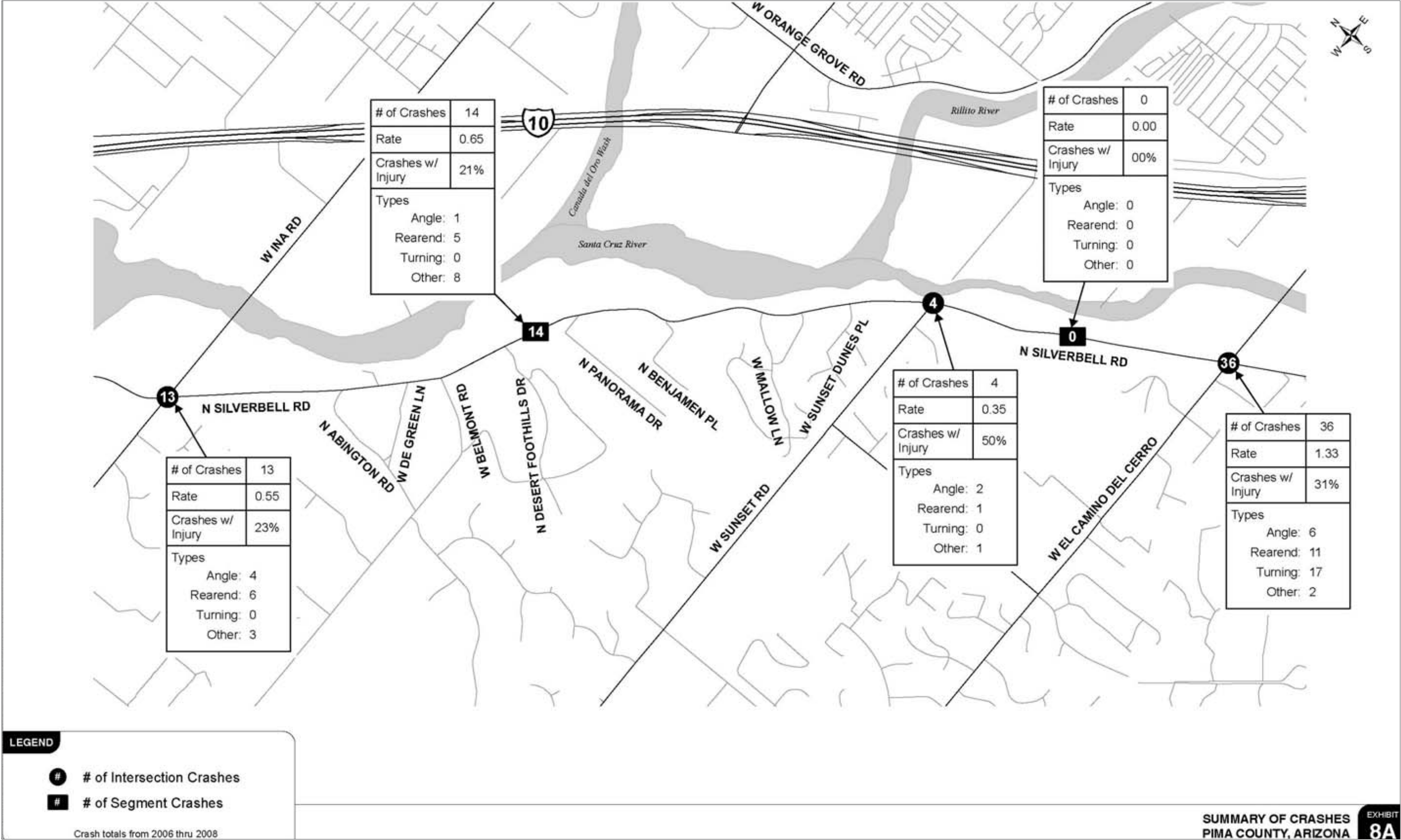
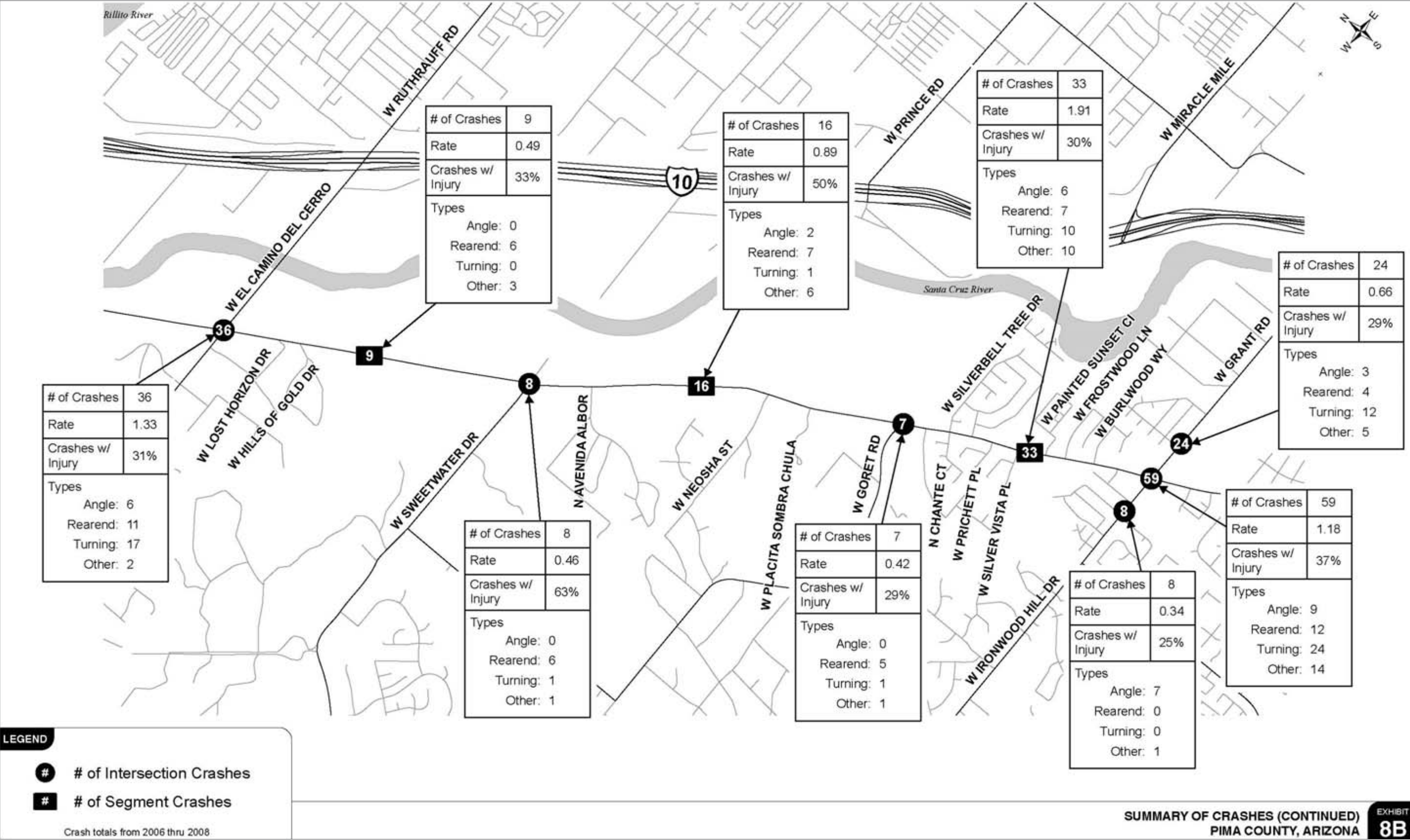


Figure 5 Continued: Crash Data Summary



Access Control

AASHTO considers a divided roadway with a raised median the preferred cross section for arterials with a design speed of 45 mph or greater, particularly with high volumes of through traffic. Considering the design speed for Silverbell Road (50 mph), future traffic demand, and the functionality of the roadway as a principal arterial, a 20-ft wide raised median is appropriate to provide necessary access control to improve motorist safety.

The recommended access plan is intended to appropriately address the access requirements of existing and future developments while providing the level of access control required on a principal arterial to ensure a high level of traffic operations and safety. The plan includes median openings at high volume driveways at commercial properties and residential side streets. Median openings at individual residential driveways will not be provided, however frequent median openings will allow for convenient U-turn opportunities. Consolidation of some single residence driveways is recommended at several locations.

Right-turn deceleration lanes will be provided at all signalized intersections and are recommended at two unsignalized locations – Christopher Columbus Park and along the east side of Silverbell Road at the Belmont Road/De Green Lane area where there are 16 closely spaced residential driveways.

Transit

Bus pullouts are recommended on the north and south legs of the Grant Road intersection. During final design, coordinate with SunTran to determine the location of bus pads and structures, as well as pullouts. At a minimum, sufficient right-of-way should be obtained at existing signalized intersections and at Sunset Road to accommodate the future installation of pullouts.

Bicycles and Pedestrians

The Regional Transportation Plan designates Silverbell Road as a priority corridor for bicycles and pedestrians. The recommended roadway cross section will include bicycle lanes on both sides of the roadway. The bicycle lane design will provide a 6-foot wide asphalt surface with curb from Grant Road to Sunset Road and curb with a 1-foot gutter from Sunset Road to Ina Road.

A continuous, ADA compliant 10-foot wide asphalt pedestrian/bicycle path will be provided along the east side of the roadway. This path will provide connectivity to the planned Santa Cruz River Parkway/De Anza Trail, as well as existing and future recreational facilities between Silverbell Road and the Santa Cruz River. Concrete sidewalk will be provided along the west side of Silverbell Road from Goret Road to Grant Road where high density residential developments exist or are planned. Crosswalks will be provided at signalized intersections.

Equestrians

Discussions with horse owners within the corridor indicate that provision of safe crossings to provide access to the Santa Cruz River will be important. Crossings will be provided at signalized intersections. In areas where equestrians will need to travel along Silverbell Road to reach a signalized crossing, the shoulders will be designed to provide an appropriate path.

Lighting and Communications

Based on the current City of Tucson roadway lighting improvement program, continuous lighting is planned for the section from Sunset Road to Grant Road. Considering that the need for continuous lighting is primarily based on deficient roadway geometry which will be corrected with the roadway improvements and since one of the project objectives is to maintain the rural feel of the Silverbell Road corridor, roadway lighting from Goret Road to Grant Road only is recommended. This is consistent with the section of Silverbell Road to the south of Grant Road. Lighting at high volume unsignalized intersections (Belmont Road) and key destinations (Christopher Columbus Park) should be considered.

The existing City of Tucson (COT) fiber optic cable, currently located on TEP poles will need to be relocated by COT Communications. The roadway improvements will need to accommodate the installation of conduit and pull boxes for extension of the City of Tucson and Town of Marana fiber optic infrastructure.

5.0 DESIGN STANDARDS AND CRITERIA

The Silverbell Road – Ina Road to Grant Road project has been designed in accordance with the design standards and guidelines adopted by the City of Tucson, Pima County, and the Town of Marana. The design of the improvements to Silverbell Road will follow standards and guidelines provided in the following publications and documents.

American Association of State Highway and Transportation Officials (AASHTO)

- A Policy on Geometric Design of Highways and Streets, Fifth Edition, 2004
- Roadside Design Guide, Third Edition, 2002, with March 2006 update
- Guide for the Development of Bicycle Facilities, 3rd Edition, 1999
- Guide for the Planning, Design and Operation of Pedestrian Facilities, 1st Edition, 2004

Federal Highway Administration (FHWA)

- Manual on Uniform Traffic Control Devices (MUTCD), 2003 Edition, with December 2007 update
- Americans with Disabilities Act Standards for Accessible Design, July 1994 revision
- Hydraulic Design of Energy Dissipators for Culverts and Channels, Third Edition, 2006
- Hydraulic Design of Highway Culverts, 1985
- Urban Drainage Design Manual, HEC-22, Second Edition, 2001
- Evaluating Scour at Bridges, HEC-18, Fourth Edition, 2001

Pima County Department of Transportation (PCDOT)

- Roadway Design Manual (RDM), Third Edition, 2010 (Including Environmentally Sensitive Roadway Design Guidelines)
- Subdivision and Development Street Standards, April 2005
- Transit Guidelines for Roadway Design and Construction, January 2009
- Traffic Signal Design Manual, Second Edition, January 2008
- Drainage and Channel Design Standards for Local Drainage, 1984
- Street Lighting and ITS Conduit Design Manual, August 2006
- Hydrology Manual for Engineering Design and Flood Plain Management within Pima County, 1979
- Floodplain and Erosion Hazard Management Ordinance
- Landscape and Irrigation Guidelines, 2008

City of Tucson Department of Transportation

- Traffic Signal Design Manual, First Edition, May 2003
- Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona, July 1998

- Transportation Access Management Guidelines for the City of Tucson, Arizona, March 2003
- Roadway Development Policies, April 1998

Town of Marana

- Subdivision Street Standards Manual, March 2004
- Traffic Signal Design Standards, September 2005

Pima County and City of Tucson (PC/COT)

- Standard Details for Public Improvements, 2003
- Standard Specifications for Public Improvements, 2003
- Pavement Marking Design Manual, Second Edition, August 2008
- Traffic Signing Design Manual, 2002

Arizona Department of Transportation (ADOT)

- Construction Standard Drawings (C-Series), May 2007, with November 2007 revisions
- Structures Section Standard Drawings (B-Series), June 1994 and current revisions

5.1 ROADWAY GEOMETRIC DESIGN CRITERIA

Table 3 provides a tabular inventory of the criteria integrated into the design of Silverbell Road, the values generally adopted in the design for each criterion, and the source of the values used. Further detailed discussion design criteria selection is provided in Section 6.0.

5.2 DRAINAGE DESIGN

The drainage design for the Silverbell Road project follows the criteria provided in the City of Tucson's Standards Manual for Drainage Design and Floodplain Management and the Pima County Roadway Design Manual. Refer to the project drainage design reports (3,4) for detailed information regarding drainage analysis and design criteria.

Hydrology

Two methodologies were used to perform hydraulic analysis:

- Q100 < 500 cfs: Weir flow analysis at 2 to 4 cross sections within each drainage crossing
- Q100 > 500 cfs: Detailed modeling of drainage way using HEC-RAS in conjunction with HEC-GeoRAS. Pima County Regional Flood Control District developed Q100 discharges and hydraulic models for eight of the nine FEMA washes crossing Silverbell Road

Cross Drainage Criteria

The criteria used for the design of cross drainage improvements are as follows:

- The depth of flow or ponding within the roadway at culvert crossings shall not exceed one (1) foot in the 100-yr storm (Q100)
- Runoff from the 100-yr storm may not overflow into adjacent basins

- Minimum drainage pipe diameter is 24 in
- Minimum box culvert height shall be 4 feet; 5 feet preferred
- Culverts and bridges shall be designed for no rise in headwater elevation in the 100-yr storm, except at City- owned property where a 1-ft rise is allowed where drainage easements or right-of-way will accommodate the increase

Design Channel Criteria

- Roadside channels and associated culverts will be designed for the 10-yr storm
- Roadside channels and associated culverts conveying off-site flow shall be designed for the 100-yr storm.

Pavement Drainage Design

- In non-depressed areas of the roadway, storm drain will convey the 10-year storm
- In depressed areas of the roadway, storm drain will convey the 100-year storm
- Catch basin capture – 10-yr storm
 - a. In roadway sag: 100% capture required
 - b. Upstream of public street intersections: 100% capture desirable
 - c. On roadway grade: minimum of 75% capture
- Efficiency
 - a. Minimum of one lane of traffic free from runoff during the 10-yr storm
 - b. Pavement runoff flow contained within roadway curbs during the 100-yr storm

5.3 ACCESS

Access between Silverbell Road and adjacent properties will follow, to the extent possible, the guidelines provided in the Pima County RDM and the City of Tucson Transportation Access Guidelines. On a principal or major arterial with a speed limit of 45 mph, these guidelines include:

- Signal spacing – ½ mile minimum
- Unsignalized median openings – 660 ft minimum
- Distance between a driveway and a side street – 150 ft minimum
- Distance between driveways – 100 ft minimum
- Distance between a driveway and median opening – 100 ft minimum

The desirable maximum distance between unsignalized median openings is ¼ mile to provide convenient U-turn opportunities.

Table 3: Design Criteria

Description	Desirable Criteria Value	Criteria Source
Design Year	2040 (Base year 2009)	-
Pavement Structural Section	20 year design life	RDM Section 3.13
Roadway Classification	Urban Principal Arterial	Major Streets and Routes Map
Design Speed (Recommended Posted Speed)		
Silverbell Road (See Note 1)	Ina Road to Goret Road: 50 mph (45 mph) Goret Road to Grant Road: 45 mph (40 mph)	
Sunset Road	40 mph (35 mph)	
El Camino Del Cerro	40 mph (40 mph)	
Sweetwater Drive	45 mph (40 mph)	
Goret Road	East of Silverbell Road: 30 mph (25 mph) West of Silverbell Road: 40 mph (35 mph)	
Grant Road	45 mph (40 mph)	
Local Streets	30 mph (25 mph) (See Note 2)	
Horizontal Alignment		
Control Location	Centerline of Roadway	
Stopping Sight Distance	425' (50 mph design speed) 360' (45 mph design speed)	AASHTO 2004 Policy, Exhibit 3-1, p 112
Min. Curve Radius (without su- perelevation)	1389' (50 mph design speed) 1039' (45 mph design speed)	AASHTO 2004 Policy, Eq 3-10, p 146 (See Note 3)
Min. Curve Length	500'	RDM Section 2.2
Reverse Curves	See Note 4	RDM Section 2.2
Compound Curves	(avoid if possible) 1.5:1 max	RDM Section 2.2
Maximum Delta without Curve	1 degree 8 minutes	RDM Section 2.2
Max. Superelevation	0.02 ft/ft	See Note 5
Superelevation Runoff/Tangent Runout	0.50% max. relative gradient	AASHTO 2004 Policy pp 175-184
Vertical Alignment		
Control Location for Profile	Centerline of Roadway	
Max. Gradient	7% (Rolling Terrain)	RDM Section 2.4
Min. Gradient	0.50%	RDM Section 2.4
Vertical Grade Break	4% max. (side-street int.) 0.5% max. (roadway)	RDM Section 2.4
Vertical Curve Length	Min. 3 x Design Speed	RDM Section 2.4
Minimum Vertical Clearance	16'	AASHTO 2004 Policy p 472
Cross-Sectional Elements (See Note 6)		
Lane Widths		
Through Lanes	2 lanes each direction 12' inside lane, 11' outside lane	RDM Section 2.3 (Table 2-1)
Right-Turn	12' to face of curb	RDM Section 2.3 (Table 2-1)
Left-Turn	12' to face of curb	RDM Section 2.3 (Table 2-1)
Paved Shoulder	6' to face of curb or edge of gutter (bike lane)	RDM Section 2.3 (Table 2-1)
Median	20' Raised Median	RDM Section 2.3 (Table 2-2)

Description	Desirable Criteria Value	Criteria Source
Pavement Cross-Slope	-2% (Crowned Section)	RDM Section 2.3 (Table 2-2)
Sidewalk Width	5' (6' against back of curb)	RDM Section 2.3
Multi-Use Path Width	10'	AASHTO Guide for the Development of Bicycle Facilities, p 35
Clear Zone Width	20'	AASHTO Roadside Design Guide, Table 3.1
Side Slopes		
Within Clear Zone	4:1 cut, 6:1 fill	RDM Section 2.3 (Table 2-2)
Outside Clear Zone	3:1 (cut & fill) or retaining wall	RDM Section 2.3 (Table 2-2)
Intersections		
Design Vehicle	Right & Left Turns: WB-50 Dual Left-Turn: WB-50 outside, SU-30 inside U-Turn: Passenger Car w/ Trailer	
		RDM Section 2.5
Bay Taper Rate or Length	100' Left-Turns 15:1 Right Turns	PC/COT PMDM Sheet 4-6.1 and Sheet 4-7
Min. Storage Length	110' (Posted Speed=40 mph) 150' (Posted Speed=45 mph) 35' arterial/arterial	PC/COT PMDM Sheet 4-6 (See Traffic Report)
Curb Radii	30' arterial/collector 25' arterial/driveway	RDM Section 2.5
Lane Addition	15:1 taper	PC/COT PMDM Sheet 4-7
Lane Drop	Posted Speed x Lane Width	PC/COT PMDM Sheet 4-1
Intersection Sight Distance	Driver Eye Height = 3.5' Object Vehicle Height = 3.5'	RDM Section 2.5 AASHTO 2004 pp 650-676
Skew	20 degrees maximum	RDM Section 2.5

- Maximum design speed for Environmentally Sensitive Roadway is 50 mph (Pima County RDM, Section 4.7)
- Abington Road, Kiley Court, and Gracious Court designed to lower design speeds to meet horizontal and vertical alignment constraints.
- Superelevation not used on horizontal curves from El Camino Del Cerro to Grant Road. Minimum curve radius with maximum superelevation of 0.02 ft/ft: 1042' (DS=50 mph), 794' (DS=45 mph). See AASHTO 2004 Policy, Equation 3-10, p 146.
- Permitted only when separated by 4/3 the length of the longer of the two superelevation runoff lengths.
- Superelevation only used on horizontal curves from Ina Road to El Camino Del Cerro, unless needed for side street tie-in or other constraint.
- Minimum values for roadway cross-sectional elements have been used in some cases, pursuant to the Pima County Environmentally Sensitive Roadway Design Guidelines (RDM Section 4.7)

6.0 MAJOR DESIGN FEATURES

6.1 HORIZONTAL ALIGNMENT

The proposed Silverbell Road horizontal alignment was established in collaboration with the City of Tucson, Pima County, Town of Marana and the Silverbell Road Citizen’s Task Force. The “preferred” horizontal alignment was developed through an alternative evaluation process described in Section 10.4. Primary considerations for establishing the location of the new roadway alignment were developed and prioritized in the following order:

- 1. Design meets City of Tucson, Pima County Department of Transportation, and City of Marana standards;
- 2. Avoid impacts to the Santa Cruz River floodway;
- 3. Minimize private property right-of-way impacts;
- 4. Minimize impacts to slopes on the west side of Silverbell Road;
- 5. Minimize floodplain impacts;
- 6. Minimize wash reconstruction;
- 7. Avoid archeological sites. (Note that this criteria was listed last since it is clear that it is infeasible to avoid archeological sites within the corridor.)

Ina Road to El Camino Del Cerro

The preferred horizontal alignment for this section is as follows:

- Ina Road to Abington Road – primarily follows the existing roadway centerline alignment;
- Abington Road to Belmont Road - shifted approximately 13 feet east to avoid impacts to the hills on the west side as well as to minimize property impacts;
- Belmont Road to Mallow Lane - shifted approximately 35 feet to the east to avoid private property impacts;
- Mallow Lane to Benjamin Road - significant shift to the east to reduce the existing sharp s-curves alignment with poor sight distance;
- Benjamin Road to Sunset Road – primarily follows the existing roadway centerline alignment;
- Sunset Road to El Camino Del Cerro - shifted approximately 30 -40 feet east. The proposed horizontal alignment for the north ties into the horizontal alignment for the south just north of El Camino Del Cerro.

The horizontal alignment for this section utilized a design speed of 50 mph. Even in areas where the proposed centerline follows closely to the existing roadway centerline, some variations exist in order to provide the minimum curve radii and curve lengths. For a design speed of 50 mph, the minimum horizontal curve radius is 1389 feet without superelevation (2% adverse superelevation). Using the maximum superelevation rate of 2%, the minimum horizontal curve radius is 1042 feet. The proposed horizontal alignment for Silverbell Road from Ina Road to El Camino Del Cerro is described in detail on the survey control sheets provided in the 15% plan set included in Appendix A.

The horizontal alignments for the side streets generally follow the existing roadway or right-of-way centerline alignments. The exceptions are Abington Road, Benjamin Road, and Sunset Road. These side street alignments have been modified to tie in to Silverbell Road at a lesser angle to provide better intersection sight distance. The alignments have been designed according to the design speeds specified previously in this report.

Superelevation was used on the majority of the horizontal curves in this section of Silverbell Road to maintain the existing alignment by utilizing smaller radius curves. The section of Silverbell Road between Belmont Road and Sunset Road contains several curves with intermittent short tangent sections. Providing superelevation on these curves will increase driver comfort and better meets driver expectations in a winding roadway environment. Using the minimum rate of 2% superelevation accomplishes the above objectives while still maintaining a more urban/suburban low-speed arterial characteristic.

In addition to the superelevation at horizontal curves, the west side of the Silverbell Road cross slope was modified at Abington Road and DeGreen Lane in order to facilitate the connection to the existing side street vertical profiles. The superelevation and cross slopes utilized on Silverbell Road from Ina Road to El Camino Del Cerro are shown in the superelevation diagram on the plan & profile sheets in the 15% plans.

El Camino Del Cerro to Grant Road

The horizontal alignment for this section of Silverbell Road begins approximately 1400 feet to the north of El Camino Del Cerro with a transition section to shift from the existing roadway centerline to the new proposed roadway centerline. This transition is necessary as the current implementation plan is to construct the south section of Silverbell Road well in advance of the north section.

The preferred horizontal alignment from Ina Road to El Camino Del Cerro is as follows:

El Camino Del Cerro to Sweetwater Drive – shifted approximately 35 feet to the east of the existing roadway centerline to minimize private property impacts and reduce impact on the west slopes;

Sweetwater Drive to Grant Road - closely follows the existing roadway centerline, with slight shifts of up to 10 to 15 feet to either side to minimize right-of-way and environmental impacts as well as to maintain horizontal alignment consistency.

The horizontal alignment on this section is based on a design speed of 50 mph north of Goret Road and 45 mph south of Goret Road. At a 50 mph design speed the minimum horizontal curve radius that may be used without applying superelevation is 1,389 feet. At a 45 mph design speed the minimum horizontal curve radius that may be used without applying superelevation is 1,039 feet. The horizontal alignment is described in detail on the survey control sheets included in the 30% plans provided in Appendix B.

The horizontal alignments on the side streets generally follow the existing roadway or right-of-way centerline alignments. The exceptions are at El Camino Del Cerro, Lost Horizon Drive, Neosha Street, Goret Road, and Silver Sun Drive. These side street alignments have been modified to accommodate intersection lane additions, to provide better intersection sight distance or to improve access management. The alignments have been designed according to the design speeds specified previously in this report.

There are two horizontal curves located along the Silverbell Road transition section north of El Camino Del Cerro and 13 horizontal curves located along the mainline construction centerline. Only one horizontal curve at Neosha Street is superelevated at 2%.

There are six segments within this section, in addition to the Neosha Street curve, where cross slopes are modified to facilitate the connection to side street vertical profiles. These cross slope modifications occur at El Camino Del Cerro, Sweetwater Road, Goret Road, Introspect Drive, Silver Vista Place, and Grant Road. The superelevation and cross slopes utilized on Silverbell Road from El Camino Del Cerro to Grant Road is shown in the superelevation diagram on the plan & profile sheets in the 30% plans.

6.2 VERTICAL ALIGNMENT

The primary objectives when developing the proposed vertical alignment for Silverbell Road were to eliminate at-grade wash crossings and to elevate Silverbell Road out of the FEMA 100-year floodplain. At-grade wash crossings were eliminated by elevating Silverbell Road where necessary for cross drain structures. Where the floodplain required the profile to be raised, the subgrade of the roadway must be one foot above the flood water elevation.

The proposed design results in a consistent vertical alignment for Silverbell Road as the roadway will no longer be constrained to the existing topography and drainage crossings. Meeting the design objectives presented several challenges in the design process, particularly with the trade-offs of providing adequate clearance over cross drain structures and minimizing the amount of fill needed to elevate the roadway. Both of these aspects were given close, careful attention during the design process and opportunities to minimize the profile elevation was evaluated.

Ina Road to El Camino Del Cerro

The vertical profile for this section of Silverbell Road is shown the 15% plan set provided in Appendix A.

The profile was designed using a design speed of 50 mph and meets AASHTO and Pima County roadway design criteria. At a 50 mph design speed the required stopping sight distance is 425 feet, and the minimum K-value is 84 for crest curves and 96 for sag curves.

To accommodate drainage culverts and address the floodplain, the proposed roadway profile is between 3’ and 7’ above the existing roadway elevation

in many areas. The higher profile will result in significant roadway fill slopes throughout this section of Silverbell Road.

El Camino Del Cerro to Grant Road

The roadway profile for the section from El Camino Del Cerro to Grant Road is described in detail in the 30% plans provided in Appendix B.

The profile is designed using a design speed of 50 mph north of Goret Road and 45 mph south of Goret Road, and meets AASHTO and Pima County roadway design criteria. At 50 mph the required stopping sight distance is 425 feet and K-values for crest and sag curves is 84 and 96, respectively. At 45 mph the required stopping sight distance is 360 feet and K-values for crest and sag curves is 61 and 79, respectively.

This section of Silverbell Road is not significantly impacted by the Santa Cruz River floodplain. Rather, existing adjacent residential and commercial properties was the primary factor in determining the profile. From Goret Road to Grant Road it was particularly important to match the existing Silverbell Road profile in order to minimize the impacts to side streets and driveways. As shown in the plans, the roadway still must be raised in many areas to accommodate the needed cross-drainage structures.

6.3 RIGHT-OF-WAY

The existing Silverbell Road right-of-way ranges from 60 feet to 150 feet. The proposed right-of-way width is typically 150 feet (75 feet each side of centerline). Additional new right-of-way as well as slope and drainage easements are required for the proposed improvements. New right-of-way, slope and drainage easement requirements are summarized in Table 4. Detailed information on right-of-way requirements are provided on the preliminary plans provided in the appendices.

6.4 CROSS DRAINAGE

The most prominent drainage feature impacting the existing and future roadway is the Santa Cruz River. South of El Camino del Cerro, there are two minor encroachments of the roadway on the Santa Cruz River floodplain, neither of which should cause a significant increase in the base flood elevation. North of El Camino del Cerro, the proposed roadway encroaches on the floodplain for approximately 40% of its length. It encroaches on the floodway at two locations. The roadway profile will be raised to provide all weather access on Silverbell Road. All weather access requires that the depth of ponding in the road not exceed 1 ft in the 100-yr storm. Pima County Flood Control District is revising the Santa Cruz River hydraulic modeling concurrently with this project. When the remapping of the Santa Cruz River is finalized, the proposed roadway encroachments will be added to the model to assess whether the roadway improvements cause an increase in the water surface elevations and in the increase at each location is within acceptable tolerances.

Runoff from the Tucson Mountains crosses the project at some 73 locations. 100-yr peak cross drainage flows will be conveyed under Silverbell Road. The proposed cross drainage improvements are summarized in Table 5. Pipe culverts are reinforced concrete pipe in accordance with City of Tucson requirements.

Table 4: Right-of-Way Requirements

Type of Property Needs	# of Properties	Total Acres
Ina Road to El Camino del Cerro		
New Right-of-Way		
Private Owners	34	22.1
Public Agencies	4	10.66
Slope Easements		
Private Owners	15	0.63
Public Agencies	0	0
Drainage Easements		
Private Owners	45	4.09
Public Agencies	4	0.76
Temporary Construction Easements		
Private Owners	18	0.63
Public Agencies	0	0
TOTAL RIGHT-OF-WAY NEEDS	120	38.87
El Camino del Cerro to Grant Road		
New Right-of-Way		
Private Owners	10	1.81
Public Agencies	8	6.08
Slope Easements		
Private Owners	14	0.59
Public Agencies	3	0.12
Drainage Easements		
Private Owners	28	4.83
Public Agencies	17	3.34
Temporary Construction Easements		
Private Owners	26	1.04
Public Agencies	5	0.36
TOTAL RIGHT-OF-WAY NEEDS	111	18.17

Headwalls are recommended for pipe culverts 42 in. in diameter and larger. Culvert profiles are generally set below existing ground to minimize structure sizes and avoid raising the upstream water surface elevation. Two of the proposed 88 drainage crossings are bridges. Both bridges will look much like culverts in that they will have concrete bottoms.

The extent of grading upstream and downstream of Silverbell Road is kept as short as possible to minimize environmental and 404 impacts. The culverts will typically have sloping inlets and riprap outlets. The sloping inlets will improve wildlife access, however use of standard dumped riprap may not be conducive to wildlife movement. This will need to be evaluated further in final design.

Drainage easements will be needed at many of the drainage crossings for the inlet and/or outlet structures. Preliminary drainage easements are identified on the plans and will need to be refined in final design. Letter of Map Revisions

(LOMR) will probably not be needed for eight of the nine FEMA washes because the increase in water surface elevation does not exceed 1 ft. A LOMR will be required for Camino de Oeste Wash and will likely be needed for the Santa Cruz River encroachments in the floodplain on the section north of El Camino del Cerro. Jurisdictional washes have been identified and a preliminary jurisdictional delineation submitted to the U.S. Corps of Engineers. Although the drainage structures were designed to minimize impacts, it is likely that an individual 404 permit will be required for several construction phases.

6.5 PAVEMENT DRAINAGE

A preliminary pavement drainage analysis and design was completed for the section from El Camino Del Cerro to Grant Road. The pavement design was based on the criteria listed in Section 5, best practices described in the City of Tucson Drainage Manual, and consideration of the objectives to incorporate water harvesting, and minimize project cost. The proposed pavement drainage concept minimizes the use of storm drain in favor of a catch basin/scupper combination to convey water to existing washes or roadside channels. Catch basin placement followed the following guidelines:

- Generally, do not exceed 1000 feet between catch basins;
- Locate catch basins within 150 feet upstream of all public streets & major driveways;
- Locate catch basins at the low point of all sag curves;
- Attempt to locate catch basins above next to cross drain structures in order to drain roadway runoff directly into the cross drain structure;
- Attempt to locate catch basins approximately 50 to 100 feet upstream of all super-elevation transition points where the roadway cross slope changes from negative to positive or vice versa.

The time of concentration for all drainage areas was assumed to be five minutes. Based on NOAA rainfall data at the Grant Road/Silverbell Road intersection, the 100-year design storm intensity was 10.32 inches/hour and the 10-year design storm intensity was 5.16 in/hr. The 100-yr and 10-yr design flows for each drainage area were estimated through use of the Rational Method.

Drainage inlets were analyzed under both the 10-yr and 100-yr design storms. The design objectives included keeping one lane of traffic in each direction open in the 10-yr event and keeping the 100-yr runoff within the roadway curbs. In areas where storm drain is required, a 24-inch diameter pipe provides sufficient capacity.

6.6 EARTHWORK CONSIDERATIONS

Constructing the proposed roadway improvements will require a large amount of borrow. Due to the need to raise a large segment of the roadway out of the 100-yr flood plain and construct the needed cross drainage culverts, most of the project will be on fill. North of El Camino del Cerro, the roadway will need to be raised by up to 10 feet in some areas to address the floodplain. Additionally, the roadway alignment on this section has been shifted east along much of the corridor to avoid right-of-way impacts and to reduce the impacts to hillsides and residences on the west side of Silverbell Road.

Table 5: Proposed Drainage Culverts

POC	STATION	PROPOSED STRUCTURE	CULVERT LENGTH (ft)	DRAINAGE AREA (ACRES)	Q100 (CFS)	Comments	Wildlife Crossing Study
100	465+58	5 – 12’ x 8’ RCBC (Extension)	59	1330	2900	Greasewood Wash; FEMA	
101a	456+52	1 – 10’ x 4’ RCBC & 1-10'x 6'x 300'	153	176	440	Nursery Wash; FEMA	
101b	455+51	3 - 36" RCPs	250	0	160	Nursery Wash; FEMA	
102a	449+92	2 – 30” RCPs (Existing)	0	8	39		
102	449+40	3 – 30” RCPs	156	0	72		
103	440+50	48” RCP (Extension)	50	7.1	35		
104	437+35	6 – 10’ x 6’ RCBC (Extension)	65	910	1458	Painted HillsWash; FEMA	
105	428+80	24” RCP	200	4.3	25		
106	424+41	3 – 36” RCPs	160	28.9	145		
107	421+22	24” RCP	190	1.7	11		
108a	416+93	6 - 36” RCPs	144	95.1	312		
108b	415+80	24” RCP	147	0.5	3		
108c	413+47	24” RCP	138	2.3	14		
108d	411+46	24” RCP	130	1	6		
109	409+36	4 Span x 110' Bridge	106	3646	6471	Camino De Oeste Wash; FEMA	
	406+77	3-10'x 5' RCBC	133				
111	396+81	24” RCP	224	2.6	15		
	395+00	24” RCP	123	2.6	15	Driveway	
111A	393+52	3 – 36” RCPs	173	42.5	182		
112a	385+51	2 – 8’ x 4’ RCBC	205	179.6	507		
112b	384+29	24” RCP	152	1.4	8		
113	381+36	30” RCP	217	6.3	36		
	380+00	2 - 10'x 4' RCBC	40	0	294	Driveway	
114	378+84	3 - 36” RCPs	170	22.7	112		8' x 5' RCBC recommended; significantly larger than proposed for drainage.
115b	373+73	30” RCP	178	3.5	20		
115a	372+29	5 – 48” RCPs	161	82.7	280		

POC	STATION	PROPOSED STRUCTURE	CULVERT LENGTH (ft)	DRAINAGE AREA (ACRES)	Q100 (CFS)	Comments	Wildlife Crossing Study
115c	370+56	24” RCP	160	2.2	12		
116	365+10	4 – 12’ x 8’ RCBC	128	1809	2546	Trails End Wash; FEMA	12' x 8' RCBC acceptable
117a	360+00	5-30” RCP	80	4.6	85*	Sweetwater Dr.	
117	348+36	3 - 10'x 4' RCBC	203	38.9	168		10' x 4' RCBC acceptable
118	344+79	2 – 10’ x 4’ RCBC	143	111	396		10 x 5' RCBC recommended, 10' x 4' RCBC acceptable
119a	337+50	2-24" RCP	150	Breakout from 119	32	Roger Wash; FEMA	
119	332+61	6 – 12’ x 8’ RCBC	147	3438	5563	Roger Wash; FEMA	12' x 8' RCBC acceptable
	334+70	1-10'x 6' RCBC	140				
120	327+51	30” RCP	197	5.3	32		
121a	321+60	2 – 10’ x 4’ RCBC	129	44.1	247*		
121b	319+78	2 - 36” RCPs	126	24.2	85*		
121	315+71	1-10'x 4' RCBC	180	Breakout from 122	191		
122	314+11	6 – 10’ x 5’ RCBC	135	3072	2099	Sweetwater Wash; FEMA	
123	305+06	5 – 10’ x 5’ RCBC	138	24.2	1867		
124	300+00	2 - 24” RCP	110	4	25		
125	294+75	2 - 24” RCPs	136	4	50*		
126	285+42	4 – 10’ x 4’ RCBC	148	795	1182	Del Cerro Wash; FEMA	

Table 5 Continued: Proposed Drainage Culverts

POC	STATION	PROPOSED STRUCTURE	CULVERT LENGTH (ft)	DRAINAGE AREA (ACRES)	Q100 (CFS)	Comments	Wildlife Crossing Study
127	279+63	2 - 24" RCP	173	3.9	23		
128	274+60	10' x 4' RCBC	154	71.1	298		
129	271+08	24" RCP	169	1.6	10		
130	267+75	10' x 5' RCBC	167	79.5	311		
131	261+25	5 - 24" RCPs	132	15.9	86		
200	255+52	4 - 36" RCPs	194	45.5	202		36" RCP acceptable
202	251+29	2 - 10' x 5' RCBC	135	290	735		8' x 6' RCBC recommended; 10' x 5' acceptable. A separate wildlife only 8' x 5' RCBC located between POC 202 and Sunset Road is rcommended.
203	249+03	24" RCP	136	2.3	13		
204a	245+61	42" RCP	143	6.7	38		
204b	242+89	30" RCP	138	2.7	15		
204c	237+29	2 - 42" RCP	166	29.8	118		
205	232+34	2 - 8' x 5' RCBC	147	233	549		8' x 5' RCBC is acceptable.
206a	230+30	24" RCP	144	1.9	11		
206b	224+52	48" RCP	135	17.1	83		
206c	221+89	24" RCP	129	3.1	18		
207	216+31	2 - 54" RCPs	144	48.9	237		
208	212+69	10' x 6' RCBC	153	259	700		
209a	207+73	2 - 10' x 4' RCBC	128	70.7	288		
209b	0	24" RCP	40	1.5	9		
210	203+61	2 - 36" RCP	184	8.4	55		
211a	198+00	24" RCP	170	1.1	7.6	Idle Hour Wash; FEMA	
211b	194+39	1-30" RCP	158			Idle Hour Wash; FEMA	
	192+25	5 - 12' x 10' RCBC	167	4177	5680		Span bridge desirable
	189+85	2 - 12'x 8' RCBC	161				
213	181+79	2 - 36" RCPs	150	21.8	117		

POC	STATION	PROPOSED STRUCTURE	CULVERT LENGTH (ft)	DRAINAGE AREA (ACRES)	Q100 (CFS)	Comments	Wildlife Crossing Study
214	179+09	24" RCP	160	3.3	19		
216	175+80	36" RCP	202	8.3	49		
217	174+40	24" RCP	158	3	17		
218	168+36	36" RCP	181	4.6	27		
219	163+00	4 – 36" RCPs	132	54.7	251		
220	159+39	5 - 30" RCPs	136	16.6	102		
221	155+04	12' x 8' RCBC	185	288	832		
222	147+82	3 - 10' x 4' RCBC	139	64	283		
223	142+83	24" RCP	125	2	12		
224	140+53	4 - 48" RCPs	160	44	235		
226	134+89	48" RCP	183	12.2	82		
227	131+94	24" RCP	174	2	12		
229	128+05	24" RCP	139	0.7	4		
231	122+92	1-120' Span Bridge	106	686	1594		Span bridge desirable
232a	118+76	24" RCP	194	4.4	25		
232b	116+54	24" RCP	145	2.2	13		
233a	115+07	24" RCP	185	2.5	14	FEMA	
233b	107+40	3 - 10' x 5' RCBC	168	513.5	1229	FEMA	10' x 5' RCBC acceptable
234a	100+61	2 - 30" RCP	137	12.9	67		
234b	97+86	2 - 8' x 4' RCBC	122	154.1	452		8' x 5' RCBC recommended; Proposed 8' x 4' RCBC acceptable.

Preliminary earthwork calculations for the section from Ina Road to El Camino del Cerro includes 365,000 cubic yards of fill and 37,000 cubic yards of cut. Applying the earthwork factors determined by the geotechnical investigation - 20% shrink and 5% compaction, the required borrow is estimated to be 420,000 cubic yards. Preliminary earthwork estimates for the section from El Camino del Cerro to Grant Road estimates 160,000 cubic yards of fill and 49,000 cubic yards of cut, resulting in 151,000 cubic yards of borrow.

6.7 STRUCTURES
Bridges

Slab bridge structures are recommended at two wash crossings. The bridges were selected as preferred options over large concrete box culverts or other cross-drainage options. The bridges will have less upstream and downstream channel grading than box culverts and will better serve as major wildlife crossings. Both bridges will have concrete bottoms.

One proposed bridge is located at the unnamed wash just north of Abington Road where there is an existing arch culvert. The proposed bridge would span 120 feet over the wash. The existing culvert was constructed in the 1930's and may have historic standing. As such, it may be desirable to leave the arch culvert in place and span it with the new bridge. The most recent inspection conducted by Pima County indicated that there were no structural problems with the existing culvert, only minor pitting associated with water seepage. A reinforced concrete box culvert with two 10'x10' openings could also be constructed in place of the existing culvert.

The other proposed bridge location is just south of Neosha Street at the Camino De Oeste Wash. The bridge would span the wash with four 40-foot bridge slabs, and would require some upstream and downstream channel improvements to the wash. In lieu of a bridge, this location would require a reinforced concrete box culvert with eight 12-foot wide openings or a multi-celled arched structure, along with significantly greater channel improvements.

Retaining Walls

From Ina Road to El Camino del Cerro there are 9 locations, all on the west side of Silverbell Road, where existing slopes will need to either be cut back (3:1 slope) and re-vegetated or a retaining wall constructed. On the section from El Camino del Cerro to Grant Road there are 14 locations where a cut slope or retaining wall will be required. The retaining wall option is preferred where a slope easement would have to be purchased from private owners. At locations where the slope is on publicly owned property, the cut slope is considered a viable option. The Citizen's Task Force prefers the retaining wall option with a sculpted, natural looking finish, and is concerned that an irrigated re-vegetated slope cannot be returned to a natural appearance. Tables 6 and 7 summarize the requirements for the retaining wall option. Another potential option is to provide a combination of a short retaining wall with a graded, re-vegetated 4:1 slope at the top. This option would reduce wall costs while limiting the extent of the slope. This option was also supported by the CTF.

There are three locations where a fill slope retaining wall is preferred to avoid encroachment into existing facilities. The three locations include:

- Christopher Columbus park frontage, where a fill slope would encroach into the internal park roadway;
- Along the Silverbell Nursery property frontage, where a new driveway alignment is proposed to run parallel to Silverbell Road.
- Along the south side of El Camino Del Cerro where the fill slope encroaches into private property and drainage areas.

Guardrail will not be required at the first two locations as the walls will be outside of the clear zone, however handrail will be required at all three locations.

6.8 ROADWAY CROSS SECTION

The proposed roadway cross-section for Silverbell Road was established based on input from project stakeholders, including City of Tucson, Pima County, Town of Marana, and the Citizens Task Force. Alternatives evaluations were undertaken to determine the preferred treatments for several of the cross-sectional elements, and are summarized in Section 10.

Considering that Silverbell Road is identified as an Environmentally Sensitive Roadway, every effort was made to minimize the footprint of the roadway and associated environmental impacts while fulfilling the capacity, safety, and multi-modal needs of the corridor. To achieve this, minimum travel lane and median widths were selected and the steepest recoverable side-slopes were used in order to reduce cut and fill slopes.

The minimum values for recoverable cut and fill slopes are recommended for this project because of the multiple significant cut and fill locations that occur from impacts to the existing topography and the need to raise the roadway in many sections. Within the clear zone, the steepest slopes recommended are 4:1 for cut sections and 6:1 for fill sections. Beyond the clear zone, a 3:1 slope is recommended for both cut and fill sections. As discussed in Section 10.0, an alternative evaluation was undertaken for cut section treatments, with the following recommendations:

- In cut sections with inadequate right-of-way abutting private property, utilize soil nail retaining walls; and
- In cut sections with adequate right-of-way width or abutting publicly owned land, utilize graded cut slopes with a maximum slope of 4:1. Where the graded slopes will extend further than 50 feet horizontally beyond the roadway hinge point, short retaining walls will be utilized to reduce the length of the graded slope.

Some cross-sectional elements vary slightly from those described above for specific roadway sections. The specific cross-sectional variations are outlined in the sections below. Detailed cross-sections are provided in the preliminary roadway plans provided in the appendices.

Ina Road to Sunset Road (Excluding Abington Road to Belmont Road)

The cross-section of Silverbell Road from Ina Road to Sunset Road maintains the same general roadway cross-section specified above, however, the Town of Marana requires curb with gutter for maintenance reasons. To provide a full 6-feet of usable pavement within the bicycle lanes, the Town and Pima County

Table 6: Wall Summary – Ina Road to El Camino del Cerro

No.	Station Begin	Station End	Length (ft)	Max. Height (ft)
25	114+80.00	115+80.00	100	6.3
24	117+90.00	118+40.00	50	4.0
23	119+70.00	121+60.00	190	5.6
22	129+70.00	131+10.00	140	4.4
21	134+40.00	137+40.00	300	10.2
20	199+30.00	202+50.00	320	12.0
19	219+00.00	221+50.00	250	5.7
18	227+00.00	229+30.00	230	6.4
17	230+60.00	231+80.00	120	9.2

Table 7: Wall Summary – El Camino del Cerro to Grant Road

No.	Station Begin	Station End	Length (ft)	Max. Height (ft)
1	380+20.00	381+70.00	150	15.7
2	382+90.00	384+10.00	120	16.4
3	384+80.00	385+80.00	100	15.0
4	389+40.00	390+70.00	130	14.4
5	403+50.00	404+40.00	90	11.0
6	411+70.00	413+20.00	150	12.0
7	418+50.00	420+30.00	180	14.3
8	420+90.00	423+10.00	220	10.6
9	426+00.00	428+30.00	230	13.6
10	430+70.00	431+60.00	90	7.8
11	431+60.00	433+20.00	160	7.2
12	459+60.00	462+80.00	320	19.2
13	470+40.00	474+00.00	360	12.8
14	474+10.00	475+20.00	110	13.6

have agreed to reduce the standard 2-ft gutter to 1-ft, making the total width of the shoulder 7 feet.

Abington Road to Belmont Road

Access is currently provided to 16 residences on the east side of Silverbell Road from Abington Road to Belmont Road via a two-way frontage road. It will not be possible to maintain a two-way frontage road with the proposed Silverbell Road improvements. Several access alternatives were developed in the frontage road area to provide safe, efficient access to the residential properties. The alternatives are discussed in Section 10.0. The recommended alternative provides a continuous northbound right-turn deceleration lane located on the outside of the bike lane. Because of the limited right-of-way width in this area, a 5-ft wide sidewalk is proposed along the back of curb on the east side of Silverbell Road in this area instead of the 10-ft wide multi-use path.

Goret Road to Grant Road

The cross-section of Silverbell Road from Goret Road to Grant Road is proposed to include a 6-foot wide sidewalk adjacent to back of curb on the west side of the road. Additionally, from Burlwood Way to Grant Road a 6-foot wide sidewalk adjacent to back of curb will replace the 10-foot wide multi-use path on the east side of Silverbell Road to avoid the need for additional right-of-way.

6.9 PROPOSED PAVEMENT STRUCTURE

Based on the result of the geotechnical investigations, the proposed pavement structure includes 2 inches of rubberized asphalt on 3.5 inches of asphaltic concrete on aggregate base ranging from 7 inches north of El Camino del Cerro to 8 inches on the south section. In areas where the roadway profile will not be raised, it is recommended that the top 3 feet of the subgrade be excavated and re-compacted.

6.10 ACCESS CONTROL

Silverbell Road will include a 20-foot wide raised median from Ina Road to Grant Road. Refer to Section 4 for a discussion of recommended access control.

6.11 INTERSECTIONS

Sunset Road: The existing unsignalized T-intersection at Sunset Road intersection intersects Silverbell Road at a skew. Sunset Road is proposed to be realigned to intersect Silverbell Road more perpendicularly. Sunset Road will remain a two-lane roadway, with a 6-foot wide raised median at the intersection. Exclusive left and right turn lanes in each direction will be constructed at this intersection.

Sunset Road Extension: Planning for a connection of Sunset Road from Silverbell Road to I-10 and eventually to River Road is currently underway. Alignment alternatives for the connection from Silverbell Road to the existing Sunset Road interchange at I-10 have been evaluated. The extension of Sunset Road along its current alignment, to form a four-way intersection with Silverbell Road does not appear to be feasible due to the close proximity to the Santa Cruz River floodway and impacts to adjacent properties associated with raising Silverbell Road and providing a bridge over the Santa Cruz River. The current preferred alternative is to provide the Sunset Road connection approximately 1,500 feet south of the existing Sunset Road intersection. Split T-intersections will be created and both may need to be signalized. This configuration is included in the 15% plans for the Silverbell Road north section.

El Camino Del Cerro: The intersection will be shifted slightly north and east. Each leg of the intersection will have bike lanes and exclusive left and right turn lanes with 6 foot wide raised median pedestrian refuge areas. The north and west legs of the intersection will be reconstructed with transition sections to tie into the existing roadway cross sections. The east leg of the intersection will be reconstructed back to the Santa Cruz River bridge and will include an eastbound acceleration lane departing the Silverbell intersection. The reconstruction will provide left and right turn lanes into the park facilities south of El Camino Del Cerro.

Sweetwater Drive: Sweetwater Drive at Silverbell Road is currently a skewed signalized intersection. Due to right-of-way constraints the intersection will not be re-aligned. The west leg of the intersection will be raised to allow drainage culverts to be installed. The east and west legs will be constructed with exclusive left turn lanes and shared through and right turn lanes, however will not have raised medians or bike lanes.

Goret Road: The north and south legs of the intersection will be reconstructed with bike lanes, exclusive left and right turn lanes and raised 6 foot wide raised median pedestrian refuge areas. The east and west legs will be constructed with exclusive left turn lanes, shared through and right turn lanes, and paved shoulders for bike usage. The east leg will include a raised median, which exists today. The northwest corner will have a channelized lane to facilitate the southbound right-turn movement.

Grant Road: The Grant Road intersection will not be fully reconstructed as part of this project. The north and south legs of the intersection will be realigned to allow dual left turn lanes in both directions. The realignment will provide space for a southbound bus pullout on the south side of the intersection. The east and west legs of the intersection will be widened to the north to allow the construction of a 6-ft wide raised median, a westbound right-turn lane and a bus pullout on the northwest corner. An eastbound bus pullout on the southeast corner of the intersection will be constructed prior to the Silverbell Road project. Bike lanes will be provided on all legs of the intersection.

6.12 LANDSCAPE

The Silverbell Road or “de Anza” landscape concept was developed with substantial input from the Citizen’s Task Force. The concept, illustrated in Figure 6, is intended to accentuate several existing thematic elements within the corridor (archeology, wildlife, and water/geology/topography), protect wildlife by encouraging the use of underpasses, enhance the scenic nature of the corridor for all users, encourage walking and other recreational activities, and utilize water harvesting techniques to provide a sustainable plant environment. Examples of elements of the three themes are provided in Appendix C.

Plants native to the Tucson basin will be emphasized. Much of the plant material used on the project will be required to mitigate the impact of the roadway improvements on the visual quality within the corridor. The planting plan will rely heavily on native tree species to accommodate the planting scheme preferred by wildlife experts.

Irrigation will be designed as a temporary Type B system. A 24” reclaimed water main runs on the west side of Silverbell north of Cmn. del Cerro to Christopher Columbus Park. The use of reclaimed water for temporary irrigation for plant establishment will be explored. Landscape plants will be located to take maximum advantage of constructed water harvesting elements.

Pedestrian nodes, defined as small scale widening of the sidewalk with seating are proposed as a way to support the landscape theme and provide locations for interpretive signage. Median nose paving patterns that support landscape themes are also proposed. Several members of the CTF have requested that

median paving be reduced to a minimum and that low grow plants be provided in all locations where the median is greater than four feet wide.

6.13 UTILITIES

Existing overhead and underground utilities within the Silverbell Road project limits will be impacted by the roadway improvements. Utility poles along sections of the improved roadway will need to be moved outside of the clear zone. The overhead transmission and distribution power lines will need to be relocated to the new poles. TEP is not required to underground power lines within the Silverbell Road corridor and funding for utility relocations is not provided in the RTA program.

It is expected that the existing underground utilities (water, gas, communications) will be in conflict with many of the new drainage cross culvert facilities being constructed. These utilities in conflict will need to be lowered or relocated. Potholing of the existing 42”water line at each proposed culvert crossing on is being carried out for the section from El Camino del Cerro to Grant Road as part of the 30% design effort. Utility potholing is recommended during the final design phase to verify conflict locations of other utilities prior to construction.

6.14 CONSTRUCTION ISSUES

A majority of the roadway widening will occur to the east of the existing roadway. This will significantly reduce construction impacts by allowing the northbound side of the roadway to be constructed with minimal disturbance to the existing roadway.

A substantial amount of fill material (borrow) will need to be imported to the project. To ensure the availability of material and reduce costs, the City of Tucson, Pima County, and Marana should identify an appropriate existing borrow pit or property that might be used for borrow. With either option, the materials site will need to be included in the environmental clearance and potentially in the 401/404 permitting. Construction staging areas should be identified for each construction phase and included in the area covered by the environmental clearance.

Traffic control and construction access will need to be addressed during final design, particularly south of Goret Road where substantial development currently exists.

6.15 DESIGN VARIANCES

No design variances will be required for Silverbell Road, however the following design variances will be required on the reconstructed side streets:

Abington Road: (Station 118+75) The horizontal alignment of Abington Road has been modified to tie in to Silverbell Road at a lesser skew angle. A 100-foot horizontal curve was utilized in the new alignment, corresponding to a design speed between 15-20 mph. Operating speeds are anticipated to be low because this curve is located very close to the Silverbell Road intersection. Advanced signing may be needed on the eastbound approach to the intersection warn of the upcoming intersection.

The 50-foot sag vertical curve utilized in the profile for Abington Road corresponds to a design speed of 15 mph. The shorter vertical curve was necessary in order to minimize the distance along Abington Road that must be reconstructed. This vertical curve is located close to the intersection of Silverbell Road so operating speeds are anticipated to be low.

Meeting a 30 mph design speed will require significant reconstruction of Abington Road thus impacting adjacent private property. This would also require a high skew angle at the intersection which would result in additional safety concerns.

Benjamin Road: (Station 187+00) The horizontal alignment of Benjamin Road has been modified to match into the realigned Silverbell Road at a perpendicular angle. The new Benjamin Road alignment utilizes a horizontal curve with a radius of 140 feet, corresponding to a design speed between 20-25 mph. Operating speeds through this curve are anticipated to be low as it is close to the intersection with Silverbell Road.

Meeting a 30 mph design speed will require significant reconstruction of Benjamin Road across private property. Realignment would also increase 404 impacts on the Idle Hour Wash.

Kiley Court: (Station 263+75) The 180-foot sag vertical curve utilized in the profile for Kiley Court corresponds to a design speed of 25 mph. The shorter vertical curve was necessary in order to tie into the short length of Kiley Court. A higher design speed would result in the need to extend Kiley Court, thus significantly impacting the surrounding private property.

Gracious Court: (Station 268+80) The 95-foot sag vertical curve utilized in the profile for Gracious Court corresponds to a design speed of 20 mph. The shorter vertical curve was necessary in order to minimize the reconstruction distance along Gracious Court to avoid impacting existing drainage facilities.

Goret Road (west approach): (Station 434+15) In order to tie-in to the existing roadway, a downgrade of 8% is required on the west approach of Goret Road. This is greater than the maximum allowed profile grade of 7% stated in the Pima County RDM.

In order to tie-in to the existing roadway, a 200-foot sag vertical curve is implemented between the 8% and 3.04% tangent grades on the west approach of Goret Road. The design speed for the west approach of Goret Road is 40 mph. The design K-value for a sag vertical curve for this design speed is 64 according to the AASHTO 2004 Policy. This results in a minimum length of

vertical curve of approximately 320 feet.

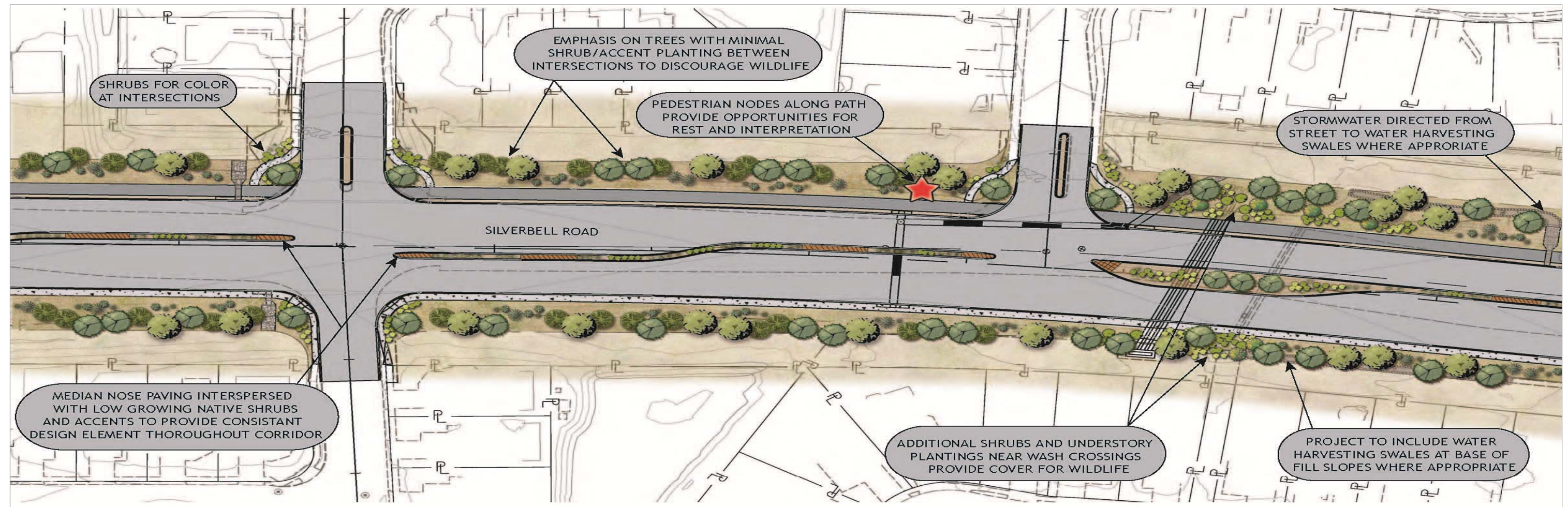
Meeting a 30 mph design speed and maximum 7% grade will require significant reconstruction of Goret Road including large impacts to adjacent property and requiring significant regrading of existing topography and vegetation.

Introspect Drive: (Station 439+50) In order to tie-in to the existing roadway, a downgrade of 8.36% is required on Introspect Drive. This is greater than the maximum allowed profile grade of 7% stated in the Pima County RDM.

Meeting a maximum 7% grade will require significant reconstruction of Introspect Drive including impacts to adjacent property and significant re-grading of existing topography and vegetation.

Silver Sun Drive: (Station 476+10) The horizontal alignment of Silver Sun Drive has been modified to tie into Silverbell Road at a full median opening. A 100-foot horizontal curve was utilized in the new alignment, corresponding to a design speed between 15-20 mph. Operating speeds are anticipated to be low because this curve is located very close to the Silverbell Road intersection.

Figure 6: Landscape Concept



Meeting a 30 mph design speed will have significant impacts to the adjacent private property or prevent the realignment of Silver Sun to the full median opening.

Grant Road: (Station 484+65) The proposed striping for the intersection includes dashed guide lines through the intersection for the dual left-turns on Silverbell Road northbound and southbound. Sheet No. 5-10 in the Pima County Pavement Markings Manual provides striping detail standards for dual left-turns. Because of the skew at the intersection, the minimum 10-foot tangent section at each end of the guide lines cannot be provided. Providing the 10-foot tangent will require the complete reconstruction of the Grant Road intersection.

7.0 ENVIRONMENTAL CONSIDERATIONS

Potential environmental impacts associated with the proposed Silverbell Road improvements and recommended mitigation measures are discussed in the Environmental Design and Mitigation Report (EDMR) prepared for the roadway section from El Camino del Cerro to Grant Road and Environmental Screening Report prepared for the section from Ina Road to El Camino del Cerro. The potential impacts and minimization or mitigation measures are summarized here.

Vegetation and Wildlife: The project will involve ground-clearing, thus removing naturally growing vegetation. The project footprint and estimated clearing impacts is as follows: Ina Rd to El Camino del Cerro - 63 Acres/29.5 Acres, El Camino del Cerro to Grant Rd. - 67.5 Acres/44 Acres. Two federally recognized threatened or endangered plant species that are in the forage range of the project area, include the lesser long-nosed bat and cactus ferruginous pygmy owl, however the project is not expected to impact either species. The project area is within a Pima County Multi-Species Conservation Plan priority conservation area for two listed species that are also federally listed - the Huachuca water umbel (endangered) and the yellow-billed cuckoo (candidate). Depending on where roadway construction occurs, the following species protected under the Arizona Native Plant Act could be affected: velvet mesquite, foothill and blue palo verde, whitethorn and catclaw acacia, ocotillo, barrel cactus, saguaro, and various species of cholla. The Arizona Department of Agriculture requires notification for protected plants impacted by construction. Impacts to plants should be minimized to the maximum extent practicable. Landscape and re-vegetation plans should be developed consistent with the mitigation measures outlined in the City of Tucson and Pima County Native Plant Preservation Ordinances.

The project area provides critical wildlife connectivity and priority wildlife movement areas exist within the project limits. Widening the roadway without adequate accommodation for wildlife connectivity will likely result in negative impacts to the long-term persistence of species currently using the area for movement, as well as continued risk of collision to motorists and wildlife. To minimize these impacts, the following measures were recommended in the wildlife crossing studies:

- Increase the heights and widths of drainage crossing culverts, particularly within the priority movement corridors, to negate the appearance of long, narrow structures, which certain species may be less reluctant to use. Recommended dimensions for drainage structures to better accommodate and encourage use by wildlife are included in Table 5 in the drainage discussion in Section 6.4. In addition, consideration should be given to situating underpass entrances as close as possible to the road edge to reduce structure length and promote use by smaller-bodied species that typically use the road edge (e.g., reptiles, small mammals).
- Implement a landscape concept that utilizes vegetation to both encourage wildlife to utilize drainage culverts and minimize roadside crossing. This includes emphasizing culvert entrances by providing higher vegetation

densities and using native vegetation, such as velvet mesquite and blue palo verde. The placement of woody debris (e.g., stumps, branches) and boulders along the length of the structure would aid in maximizing the probability that smaller-bodied species would use the structure. For smaller structures, little is known regarding their effectiveness under wider roadways (four or more lanes). In addition, vegetation along the roadside edge and in between culverts should be void of dense areas of shrubs and plants that would provide cover for wildlife. Use of trees with high canopies in these areas is acceptable.

- Minimize roadway lighting along Silverbell Road, particularly within the priority wildlife movement corridors. Where roadway lighting is required, efforts should be made to keep lighting at least 200 feet away from culverts and should be directed away from the structure and the wash area.
- Implement 8-ft high wildlife fencing within the Saguaro National Park West – Santa Cruz River and Wastewater treatment plant priority corridors.
- Install additional pipes, typically 1.5 ft in diameter, within each priority corridor to further accommodate snakes, lizards, and small mammals.

The Silverbell Road widening project is not expected to impact any special status species protected under the Endangered Species Act, state protected species managed by the Arizona Game and Fish Department, or species recognized in the Pima County Multi-Species Conservation Plan. The Sonoran desert tortoise is a target species identified in the wildlife linkages assessment. Impacts to the tortoise will be minimized to the maximum extent practicable through the implementation of the recommended wildlife crossing mitigation measures where feasible and reasonable. Priority conservation areas occur within and around the project area for several additional species.

Air Quality: The Tucson metropolitan area is in attainment for all National Ambient Air Quality Standards (NAAQS) pollutants, with a limited maintenance plan for carbon monoxide. The Rillito non-attainment area for PM10 particulate matter extends north from Ina Road and is outside of the project limits. The results of the regional air quality assessment conducted by the Pima Association of Governments (PAG) indicate that the planned transportation improvements included in the regional transportation plan, including Silverbell Road, will satisfy the federal air quality conformity requirements. During roadway construction activities, an increase in particulate matter (PM10 and PM25) is expected and will need to be mitigated through dust control.

Water Quality: A preliminary jurisdictional delineation (JD) has been submitted to the US Corps of Engineers. Of the 73 washes within the project, 58 washes with an estimated total impact of 11.3 acres have been recommended as being potentially jurisdictional. The impact at several washes is expected to exceed ½ acre, requiring an individual 404 permit. 401 permitting will be required from ADEQ. Upon approval of the JD, consultation with the Corps is necessary to define the most appropriate permitting process for Silverbell Road. Development and implementation of storm water pollution prevention plans (SWPPP) will be required for each construction phase.

Drainage/Floodplain: Installing culverts and short bridges to eliminate at-grade drainage crossings along Silverbell Road will result in the roadway profile being raised. While much of Silverbell Road lies within the Santa Cruz River floodplain, it is not anticipated that raising the roadway will impact the water surface elevation of river, however this is being evaluated by the Pima County Flood Control District. Culverts will be designed so as not to increase the existing upstream flooding elevation more than one foot and control downstream erosion.

Noise: Potential noise impacts associated with the Silvebell Road improvements and future traffic growth were evaluated per the Pima County Noise Mitigation ordinance. The noise report (Ref.13) provides detailed information on the evaluation process and results. As expected, increased traffic volumes coupled with the roadway realignment and widening will result in higher sound levels at residences and in open space along Silverbell Road. Generally, the largest increase in traffic generated sound will occur at residences along the east side of Silverbell Road between Belmont Road and Silver Ridge Lane due to the close proximity of the residences to the proposed roadway. All of the predicted sound level increases are below the substantial increase threshold of 15 dBA. Future sound levels at 17 residences are predicted to exceed the 66 decibel (dBA) threshold established by Pima County for consideration of noise mitigation. Applying a 3 dBA reduction for rubberized asphalt pavement, as prescribed in the Pima County procedures, drops the sound levels at 16 of these residences below the 66 dBA threshold. At the one residence where the predicted noise exceeds the threshold, located on the southwest corner of El Camino del Cerro intersection, construction of a noise wall is not recommended since the residence is in close proximity to a major intersection and a sound wall will have minimal effectiveness (i.e. less than 5 dBA as required by Pima County)

Hazardous Materials: During final design, a Phase I investigation of the Silverbell Jail Annex contamination plume should be conducted. If it is determined that the plume is within the limits of the project, Phase II testing should be performed on soils in areas where excavation is deeper than 18 inches. As part of the roadway improvements, existing concrete asbestos water pipe will be impacted and need to be replaced. Removal and disposal of the pipe will need to follow approved procedures.

Historic/Cultural Resources: The archaeological survey of Silverbell Road between Grant and Ina roads documented the nearly uninterrupted deposit of cultural resources between the west bank of the Santa Cruz River and the toe of the Tucson Mountains. For that reason, the City of Tucson, Pima County, and Marana have collectively recommended that the area be designated the Silverbell Archaeological District, eligible for National Register listing for its potential to contribute significant information regarding prehistoric and historic period occupation and land use along the Santa Cruz River. This NRHP-eligible district contains 35 known historic properties and an unknown number of buried archaeological sites. As a result, ground disturbing activities associated with road improvements have the potential to adversely affect cultural and historical resources within the district. Recommendations to minimize adverse impacts include:

- In project design and implementation, every impact should be made to avoid adverse impacts to historic properties (realistically, the topography of the roadbed presents limiting factors that favor expansion to the east in many locations, which may affect the larger prehistoric archaeological sites).
- Review the historic eligibility with SHPO of the arch culvert located north of Abington Road. The project is not anticipated to impact the eight parcels that have potential historic buildings.
- Any portion of the project limits that includes areas not surveyed as part of this project should be surveyed for historic properties.
- Identification testing should be conducted in non-site areas where portions of the project cross alluvial fans and floodplain deposits (i.e., mostly those areas in and east of the existing roadway).
- Considering the roadway improvements will be constructed in phases over the next 15 years and the current uncertainties regarding the impacts to cultural resources, a Programmatic Agreement (PA) should be developed to govern the resolution of adverse effects. Consultation in development of the PA should include, but not be limited to, the USACE, SHPO, Tohono O’odham Nation, Pima County, City of Tucson, Town of Marana, Arizona State Museum, and the Advisory Council on Historic Preservation.
- Work with the USACE to develop a recovery plan that minimizes impacts to waters of the U.S.
- A Historic Properties Treatment Plan (HPTP) should be prepared to mitigate adverse effects to all affected historic properties and should include data recovery excavations, public interpretation, procedures for handling human remains, and monitoring during construction.
- The seven roadside shrines (one pet burial and six human descansos or memorials) should receive special treatment in recognition of the sensitive nature of this type of property. Although these IOs do not qualify as NRHP-eligible properties nor do the COT, County, or TOM have official policies concerning these shrines, the practice has been to make every effort to contact the deceased’s relatives to arrange for relocation or removal of the memorial.

Visual and Aesthetic Resources: Widening the roadway will change the visual quality of the area by more than doubling the footprint of the paved area, raising the roadway profile, and from the removal of existing vegetation at wash crossings and roadside vegetation that currently provides some screening of industrial areas east/northeast of the roadway. For users of the corridor mid- and background views will be more prominent, as will the drainage crossing. To adjacent residences and businesses along the roadway, slopes and drainage culvert headwalls will be highly visible. New cut slopes could potentially occur on the west/southwest side of the roadway. Slope treatments could take the form of walls, soil cement, grouted rip-rap or hand placed rip-rap depending on the height and slope of the cut. There are many options for the treatment of these slopes to minimize contrast.

Measures to mitigate visual impacts of various elements of the roadway and maintain its scenic quality will be incorporated in the roadway and landscape design include the use of vegetation to stabilize and soften fill slopes and drainage inlets/outlets, utilize materials in fill areas and on slopes that blend with the existing landscape, and utilization of retaining walls to minimize slope impacts. The surface of the retaining walls will include an architectural treatment that would blend visually with surrounding native slopes. Where new cut slopes are required, landscape and irrigation will be applied to revegetate the slope to as close to the original native look as possible. A proposed landscape concept for the corridor is presented in Figure 6.

Neighborhood Impact: It is expected that the proposed roadway improvements will have no adverse impacts upon the character of neighborhoods within the corridor. The addition of bike lanes, a continuous multi-use path, and sidewalk is expected to substantially enhance connectivity to the existing (i.e. Christopher Columbus Park) and planned recreational facilities within the corridor and provide greater exercise and recreational opportunities to area residents.

Implementation of a raised median will affect access to some property owners, however no access will be eliminated. Full access will be maintained for each business, residential subdivision, and dedicated street. Full access to individual residential driveways will not be provided, however frequent median openings will provide convenient and safe U-turn opportunities for these residents.

Community Resource Impact: The new roadway alignment and widening will have a minor impact on Christopher Columbus Park requiring reconstruction of a short section of the park’s internal access road. Provision of 6-foot wide paved shoulders, a continuous 10-foot wide paved multiuse path along the east side, and sidewalk and graded area along the west side, will substantially improve the safety for bicyclists and joggers/walkers within the corridor, thereby enhancing the multi-modal function of the roadway. These improvements will also contribute and support the long term vision for reclamation and conversion of the Santa Cruz River between Silverbell Road and I-10 from industrial to recreational use. The application of water harvesting techniques will produce a sustainable landscape element of the corridor.

8.0 PUBLIC INVOLVEMENT

The public participation process carried out for this project was in accordance with the City of Tucson Roadway Development Process and included the formation of a Citizen’s Task Force (CTF). A 15-member CTF was approved by Mayor and Council in March 2009. The CTF ensures that public stakeholders are afforded an opportunity to express their views early in project development to ensure that decisions are made in the overall public interest. CTF members, comprised of community residents and business owners near Silverbell Road and residents of the larger metropolitan region, assisted the project team in identifying and assessing alternatives and developing the corridor design concept. This task force also served as a liaison between the neighborhoods, residents, and stakeholders they represent and the project team. CTF input followed a consensus based approach. Eleven CTF meetings were held. A summary of CTF feedback and other public involvement activities is provided below.

Citizen’s Task Force:

- CTF feedback included support for the proposed roadway features, including:
- Minimum through lane widths to reduce the total roadway footprint.
 - A raised 20-ft wide landscaped median that will provide access control, accommodate U-turns, and provide enhanced safety.
 - Bike lane widths that provide a minimum of 6-feet of asphalt, not including gutter (strong support)
 - Outside curbs.
 - A continuous multi-use path between Ina Road and Grant Road.
 - A roadway alignment that minimizes the need for right-of-way acquisition and impacts to currently undisturbed open space.
 - Minimal street lighting within the corridor.

- Elements of corridor reconstruction of particular importance to the CTF include:
- The CTF prefers the use of sculpted retaining walls versus landscaped slopes, noting concern regarding the ability to successfully re-vegetate slopes to match the surrounding area. The application of retaining walls on private property to avoid right-of-way impacts is preferred. On public property, a combination of short retaining walls with landscaped slopes at the top is the preferred approach. It was requested that the top of the slopes be contoured to provide a more natural look.
 - Accommodation and protection of wildlife within the area is of primary importance. The CTF proposed that wildlife mitigation should be extended throughout the corridor and not just within the priority crossing areas. The CTF supported the recommended increase in culvert sizes and landscape measures to encourage wildlife to cross under the roadway, however were not necessarily in support of long stretches of 8-ft high fencing.

- The landscape themes developed for the corridor are enthusiastically supported and are considered a vital element to enhance the scenic quality of Silverbell Road. The CTF strongly encourages the implementation of the landscape concept as defined in the corridor design concept.
- The CTF strongly supports efforts to salvage and re-plant existing vegetation within the corridor, to the extent possible, and utilization of water harvesting techniques to produce a sustainable landscape element.

Public Open Houses:

- Initial Public Meetings; held August 12, 2009 at El Rio Neighborhood Center and August 19, 2009 at Wheeler Taft Abbett Library (Attendance – 195). The focus of this meeting was to present the project scope and schedule and to solicit issues and concerns.
- Interim Public Meetings; held June 7, 2010 at Holy Trinity Church and June 9, 2010 at Coyote Trail Elementary School (Attendance - 88). Proposed improvements, including roadway alignment and profile, drainage culverts, environmental mitigation, and landscape themes were presented.
- Final Public Meetings; held October 19, 2010 at Holy Trinity Church and October 21, 2010 at Coyote Trail Elementary School (Attendance - 44). The final recommended improvements and landscape concepts were presented to the public.
- Comments received at the public meetings are included in the environmental clearance document (EDMR) and are posted on the project website.

Other Public Outreach:

- Meetings with affected property owners along the corridor were held individually and at two general meetings held on May 24th and 25th, 2010 at the Wheeler Taft Abbett Library; Discussions with property owners included right-of-way and access impacts.

9.0 AGENCY COORDINATION

Substantial involvement with the U.S. Army Corps of Engineers (Corps), the Arizona Department of Environmental Quality, the State Historic Preservation Office (SHPO), and the Federal Emergency Management Agency (FEMA) will be required in order to implement the Silverbell Road improvements.

A preliminary jurisdictional delineation of the Waters of the U.S. has been prepared for the entire project limits and submitted to the Corps for review and approval. Of the 73 drainage crossings within the project limits, 58 are proposed to be jurisdictional. Considering that the impact on several washes will likely exceed ½ acre and that these areas will include archeological sites, the project will likely require an individual permits under Sections 401 and 404 of the Clean Water Act.

Since the Corps is the lead federal agency for Section 106 of the National Historic Preservation Act, the City of Tucson, Pima County, and the Town of Marana have requested that the Corps also take the lead for historic and archeological consultation for Silverbell Road. Historic and archeological clearance activities will begin after approval of the jurisdictional delineation by the Corps. A treatment plan will be prepared for the entire corridor. Upon approval of the plan by SHPO, recovery of historic and archeological data can begin.

Pima County Regional Flood Control District (PCRFCD) will take the lead in addressing project impacts on the Santa Cruz River floodway and floodplain and the floodplains for the nine FEMA washes within the project limits. LOMR’s have already been submitted to FEMA for the nine washes and PCRFCD will be submitting a CLOMR for the Santa Cruz River. Upon completion of the roadway design, a LOMR for each FEMA regulated watercourse will be submitted, followed by a CLOMR at the completion of construction. PCRFCD will coordinate with FEMA ensure that ESA Section 7 requirements are addressed.

10.0 ALTERNATIVES

The following sections describe alternatives that were evaluated specifically for Silverbell Road in an effort to minimize impacts on environmentally sensitive areas, cut and fill slopes, private property, utilities, and project cost.

10.1 HORIZONTAL ALIGNMENT ALTERNATIVES

The horizontal alignment detailed in Section 6.0 above was selected through an alternatives evaluation process implemented early in the project development process to gain early consensus on the direction of the project and to reduce the number of iterations necessary to arrive at a preferred alternative. The development and selection of the preferred horizontal alignment utilized several alignment criteria and constraints established and agreed upon by the project development team, the Technical Advisory Committee, and the Citizens Task Force. The criteria used in the development of horizontal alignment alternatives were the following:

- COT, PCDOT, Marana design standards;
- Avoid impacts to the FEMA 100-year storm floodway for the Santa Cruz River. Roadway cannot encroach on floodway;
- Minimize private right-of-way acquisition
- Minimize floodplain impacts. The roadway structural section must be raised above the FEMA 100-year floodplain level where it travels through it;
- Minimize impacts to slopes on west side of roadway. Minimize the number and size of retaining walls required;
- Minimize wash reconstruction and impacts; and
- Avoid archeological sites.

Several different horizontal alignments were developed while aiming to balance the competing interests of the many constraints and criteria. Project cost was another major factor in the project development process, and it was recognized that a more economically efficient design would be arrived at by effectively balancing and minimizing the many constraints. Through this objective alternative evaluation process a preferred alignment was selected and agreed upon to move forward through the preliminary design process, recognizing that further adjustments to the alignment were likely as more specific and localized design constraints were identified.

The horizontal alignment alternatives were developed for the north portion (Ina Road to El Camino Del Cerro) and the south portion (El Camino Del Cerro to Grant Road) separately, since the two portions or the project have somewhat differing characteristics with regards to topography, drainage needs, density of existing development, mix of public and private lands, and floodplain and floodway encroachment issues. The cultural investigation for the project identified most of the project area as a significant archeological site, meaning that impacts to archeological sites could not be avoided regardless of the horizontal alignment alternative selected.

Ina Road to El Camino Del Cerro

The controlling constraints driving the horizontal alignment for the north section of Silverbell Road differ somewhat from the south section. The density of existing development is much lower in the north section compared to the south, though the majority of properties on the west side of the road are private as in the south section. The east side of Silverbell Road has much more publicly owned land, along with large parcels of undeveloped private commercial/industrial land owned by California Portland Cement. The north section is impacted much more by the Santa Cruz River floodplain, which in several areas encroaches over the existing roadway. In addition, slopes exist along the west side of much of the north section of Silverbell Road from Ina Road to El Camino Del Cerro. The following horizontal alignment alternatives were developed for the north section of Silverbell Road, from Ina Road to El Camino Del Cerro:

1. Existing Alignment: This alternative generally follows the existing Silverbell Road centerline alignment, with slight modifications in the centerline geometry to meet the design criteria outlined in Section 5.0 above. A more significant modification in the horizontal alignment was needed in the vicinity of Benjamin Road to smooth out the existing sharp s-curve with poor site distance. This alignment shift at Benjamin Road is common to all the alternatives.
2. The second alignment alternative has the following characteristics:
 - a. Existing alignment from Ina Road to Abington Road;
 - b. 30’ shift east from Abington Road to El Camino Del Cerro; nd
 - c. Follows the existing road centerline from north of Mallow Lane to Sunset Dunes Place where adequate existing right-of-way width allows.
3. The third alignment alternative has the following characteristics:
 - a. Follows close to existing alignment from Ina Road to Belmont Road;
 - b. 35’ shift to the east from Belmont Road to north of Mallow Lane;
 - c. Follows close to existing alignment from north of Mallow Lane to Sunset Road;
 - d. 30’ shift east from Sunset Road to north of Kiley Court; and
 - e. 40’ shift east from north of Kiley Court to El Camino Del Cerro.

In all the proposed horizontal alignments for the north section of Silverbell Road, the general approach was to widen the roadway to the east to minimize the need for purchasing private residential property, and minimize the impact to slopes and the number of cut retaining walls needed. It was recognized that a trade-off of shifting the alignment to the east was that more of the roadway would fall into

the existing Santa Cruz River 100-year floodplain. In many cases, this couldn't be avoided by a shift to the west and would cause private property impacts and greater impact to slopes and drainage washes. In these areas, the roadway must be raised to be above the floodplain water surface level.

In evaluating the various impacts associated with the above alignment alternatives, Alternative 3 was found to best balance the competing criteria and impacts of the roadway widening. The alignment follows close to the existing right-of-way centerline where the existing right-of-way width is wide enough to accommodate the proposed roadway cross-section, and where slopes will not be significantly impacted. Where existing right-of-way is not wide enough, shifting the centerline east provides opportunity for the widening to occur into undeveloped public and industrial lands, reducing the right-of-way costs of the project. Since the topography of the land slopes to the east toward the Santa Cruz River, the trade off of shifting the alignment to the east results in increased fill needed for the project. Conversely, the benefit of minimizing the impact on the slopes on the west side results in less need for retaining walls or graded slopes in cut sections and better aesthetics of the project.

Alignment Alternative 3 was agreed upon as the “preferred” horizontal alignment for the north section of Silverbell Road and was moved forward in the preliminary design process. Several modifications or refinements have since been made to the alignment to address more localized constraints along the corridor, which have resulted in the alignment described in Section 6.0 above.

El Camino Del Cerro to Grant Road

The horizontal alignment alternatives for the south section of the Silverbell Road project, from Ina Road to El Camino Del Cerro, were developed in a similar manner to the north section. However, the south section of the Silverbell Road project has more existing commercial and residential development, especially in the vicinity of Grant Road. The impacts that the widening of Silverbell Road have on the existing development and private right-of-way were a major constraint in the development of the horizontal alignment in this area. The other primary constraint was the impact to the slopes on the west side of Silverbell Road and minimizing the number and magnitude of the cut walls needed.

The Santa Cruz floodplain and floodway do not encroach in the vicinity of Silverbell Road between El Camino Del Cerro and Grant Road, so this criterion was not a factor in developing the horizontal alignments.

Considering the above information, four horizontal alignment alternatives were developed from El Camino Del Cerro to Grant Road:

1. Existing Silverbell Road Centerline: Generally follows the existing Silverbell centerline alignment from El Camino Del Cerro to Grant Road, with slight variations where necessary to be consistent with the horizontal alignment design criteria presented in Section 5.0 above.
2. 10' Shift East: This alternative generally follows the existing centerline

alignment as in Alternative 1, with the exception of an approximately 10-foot shift east between Sweetwater Drive and Burlwood Way.

3. 30’ shift El Camino Del Cerro to Golf Course Driveway. 10’ shift Golf Course Driveway to Burlwood Way. Existing alignment Burlwood Way to Grant Road.
4. 35’ shift El Camino Del Cerro to Sweetwater Drive. 10’ shift Sweetwater Drive to Goret. Existing alignment Goret Road to Grant Road.

The various horizontal alignment alternatives for the south section of Silverbell Road were evaluated based on the criteria outlined above, with Alternative 4 identified as the “preferred” alternative. From El Camino Del Cerro to Sweetwater Drive, property on the east side of Silverbell Road is owned by City of Tucson or Pima County, and property on the west side is privately owned. Slopes exist on the west side of Silverbell in this section as well. With these constraints in mind, a significant enough shift of Silverbell Road (approximately 35’) to widen the road to the east would best minimize impacts to private right-of-way as well as minimize the impacts to the slopes on the west side and the need for any associated retaining walls or cut slopes.

From Sweetwater Drive to Goret Road the existing right-of-way width is generally 150’ (75’ half) and property along the west side is generally owned by City of Tucson, with a mix of public and privately owned property on the east side of Silverbell Road. Slopes also exist on the west side of Silverbell Road in this section. Given these constraints, the existing right-of-way width needed to be utilized as much as possible by following the existing centerline as closely as possible. A 10’ shift of the roadway to the east, however, reduces the impacts to slopes and reduces the need for retaining walls or grading of slopes.

From Goret Road to Grant Road the existing density of commercial and residential development is much higher than the rest of the project area. Because of this, right-of-way was a particular concern and the objective of the alignment in this area was to minimize the need for purchasing private property for the widening of the roadway. The majority of this section of Silverbell Road has a 150’ existing right-of-way width, which will generally accommodate the proposed Silverbell Road cross-section. Because of this, the alignment should generally follow the existing roadway centerline alignment to minimize impacts.

Alignment Alternative 4 was agreed upon as the “preferred” horizontal alignment for the south section of Silverbell Road and was moved forward in the preliminary design process. Several modifications or refinements have since been made to the alignment to address more localized constraints along the corridor, which have resulted in the alignment described in Section 6.0 above.

10.2 CURB VERSUS UNCURBED

The determination of specific cross-sectional elements was included in the project development process for Silverbell Road. The parameters for many of the roadway elements are specified in the Pima County RDM or other national or local design guidelines. The advantages and disadvantages for both a curbed and uncurbed roadway are summarized below.

Uncurbed Roadway:

- Disabled vehicles can pull off of the roadway onto the shoulder outside the travel way.
- Preferred by some cyclists, raised curb can cause conflicts with pedaling.
- Lack of curb requires a wider buffer between roadway and pedestrian path be provided to increase pedestrian safety.
- Drainage channels in the shoulder are typically required to carry pavement drainage.
- Requires wider right-of-way, due to additional pedestrian path buffer and pavement drainage features.
- Reduced construction cost.

Curbed Roadway:

- Pima County RDM specifies 6” vertical curb for divided urban/suburban roadways with adjacent pedestrian facilities. Vertical curb is also specified for the median on 4-lane divided roadways.
- The AASHTO Policy on Geometric Design of Highways and Streets notes that raised curb provides pavement drainage control, enhanced roadway edge delineation, and delineation and protection of pedestrian walkways, and reduces maintenance operations.
- AASHTO recommends the use of raised curb on lower speed roadways. Silverbell Road is being designed as a low-speed urban/suburban arterial.
- Curb or curb and gutter form the principal drainage system for the roadway. Curb eliminates the need for roadside ditches, and controls runoff from interfering or damaging adjacent sidewalks or pedestrian paths.
- Curb delineates the roadway edge to provide pedestrians and bicyclists a better sense of security and separation from traffic.
- Curb, provides access control, restricting vehicular access to environmentally sensitive and landscaped areas.
- Curb improves long-term landscape appearance.
- Curb lowers maintenance costs (sign knockdowns, damage to drainage inlets, damage to landscape, weeds);
- Use of curb can potentially reduce right-of-way requirements.
- Curb can potentially reduce the length of drainage culverts.
- Curb tends to provide an urban/suburban feel.

Given these advantages and disadvantages of curbed versus uncurbed roadway the stakeholders for the Silverbell Road project reached consensus that a curbed roadway will provide substantial benefits and therefore is appropriate. Since Silverbell Road is fairly urban/suburban in character at the south end of the project, and the project is being designed as a lower-speed urban/suburban arterial, it is reasonable that curb would be utilized consistently throughout the the entire project limits. Additionally, the provision of curb along the outside of the roadway lends itself to the pedestrian and bicycle friendly nature of the corridor by providing clear delineation of the roadway edge and a physical separation

between vehicles and pedestrians. Finally, the use of vertical curb allows for a slightly narrower right-of-way, reducing the environmental impacts of the project consistent with the environmentally sensitive roadway classification of the project.

The advantages and disadvantages of at-grade and raised median options are summarized below.

At-Grade Median:

- Typically lower construction cost.
- Provides a more rural roadway feel.
- An uncurbed median provides more opportunity for gathering pavement runoff into median for water harvesting, although water harvesting can be accomplished with curb as well.
- Uncurbed medians do not provide physical access control. Vehicles can simply cut through the median to make a turn, damaging landscape and signing.

Raised/Curbed Median:

- Curbs provided improved roadway delineation, especially at night.
- A raised median provides improved access control and eliminates median cut-through traffic.
- A raised median reduced the potential of cross-over crashes.
- A curbed median has lower maintenance costs (sign knockdowns, damage to landscaping, less weeds, less debris).
- A raised median enhances long-term landscape appearance and roadway aesthetics.
- A raised median provides a more urban/suburban feel and contributes to lower speeds.

Given these advantages and disadvantages, project stakeholders reached consensus that raised vertical curb should be used. Vertical curb in the median allows for the establishment of more significant landscaping, fitting the goals of providing a desert parkway character of the corridor and reducing the visual impact of the wider roadway. The raised curb median also provides better delineation of the road edge and provides better access control than if no curb is used.

10.3 FRONTAGE ROAD ACCESS ALTERNATIVES

Access is currently provided to residences on the east side of Silverbell Road from Abington Road to Belmont Road via a two-way frontage road. The existing frontage road is separated from Silverbell Road through lanes by a narrow buffer of trees and landscaping that is not well defined. Several openings in the separation buffer exist, creating several access and egress points to and from Silverbell Road. The proposed horizontal alignment through this section of Silverbell Road is shifted approximately 13 feet east of the existing roadway center line. With this alignment shift in combination with the widening of Silverbell Road, the new road will impact the existing frontage road and reduces

the width available for maintaining the two-way operation if a new frontage road were to be constructed. This area is unique to the project in the fact that there are eighteen residential driveways along 1500 feet of road frontage.

Several access alternatives were developed in the frontage road area to provide safe, efficient access to the residential properties on the east side of Silverbell Road, while still maintaining the high mobility function of the arterial roadway. The alternatives were as follows:

1. One-way northbound frontage road: The frontage road would be 15’ wide, separated from the Silverbell Road northbound through lanes by a 6’ wide raised median. There are potential limitations to emergency vehicle access with this alternative.
2. One-way southbound frontage road: The frontage road would be 15’ wide, separated from the Silverbell Road northbound through lanes by a 6’ wide raised median. Limitations with this alternative include the movement of vehicles in the opposite direction of adjacent Silverbell Road traffic, and potential for vehicles to enter in the wrong direction. There are potential limitations to emergency vehicle access.
3. Two-way frontage road: The frontage road would be a minimum of 20’ wide, separated from the Silverbell Road northbound through lanes by a 4-6’ wide raised median. Separation using a highway “Jersey” barrier was also discussed in order to reduce the cross-section, though safety and aesthetic concerns were noted with this approach, as crash attenuators would also be needed. Southbound access and northbound egress to the frontage road would only be provided through a directional median opening on the north end, and would require northbound vehicles exiting to proceed northbound and make a u-turn if needed at the next median opening at Abington Road. Northbound access and southbound egress to the frontage road would be at the southern end via a directional median opening. A limitation with this configuration is that it provides potential for southbound vehicles in the frontage road to exit into the northbound lanes. Also, northbound vehicles that miss the entrance to the frontage road may be inclined to try to make the sharp u-turn movement into it at the northern end. Other limitations associated with this alternative are significant increased right-of-way and slope impacts on the east side due to the increased roadway cross-section width.
4. Continuous northbound right-turn deceleration lane: This alternative would not utilize a frontage road concept, but instead would provide a third lane in the northbound direction. The added lane would be on the outside of the bike lane, and would be signed and operate as a continuous right-turn deceleration lane for vehicles turning into the residential driveways. This alternative provides no physical separation of the driveways from the roadway, but has the least right-of-way and slope impacts of the four alternatives. On-site circulation for each property must also be provided through adequate turn-around areas or horseshoe driveway configurations to ensure that vehicles do not back out onto Silverbell Road.

The four alternatives were presented and discussed with Pima County and Town of Marana staff and the two preferred alternatives were numbers 3 and 4. Concerns with potential wrong-way movements and limited emergency vehicle access ruled out the one-way frontage road alternatives 1 and 2. The additional northbound right-turn lane in Alternative 4 was chosen as the preferred alternative because of the lesser right-of-way and slope impacts. Alternative 4 also reduces the need for directional median openings, and full median openings can be provided at Abington Road, DeGreen Lane and Belmont Road. The additional northbound right-turn deceleration lane was presented to the property owners for which it would serve, and the concept was generally accepted as providing adequate and comparable access to their properties.

10.4 SLOPE VS. WALL ALTERNATIVE

Though the widening of Silverbell Road was designed to minimize the impact to the hills and slopes on the west side of the corridor, some impacts could not be avoided because of other design constraints. In some areas it is necessary to cut into the hillsides significantly to accommodate the roadway, which means roadside grading or retaining wall treatments are also needed. Because of the scenic nature of the Silverbell Road corridor, impacts to the existing landscape must be minimized to retain the aesthetic character. As shown in the typical sections provided in the plans, several options exist for roadside tie-in treatments, including cut slopes of varying steepness, and retaining walls. Several advantages and disadvantages to each treatment exist, including the following:

- Cut slopes:
 - Can retain the existing landscape character by grading and re-planting with native vegetation;
 - Less initial construction cost and provides needed fill material;
 - Slopes should not be steeper than 4:1 for successful re-vegetation, increasing the impacted cut area;
 - Temporary irrigation for 3 years is needed to successfully re-vegetate, increasing maintenance and operations costs.
- Retaining walls:
 - Less right-of-way impact. Walls may be placed at the clear zone, reducing the need to purchase right-of-way;
 - May be constructed with varying face treatments to resemble natural geographic features, provide public art, or incorporate vegetation;
 - May change the existing character and aesthetic of the corridor, which may be viewed in a negative or a positive way by users;
 - More costly to construct, especially as wall height increases.

Several options for treatments in roadway cut sections were presented to the Citizens Task Force as well as the Technical Advisory Committee, including examples of existing treatments already implemented in the region. Feedback was solicited to determine the priorities of both the citizens/road users as well as the agencies who will be maintaining the roadway. The following priorities related to roadway cut treatments came out of this process:

- Ensure that any graded slopes in cut sections can be re-vegetated with native plants to reduce the visual impact of the project;

- Retaining walls are preferred along private property frontages to reduce or eliminate right-of-way impacts;
- Retaining walls should be limited in height, for aesthetics as well as cost;
- Size and length of graded cut slopes should be minimized to reduce visual impact as well as right-of-way impacts; and
- Retaining walls should be located outside the clear zone to eliminate the need for guardrail.

Based on the priorities of the various stakeholders, the following approach is recommended for treatments in roadway cut sections for Silverbell Road:

- In cut sections with inadequate right-of-way abutting private property, utilize soil nail retaining walls with wall face treatments to minimize visual impacts; and
- In cut sections with adequate right-of-way width or abutting publicly owned land, utilize graded cut slopes with a maximum slope of 4:1. Where the graded slopes will extend further than 50 feet horizontally beyond the roadway hinge, short retaining walls will be utilized to reduce the length of graded slope.
- Where short retaining walls (i.e. < 5’) are required, masonry walls or 2:1 slopes with grouted hand placed rip-rap or sculpted shotcrete will be considered.

11.0 COST AND BUDGET

11.1 PROJECT COST

A summary of the estimated project costs based on the current design level for each roadway section is provided in Table 8. The estimates reflect current (2010) median construction bid prices. Comparative project costs are provided for a full 4-lane divided roadway from Ina Road to El Camino del Cerro versus 3-lanes from Ina Road to Sunset Road and 4-lanes from Sunset Road to El Camino del Cerro. The 3-lane costs are based on an uncurbed roadway cross section that includes right-turn deceleration lanes at side streets. Detailed preliminary construction cost estimates are provided in Appendix C.

Some reduction in construction costs can be realized by eliminating retaining walls in favor of slopes where private property is not impacted, reducing the length that culverts extend beyond the edge of roadway and install guardrail, and using box culverts instead of bridge structures. Additional cost reductions may be realized through value analysis during final design.

Table 8: Preliminary Cost estimate

	Ina Road to El Camino del Cerro		El Camino del Cerro to Grant Road
	4-Lane	3-Lane/4-Lane (1)	4-Lane
Construction	\$35,750,000	\$32,050,000	\$35,300,000
Construction Engineering/Admin. (15%)	\$4,300,000	\$3,800,000	\$4,200,000
Construction Cost	\$40,050,000	\$35,850,000	\$39,500,000
Final Design (10%)	\$ 3,600,000	\$3,200,000	\$3,500,000
404 Permitting	\$ 250,000	\$250,000	\$250,000
Archeological Clearance	\$8,000,000	\$7,000,000	\$ 4,000,000
Right-of-Way	\$3,100,000	\$2,200,000	\$750,000
Project Cost	\$55,000,000	\$48,500,000	\$48,000,000

1. 3-lane Ina Road to Sunset Road; 4-lane Sunset Road to El Camino del Cerro

11.2 BUDGET CONSIDERATIONS

Funding currently committed for the widening of Silverbell Road includes \$42.7 million of RTA funds and \$14.4 million from the City of Tucson, Pima County, and the Town of Marana, for a total of \$57.1 million. Additional funds will be requested from the RTA for implementation of the proposed wildlife crossing enhancements, estimated at \$1 million. Based on the estimated cost to implement the proposed improvements for the entire 7.6 miles of Silverbell Road, additional local and/or regional funding will be required.

12.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the preliminary engineering and environmental planning that has been completed, the following is concluded and recommended relative to the widening of Silverbell Road from Ina Road to Grant Road.

- Provision of a 4-lane divided roadway from Ina Road to Grant Road will provide the capacity necessary to provide LOS D operations for the current 2040 traffic projections on Silverbell Road. A 4-lane divided cross section from Ina Road to Sunset Road is preferred by project stakeholders, including the Town of Marana And Pima County. Considering that construction of the Ina Road to Sunset Road section is not scheduled to begin until 2022, traffic projections for this section should be re-evaluated prior to beginning final design to confirm the necessary capacity requirements.
- A raised median and outside curbs provide distinct advantages to traffic operations, access control, vehicular and pedestrian safety, and maintenance. These roadway features are preferred by project stakeholders and are recommended.
- Provision of dedicated bicycle and pedestrian facilities on Silverbell Road will support multimodal travel within the corridor as well as the planned recreational development of the adjacent Santa Cruz River. Recommended facilities include 6-ft wide asphalt bicycle lanes (excluding gutter), a continuous asphalt pedestrian path on the east side between Ina Road and Grant Road, and provisions for pedestrians and equestrians along the west side.
- Considering the prevalence of archeological sites within the corridor, avoidance of impacts is not feasible. Rather, design and implementation of roadway improvements will focus on minimizing and mitigating impacts. As such, the proposed roadway cross section includes minimum lane, median, and shoulder widths per agency standards.
- Of the 73 drainage crossings, 58 are proposed to be jurisdictional waters of the U.S. Considering that the impact on several crossings will likely exceed ½ acre, coupled with the archeological clearance process which will be led by the U.S. Corps of Engineers, it is expected that individual Section 404 and 401permits will be required in several construction phases. It is recommended that consultation with the Corps and ADEQ be initiated upon approval of the jurisdictional delineation to define the necessary permitting processes.
- While Silverbell Road is intended to function as a principal arterial, the existing and desired characteristics of the corridor and the need to minimize impacts to archeological sites and washes, supports roadway geometry that limits excessive speed (>50 mph). The recommended design speed is 50 mph for the more rural section from Ina Road to Goret Road and 45 mph for the more densely developed section from Goret Road to Grant Road.

- The Santa Cruz River floodplain currently inundates much of Silverbell Road north of El Camino del Cerro. As such, the new roadway in this area will need to be elevated on fill.
- Recommended cross drainage structures will accommodate the 100-yr storm. Culvert profiles will generally be set below existing ground to minimize structure sizes, avoid raising the upstream water surface elevation, and minimize the amount the roadway will need to be elevated and associated impacts on archeological sites. Upstream and downstream grading will be as short as possible to minimize environmental and 404 impacts.
- Significant wildlife movement between the Tucson Mountains and Santa Cruz River occurs along Silverbell Road. Widening the roadway without adequate accommodation for wildlife connectivity would likely result in negative impacts to the long-term persistence of species in the area. Recommended mitigation measures include slight increases in the size of drainage culverts in specified priority crossing corridors to encourage use by wildlife, provision of culvert inlet/outlet designs that accommodate wildlife access, application of a landscape concept along the entire corridor that encourages use of culvert crossings and discourages at-grade crossing, minimizing illumination from roadway lighting at culvert crossings, and installing additional small diameter pipes within priority crossing areas to accommodate smaller species. Implementation of 8-ft high fencing within the priority corridors is not recommended until its effectiveness has been determined by on-going studies being conducted by the Arizona Game and Fish Department.
- The recommended access plan includes median openings at commercial properties and residential side streets which serve higher traffic volumes. Median openings at individual residential driveways will not be provided, however frequent median openings will allow for convenient U-turn opportunities.
- It is anticipated that a new traffic signal will be warranted at the T-intersection that is created when the Sunset Road extension from Silverbell Road to I-10 is constructed. The new intersection will be located 1,500 feet south of the existing Sunset Road T-intersection. The existing T-intersection may have to be signalized also, depending upon future traffic demand when the extension is in place.
- Existing overhead and underground utilities will be impacted, potentially significantly. Widening of the roadway and shifting of the alignment in some areas will require that power poles be relocated. Placing overhead lines (power and communications) underground is not a requirement of the roadway widening nor is it planned by TEP or the communications providers. Water, gas, and communications lines will be impacted by the drainage culverts that will be installed. The depth of the 42” water main and 24” reclaimed water main are being verified to determine the need to lower these lines. It is recommended that gas and communications lines be accurately located during final design.

- The recommended roadway alignment is intended to minimize right-of-way impacts to private property, however, a substantial amount of right-of-way acquisition will still be required, particularly on the section from Ina Road to Grant Road. Acquisitions will include roadway right-of-way, slope easements, and drainage easements.
- Based on estimated construction costs of the proposed improvements, additional funding beyond that currently committed in the RTA program will be required. Some cost savings may be realized through value engineering during final design.
- Implementation and maintenance of a SWPPP will be required for each Silverbell Road construction phase.

13.0 REFERENCES

1.

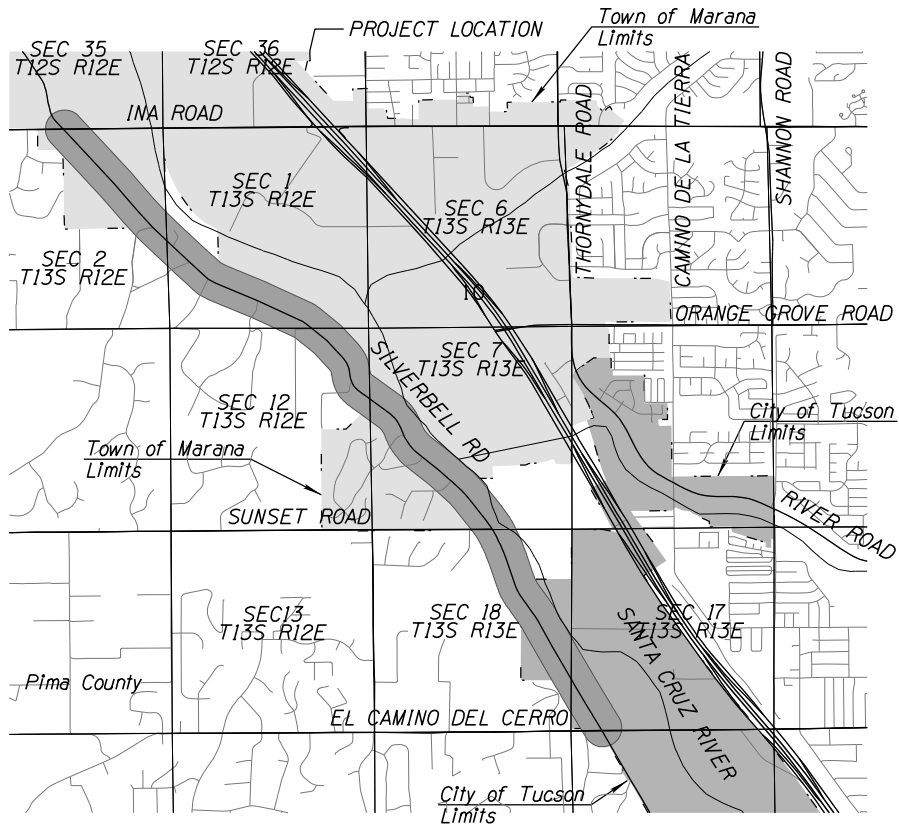
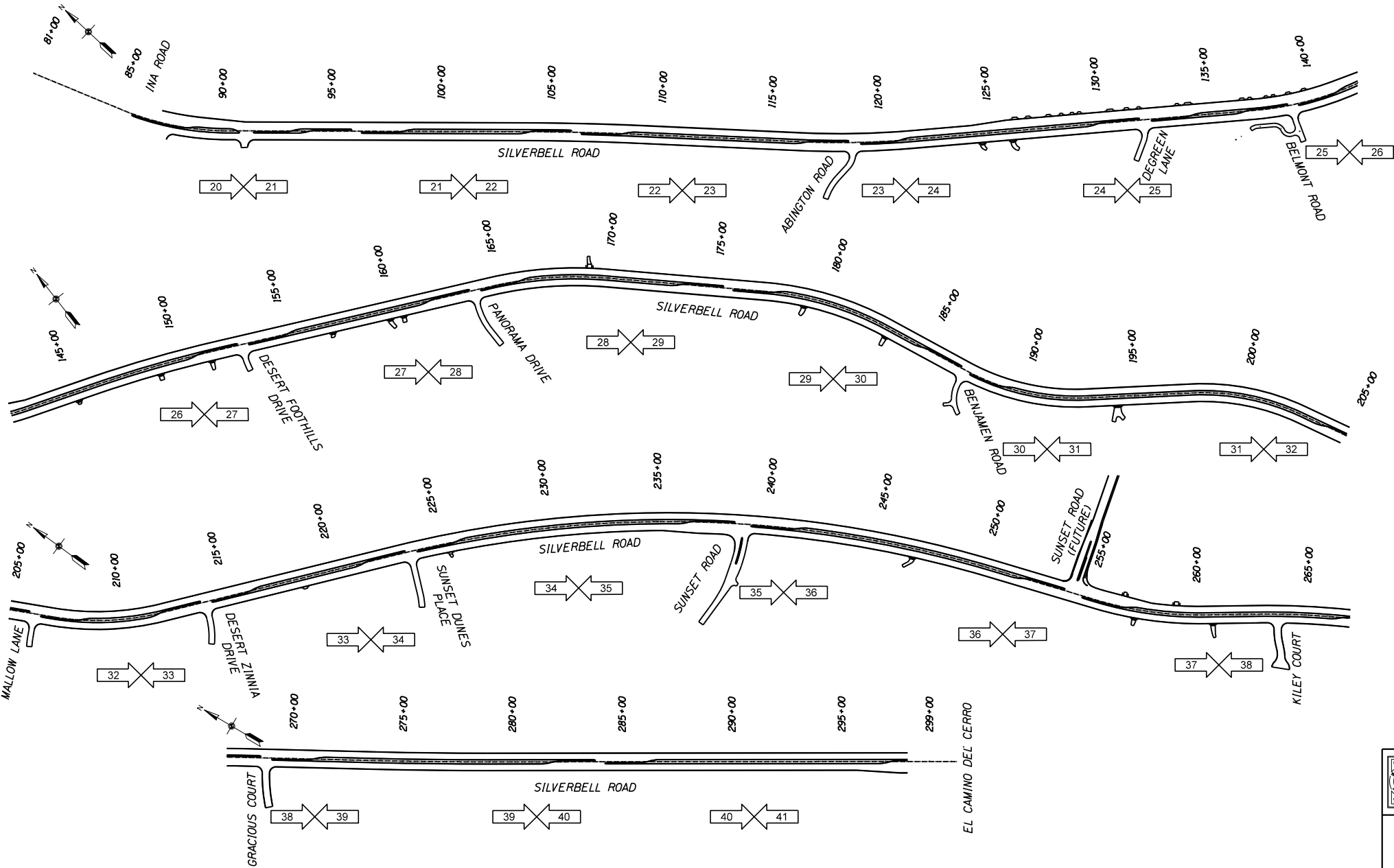
1. Traffic Engineering Report, Silverbell Road, Grant Road to Ina Road, Kittelson & Associates, September 2009.
2. Hydrologic and Hydraulic Analysis for Existing Conditions, Silverbell Road, Grant Road to Ina Road, HDR, October 2010.
3. Hydrologic and Hydraulic Analysis –Proposed Cross Drainage, Silverbell Road, Grant Road to Ina Road, HDR, April 2011.
4. Pavement Drainage Report, Silverbell Road, El Camino del Cerro to Grant Road, Kittelson & Associates, October 2010.
5. Preliminary Jurisdictional Delineation of Waters of the United States, Silverbell Road, Grant Road to Ina Road, EcoPlan, September 2010.
6. Preliminary Initial Site Assessment for Silverbell Road Widening Project, SWCA Environmental Consultants, November 10, 2009.
7. Class III Cultural Resources Survey on Silverbell Road from Grant Road to Ina Road, SWCA Environmental Consultants, Final Report, June 2010.
8. Biological Evaluation of the Silverbell Road Widening Project , Grant Road to El Camino del Cerro, SWCA Environmental Consultants, November 2009.
9. Biological Evaluation of the Silverbell Road Widening Project , El Camino del Cerro to Ina Road, SWCA Environmental Consultants, November 2009.
10. Wildlife Linkage Assessment, Silverbell Road (South); SWCA Environmental Consultants, February 2010.
11. Wildlife Linkage Assessment, Silverbell Road (North); SWCA Environmental Consultants, February 2010.
12. Visual and Aesthetic Resource Analysis, Silverbell Road, Grant Road to Ina Road, McGann & Associates, July 2010.
13. Noise Report, Silverbell Road, Ina Road to Grant Road, Kittelson & Associates, September 2010.
14. Environmental Design and Mitigation Report, Silverbell Road, El Camino del Cerro to Grant Road, HDR, April 2011.
15. Environmental Screening Results Memorandum. Silverbell Road, El Camino del Cerro to Grant Road, HDR, April 2011.
16. Land Use and Zoning within the Silverbell Corridor, Swaim & Assoc., August 2009.
17. Draft Preliminary Geotechnical Report for Silverbell Road, El Camino del Cerro to Grant Road, NCS Consultants, April 2011.
18. AASHTO, A Policy on Geometric Design of Highways and Streets, 2004.
19. AASHTO, Roadside Design Guide, 2002.
20. Pima County Department of Transportation, Roadway Design Manual, Second Edition and Addenda, 2003.
21. Transportation Access Management Guidelines for the City of Tucson, July 2010.

Appendix A
Preliminary (15%) Roadway Plans – Ina Road to El Camino del Cerro

CITY OF TUCSON, ARIZONA
SILVERBELL ROAD
INA ROAD TO EL CAMINO DEL CERRO
ROADWAY AND DRAINAGE IMPROVEMENTS
C.O.T JOB NO. SR6A

PROPOSED PROJECT BEGINS SOUTH OF INA ROAD AND ENDS NORTH OF EL CAMINO DEL CERRO
THE 4 MILES OF NEW ROADWAY IMPROVEMENTS INCLUDE A FOUR LANE DIVIDED ROADWAY,
RAISED MEDIANS, BIKE LANES, MULTI-USE PATH, PAVEMENT MARKINGS,
STRIPING AND SIGNING, AND DRAINAGE IMPROVEMENTS.

PLAN AND PROFILE SHEET LAYOUT



LOCATION MAP

SCALE: 1" = 1 MILE
T-12S, R-13E
Section 35
T-13S, R-12E
Sections 1, 2, 12
T-13S, R-13E
Sections 7, 17, 18
G & SR B&M

INDEX OF SHEETS

PAGE NUMBER	SHEET NUMBER	DESCRIPTION
1	CS1	COVER & INFORMATION SHEET
2-3	NOT1-NOT2	GENERAL NOTES AND LEGEND
4-10	TYP1-TYP7	TYPICAL SECTIONS
11-19	SC1-SC9	SURVEY CONTROL
20-48	PP1-PP29	ROADWAY PLAN AND PROFILE
49-70	CPP1-CPP22	CULVERT PLAN AND PROFILE
71-81	PM1-PM11	PAVEMENT MARKING PLAN

Acceptance _____ Date _____
Orville Saling, Director of Public Works
Town of Marana

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
INA ROAD TO EL CAMINO DEL CERRO



CITY OF
TUCSON

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

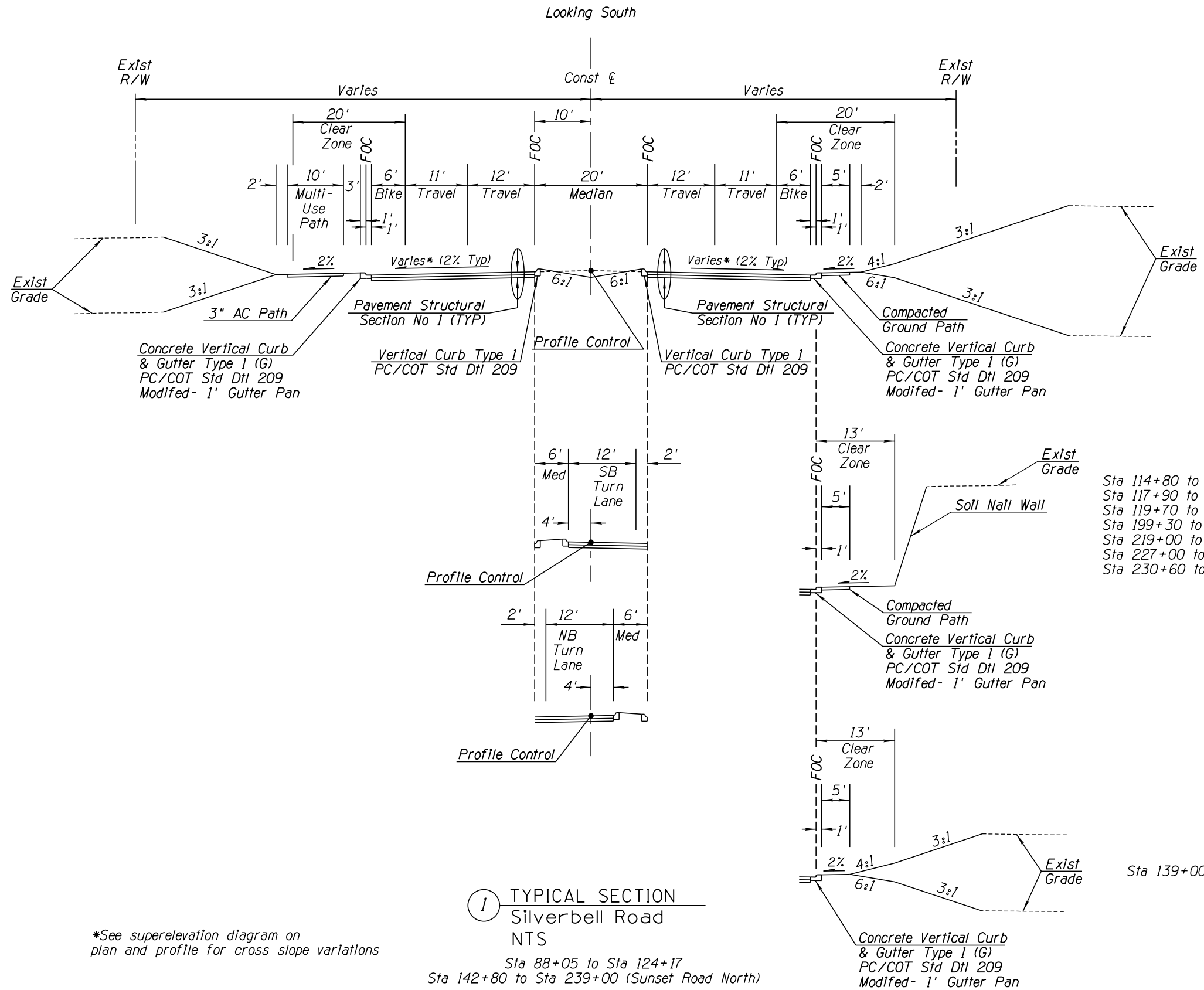
Approvals	Signatory	Date	Approved _____ 20__	1 OF 81
DESIGN SECTION				
TRAFFIC ENGINEERING				
TRANSPORTATION PLANNING				
ENGINEERING LANDSCAPE ARCH				
ENGINEERING ADMINISTRATOR				
DRWN. BY LAS/TMR 20_11	DSGN. BY MDA/JBB 20_11	CHKD. BY JAS 20_11	REF. _____ SCALE: _____	PLAN NO. I-2010-005



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

PCWWM NO. U-2006-054 NO. DATE REVISION BY CHKD. APPR.



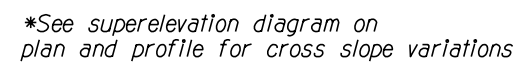


Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.
-----	------	----------	----	-------	-------

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

TYPICAL SECTION			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			
DRWN. BY	LAS/TMR	REF.	SCALE:
DSGN. BY	JBB/JAS		
CHKD. BY	JAS		
CITY OF TUCSON		PLAN NO. I-2010-005	
4		Typ 1 OF 81	

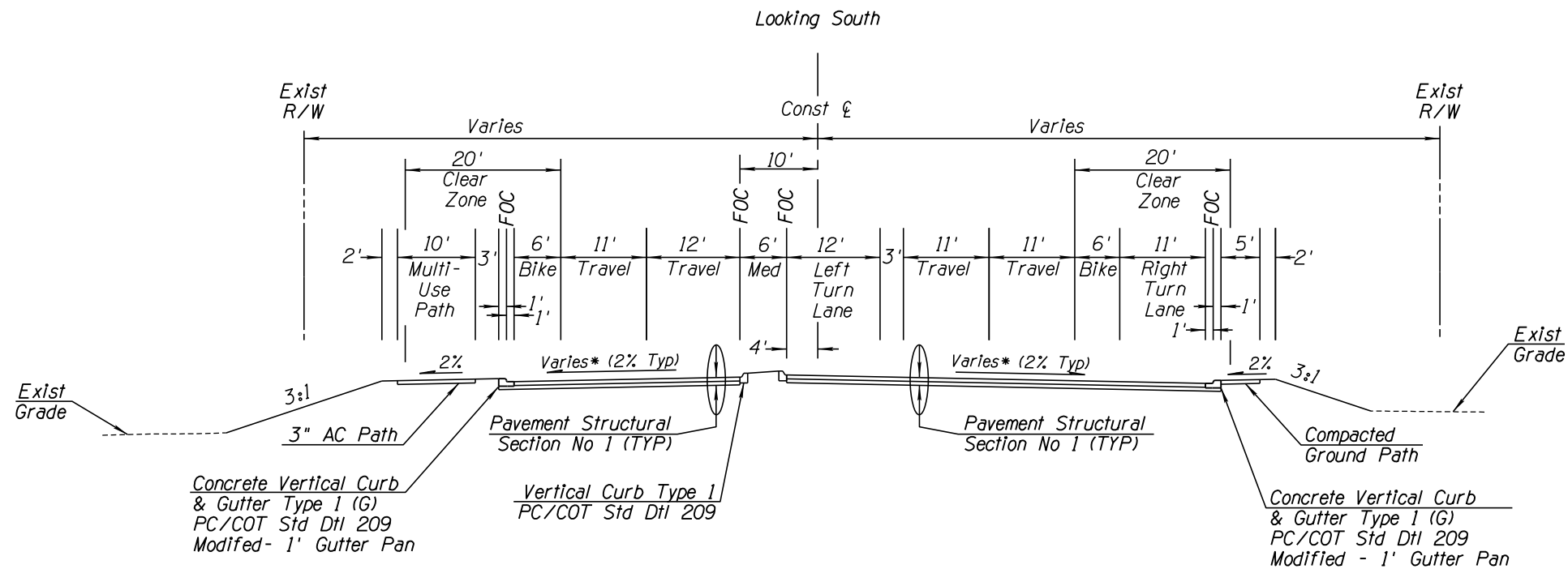


PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

7/5/2011
H:\profile\9589 - Silverbell Road DCR\15%-North\03 Typ\svb-Typ02.dgn



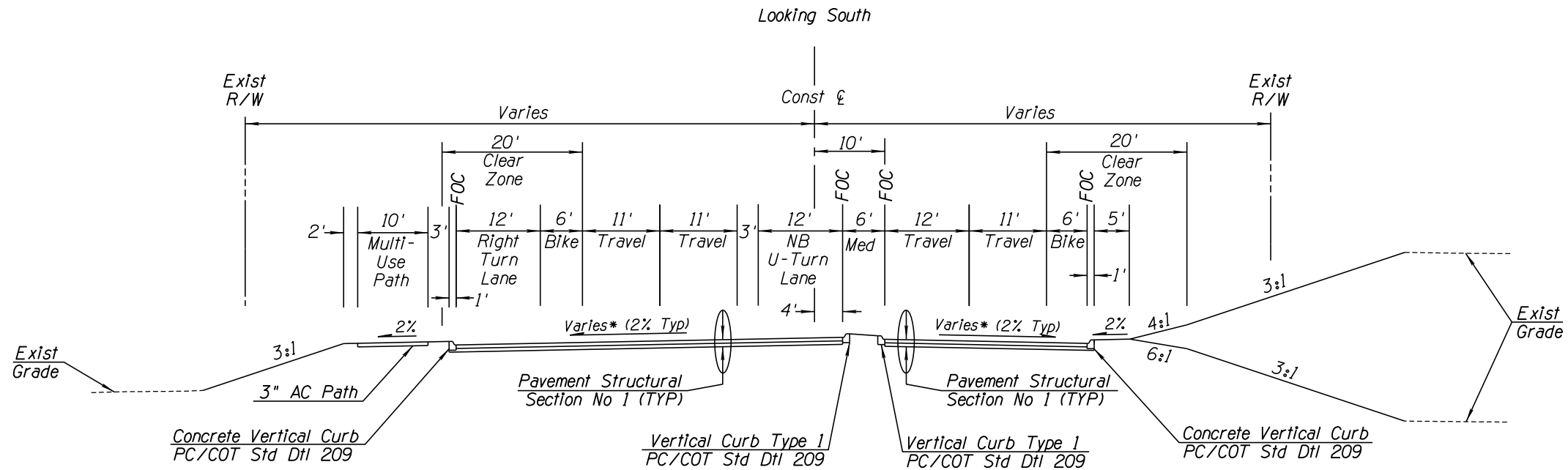
K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067



3 TYPICAL SECTION
Silverbell Road
NTS

*See superelevation diagram on
plan and profile for cross slope variations

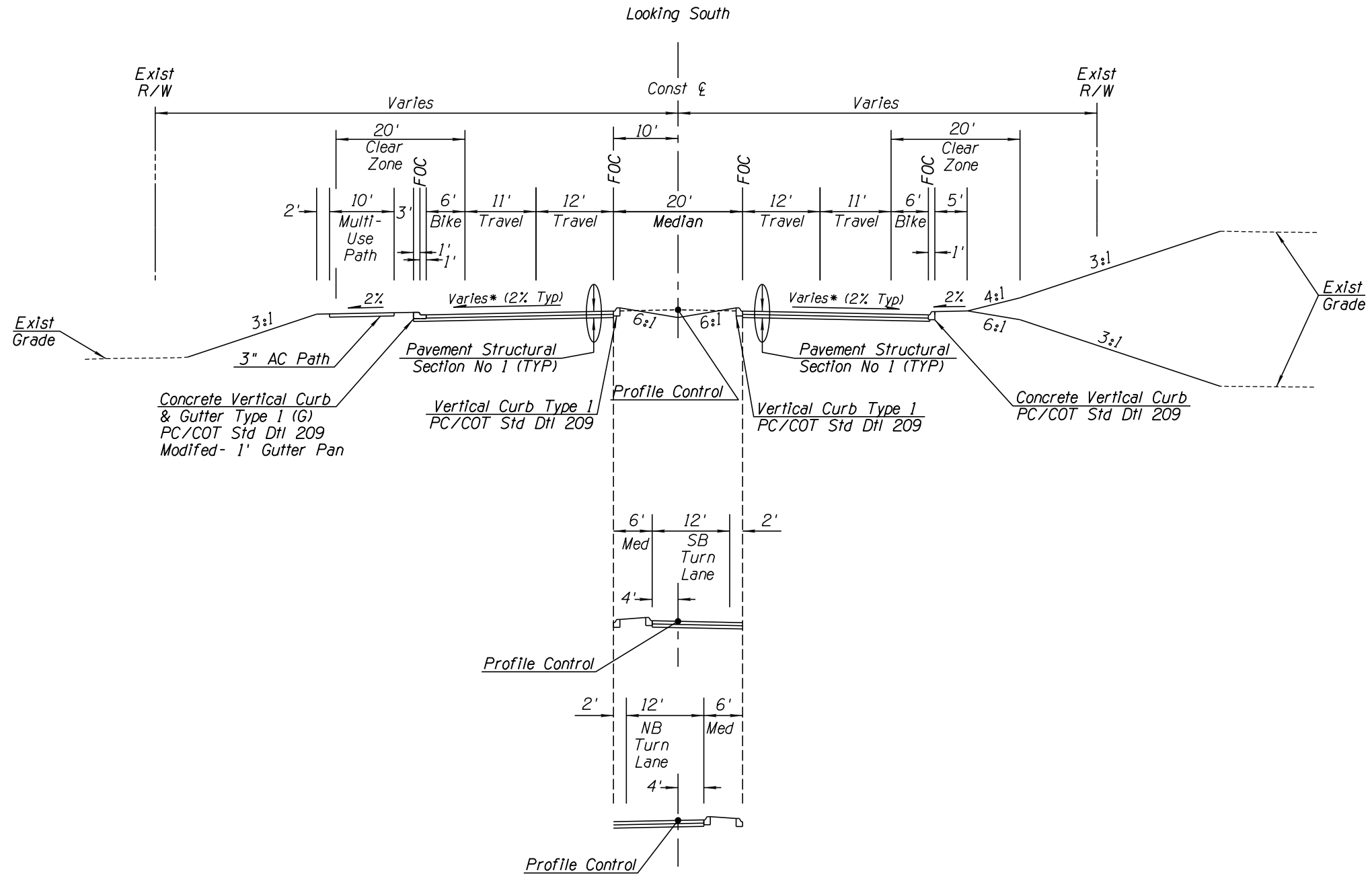
North Leg - Sunset Road North Intersection
Sta 236+87 to Sta 238+51



4 TYPICAL SECTION
Silverbell Road
NTS

*See superelevation diagram on
plan and profile for cross slope variations

South Leg - Sunset Road South Intersection
Sta 254+72 to Sta 256+37



5 TYPICAL SECTION
Silverbell Road
NTS

Sta 239+00 (Sunset Road North)
to Sta 254+25 (Sunset Road South)

*See superelevation diagram on
plan and profile for cross slope variations

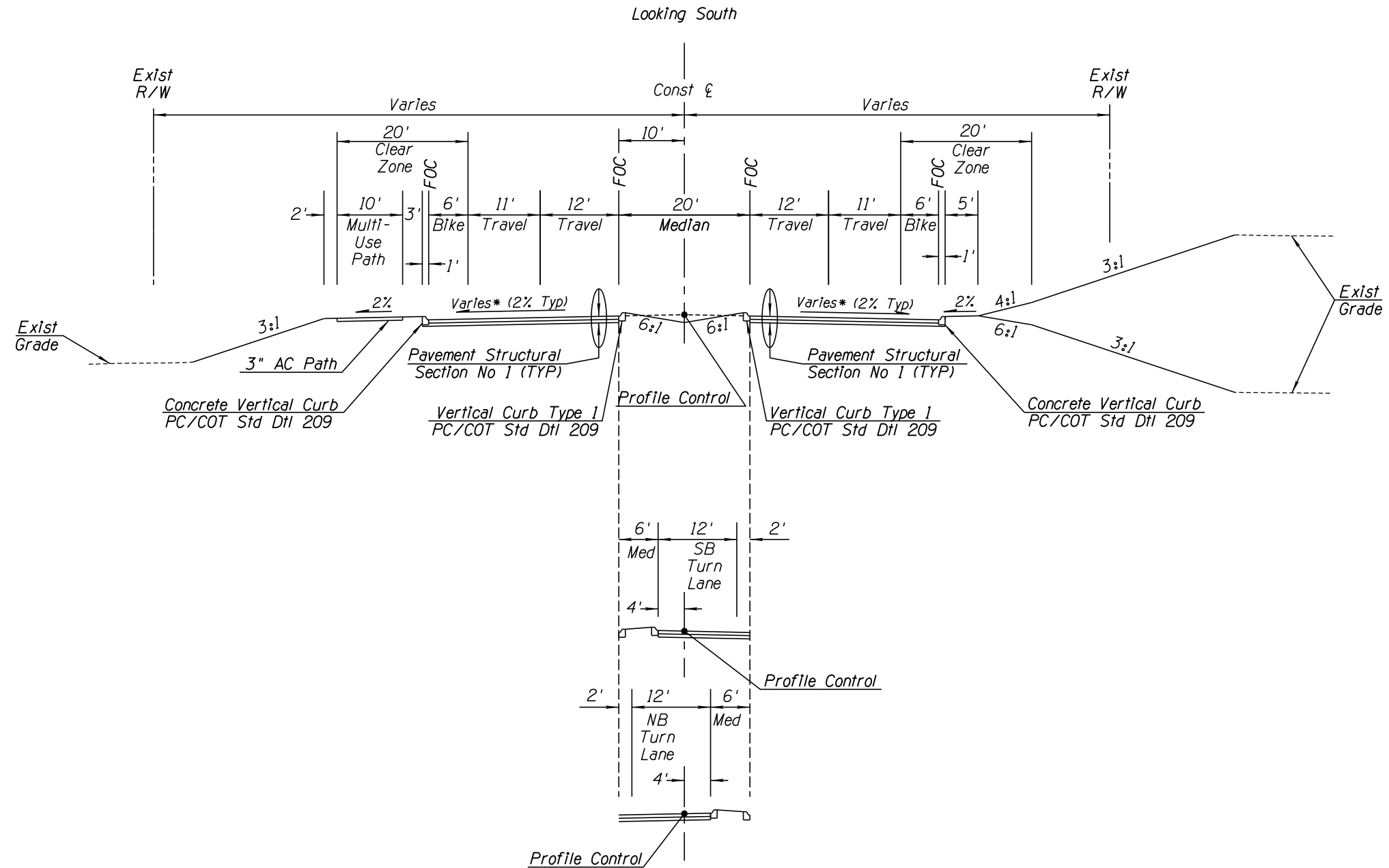


K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

TYPICAL SECTION			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			7
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			Typ 4 OF 81
CITY OF TUCSON	DRWN. BY	LAS/TMR	REF. _____ SCALE: _____
	DSGN. BY	JBB/JAS	_____
	CHKD. BY	JAS	PLAN NO. I-2010-005



6 TYPICAL SECTION
Silverbell Road
NTS

Sta 254+25 (Sunset Road South)
to Sta 299+00 (El Camino Del Cerro)

*See superelevation diagram on
plan and profile for cross slope variations

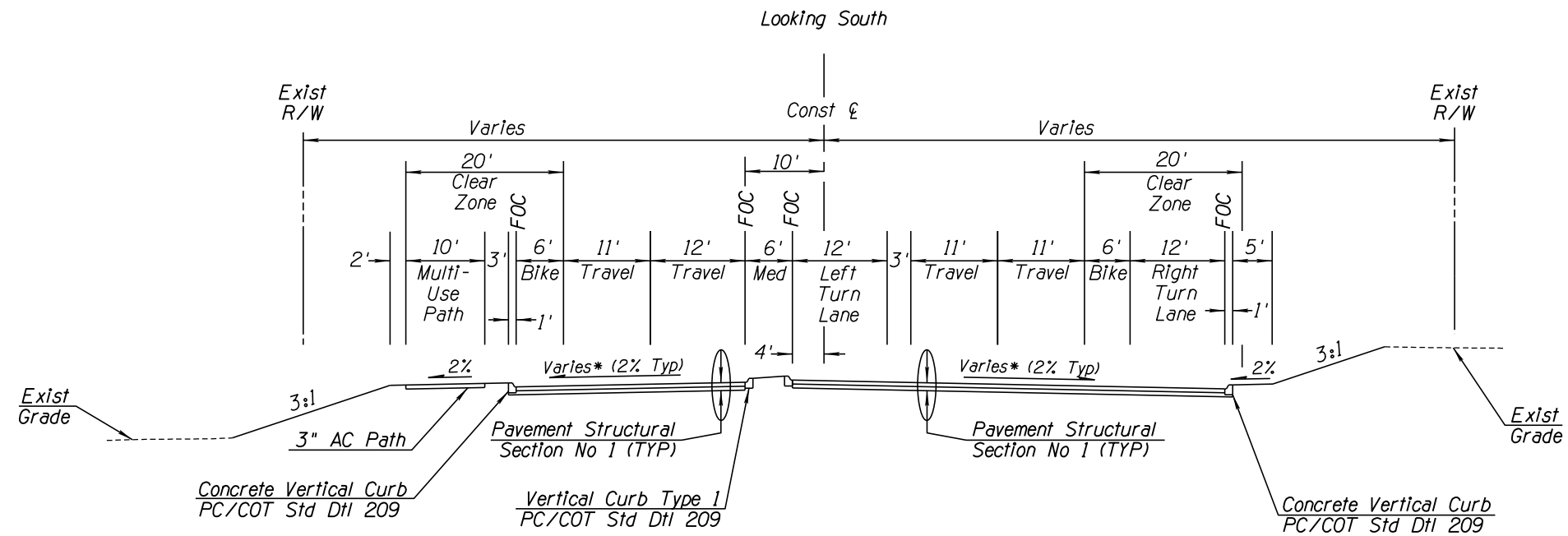


Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

TYPICAL SECTION			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			8
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			Typ 5 OF 81
DRWN. BY	LAS/TMR	REF.	SCALE:
DSGN. BY	JBB/JAS		
CHKD. BY	JAS		
CITY OF TUCSON			PLAN NO. I-2010-005

NO.	DATE	REVISION	BY	CHKD.	APPR.
-----	------	----------	----	-------	-------



7 TYPICAL SECTION
Silverbell Road
NTS

*See superelevation diagram on
plan and profile for cross slope variations

North Leg - El Camino Del Cerro Intersection
Sta 297+63 to Sta 299+00

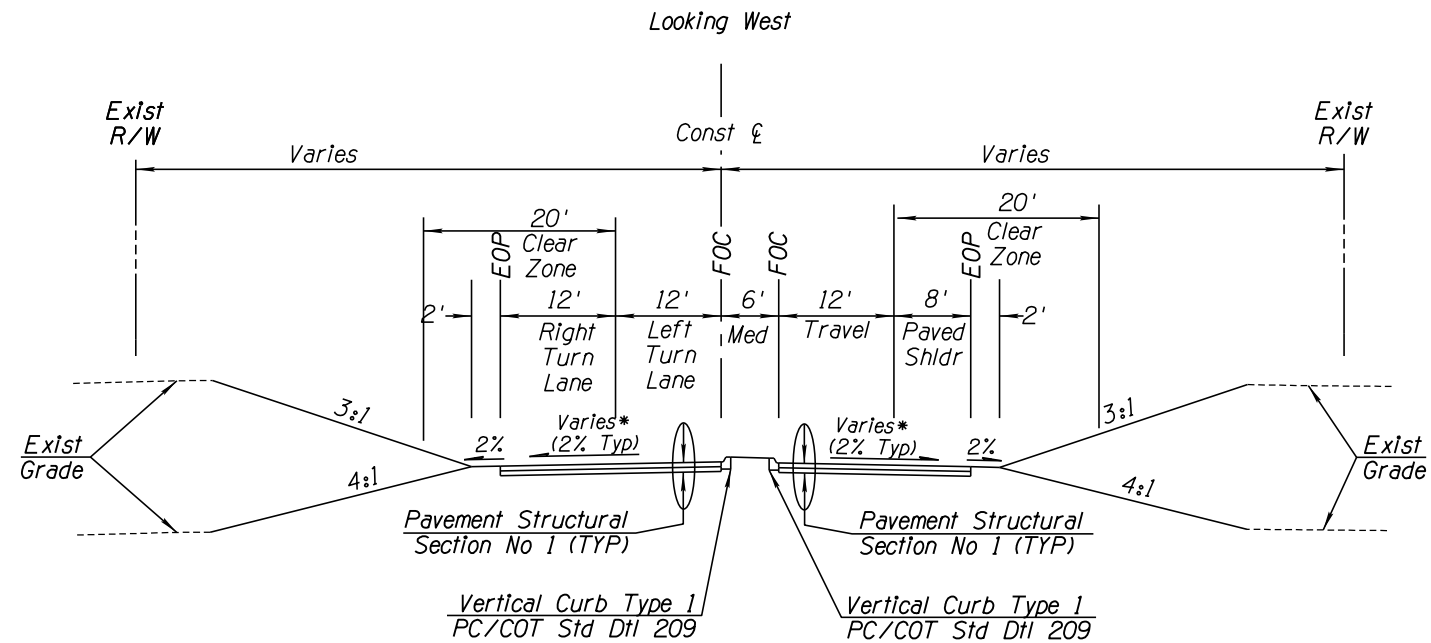


K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.

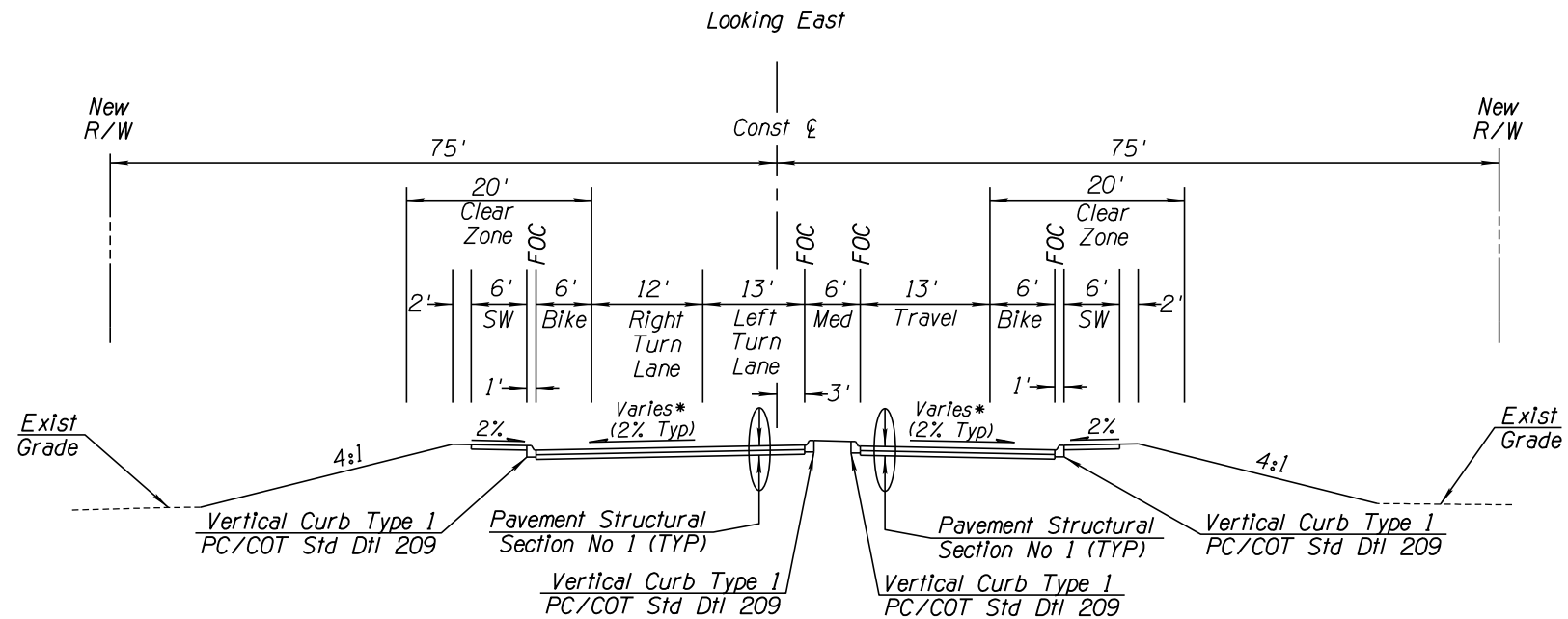
PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

TYPICAL SECTION			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			9
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			Typ 6 OF 81
CITY OF TUCSON	DRWN. BY	LAS/TMR	REF. _____ SCALE: _____
	DSGN. BY	JBB/JAS	_____
	CHKD. BY	JAS	PLAN NO. I-2010-005



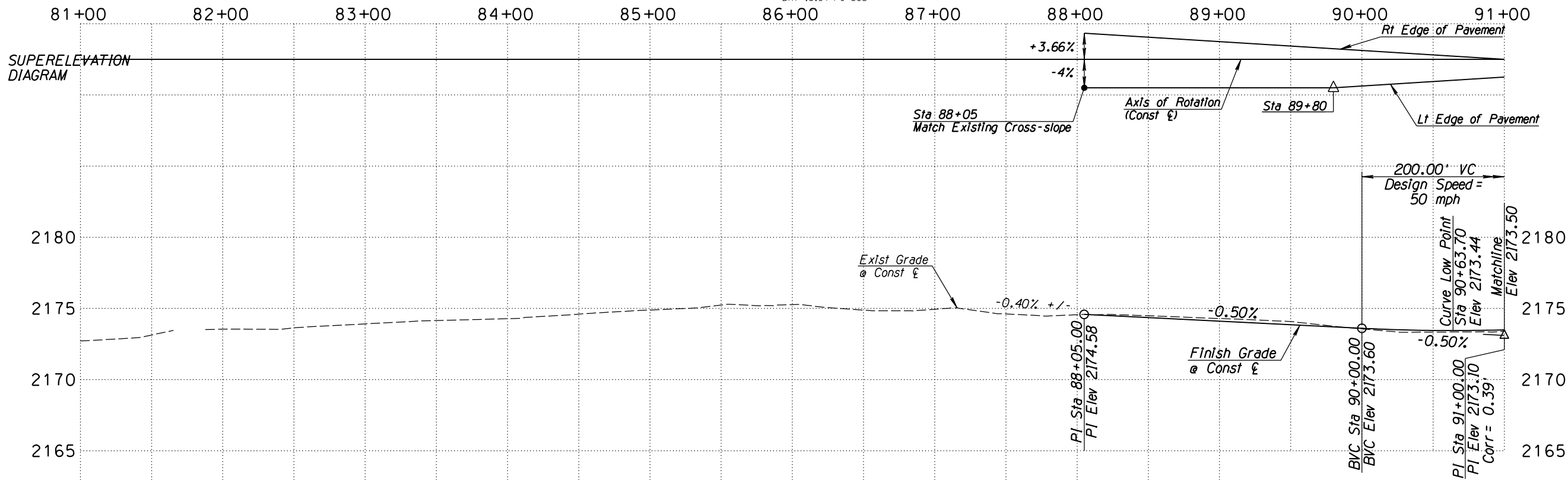
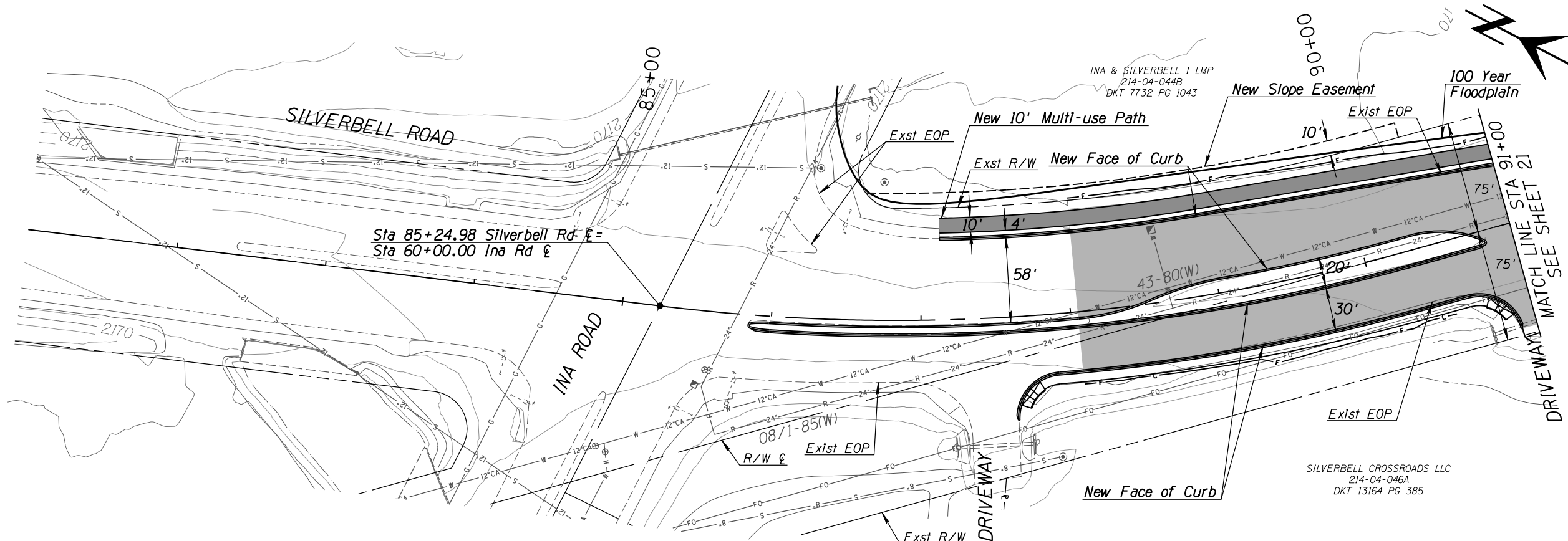
8 TYPICAL SECTION
Sunset Road North
NTS
West of Silverbell Road

*See superelevation diagram on
plan and profile for cross slope variations



9 TYPICAL SECTION
Sunset Road South
NTS
East of Silverbell Road

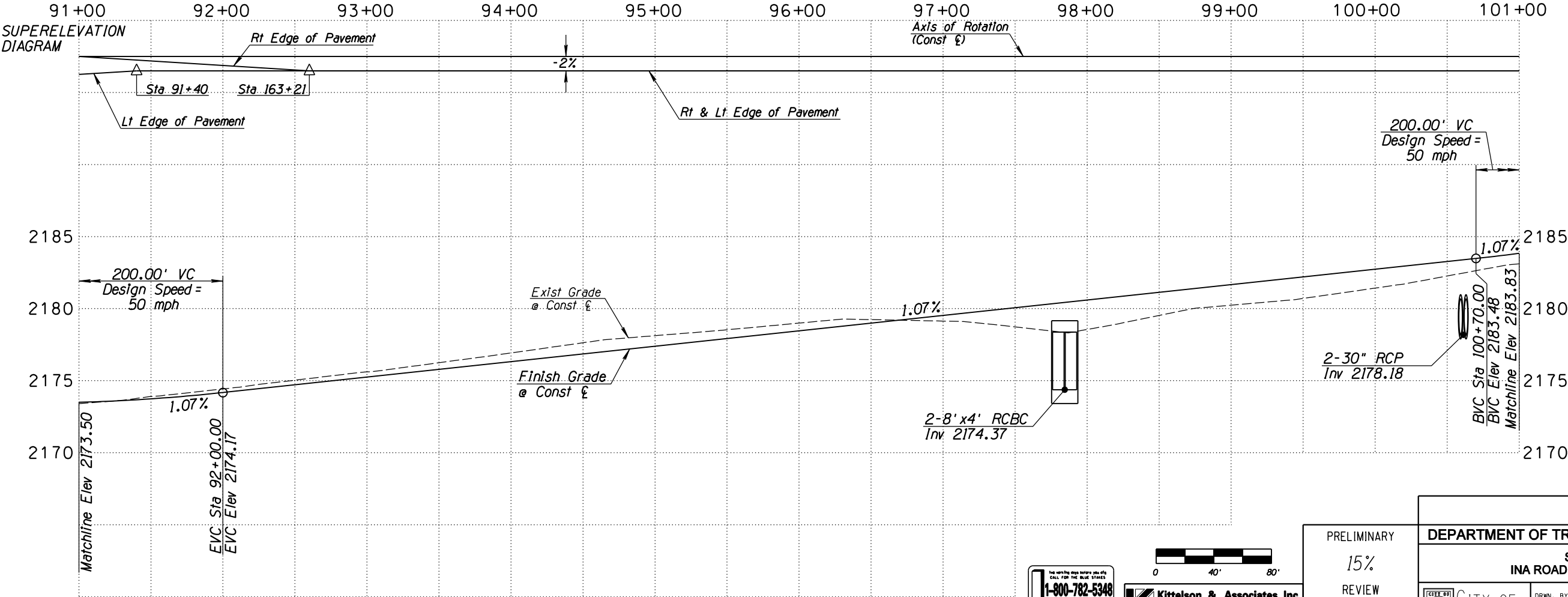
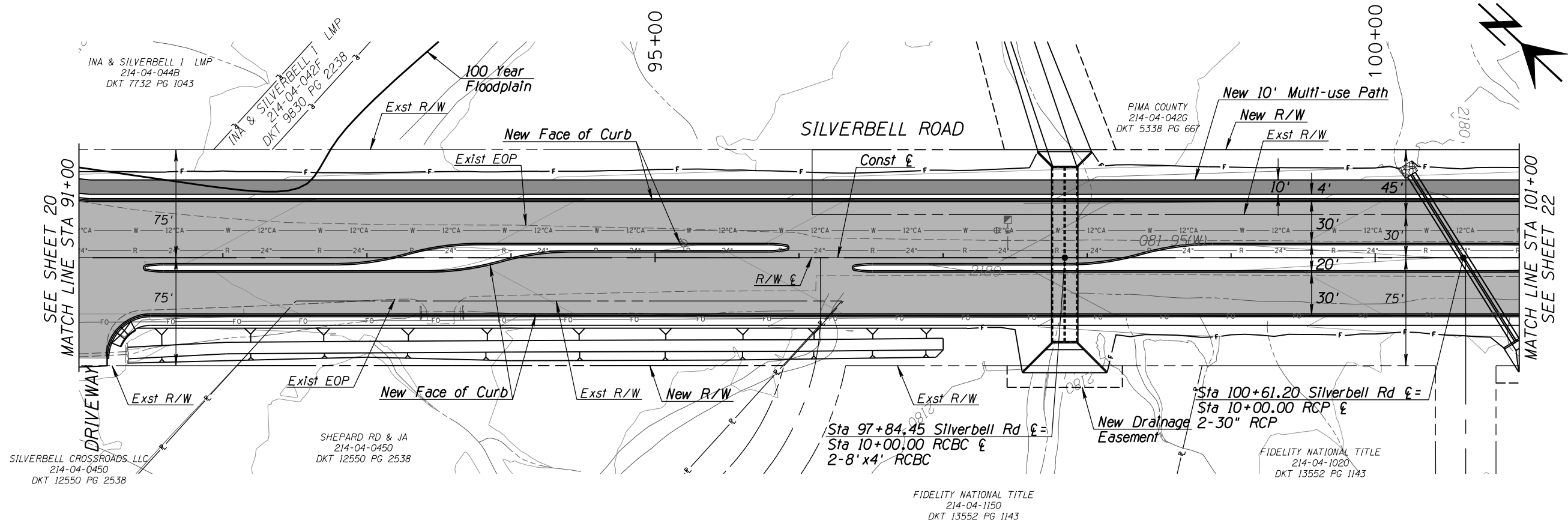
*See superelevation diagram on
plan and profile for cross slope variations



NO.	DATE	REVISION	BY	CHKD.	APPR.
-----	------	----------	----	-------	-------

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO				PP1 OF PP29	20 OF 81
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'	
DSGN. BY	JBB/JAS	9/10		1" = 4'	
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005	



1-800-782-5348

Blue State Center

CALL COLLECT

K

Kittelson & Associates, Inc.

33 N. Stone Ave., Suite 900

Tucson, AZ 85701

(520) 844-4067

NO.

DATE

REVISION

BY

CHKD.

APPR.

PRELIMINARY

15%

REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD

INA ROAD TO EL CAMINO DEL CERRO

21

OF

81

PP2

OF

PP29

DRWN. BY

LAS/TMR

9/10

REF.

SCALE: 1" = 40'

1" = 4'

DSGN. BY

JBB/JAS

9/10

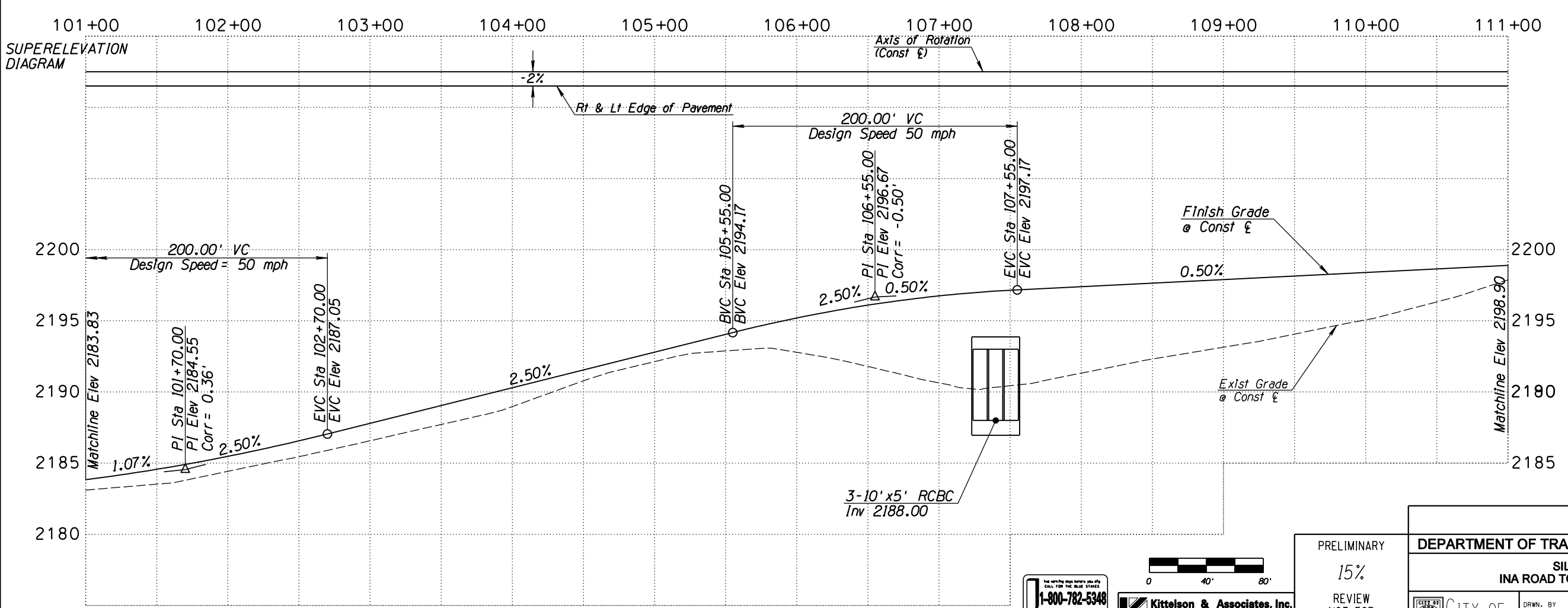
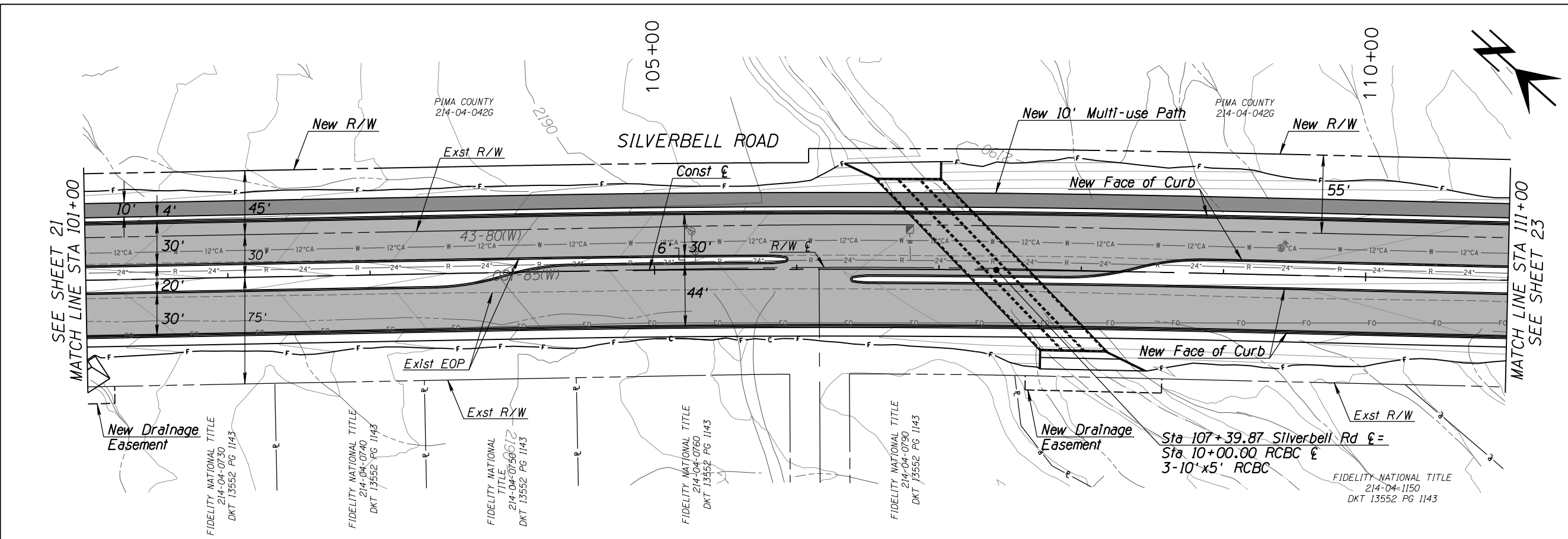
PLAN NO.

I-2010-005

CHKD. BY

JAS

9/10



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

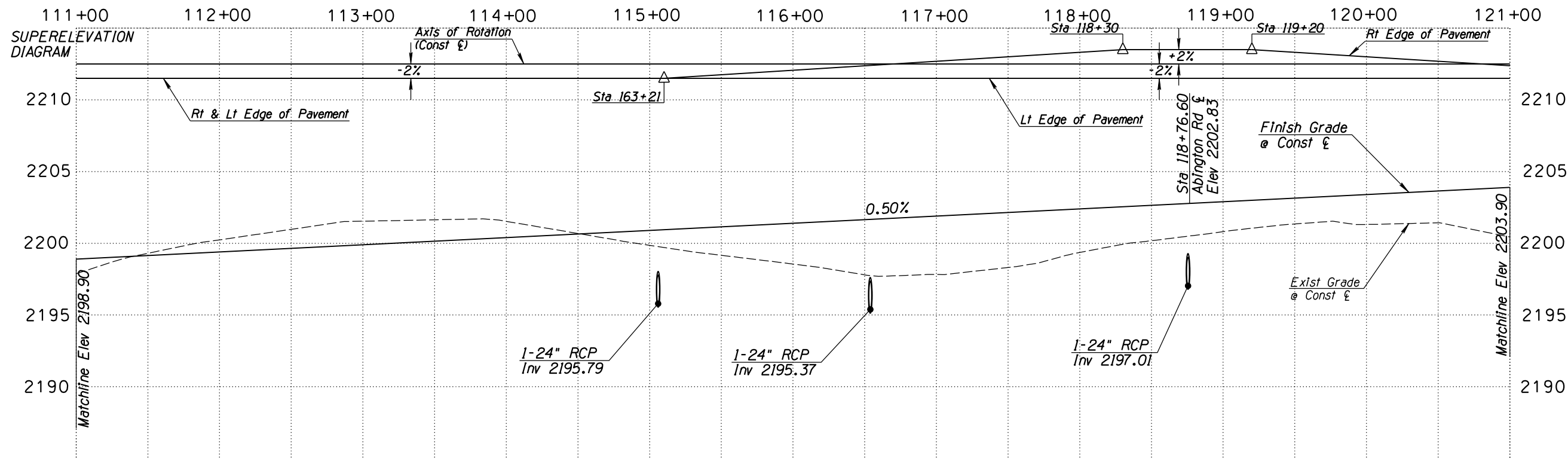
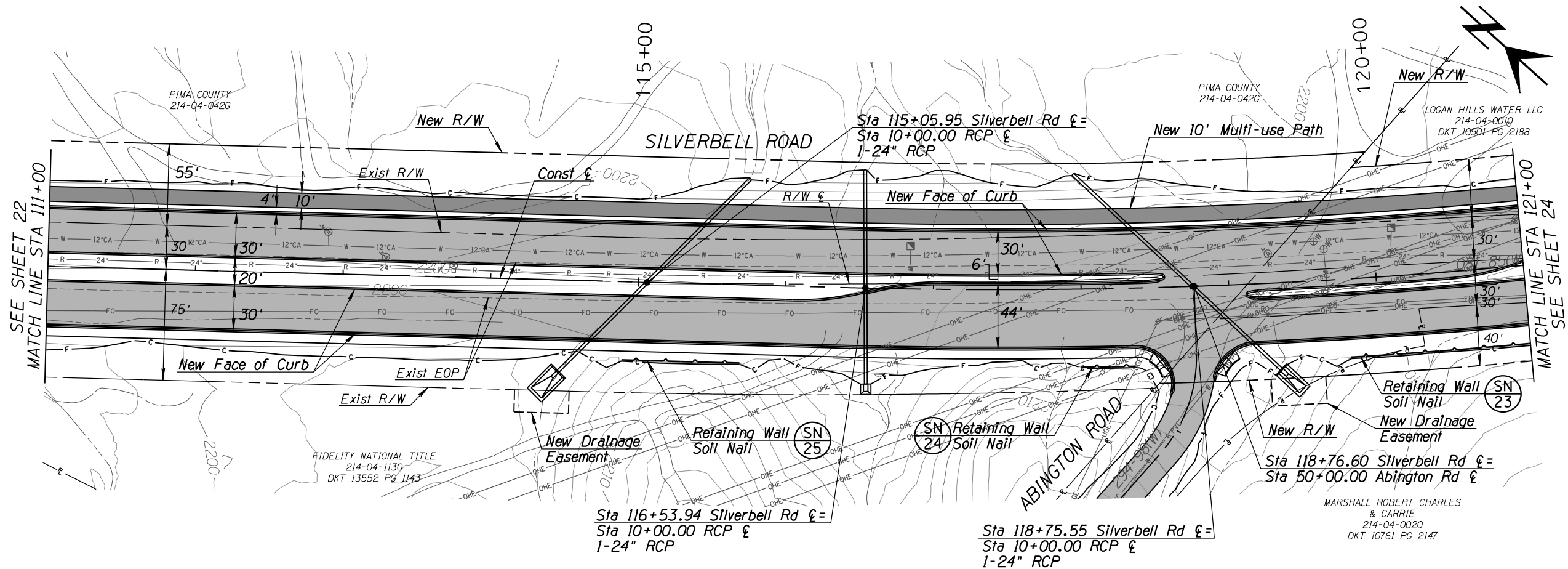
1-800-782-5348
Blue Stone Center
CALL COLLECT

NO. DATE REVISION BY CHKD. APPR.

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE

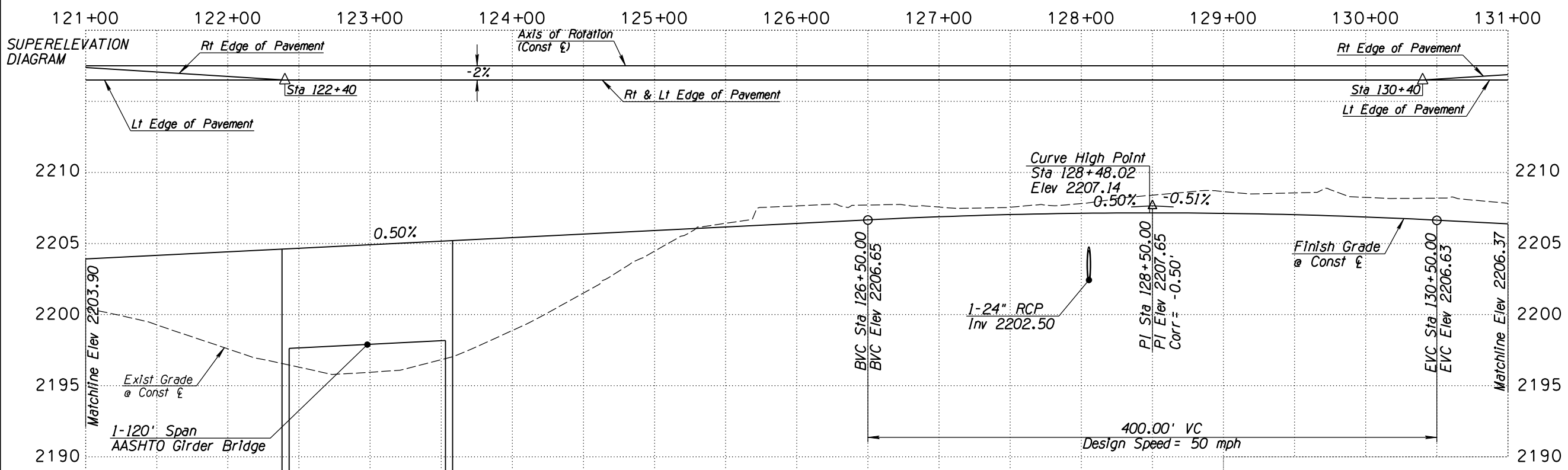
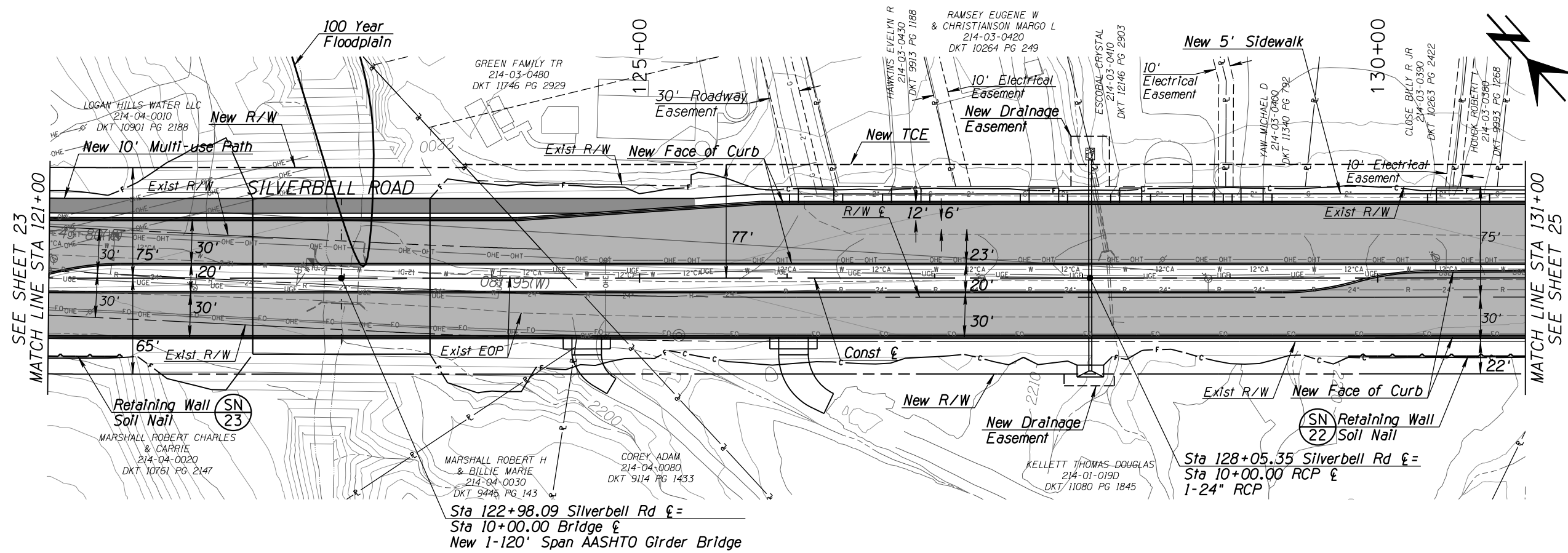
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			22 OF 81
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			PP3 OF PP29
DRWN. BY	LAS/TMR	9/10	SCALE: 1" = 40' 1" = 4'
DSGN. BY	JBB/JAS	9/10	
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			23 OF 81
DRWN. BY	LAS/TMR	9/10	PP4 OF PP29
DSGN. BY	JBB/JAS	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON			PLAN NO. I-2010-005



PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

NO. DATE REVISION BY CHKD. APPR.

1-800-782-5348
Blue Stone Center
CALL COLLECT

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

0 40' 80'

PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
INA ROAD TO EL CAMINO DEL CERRO

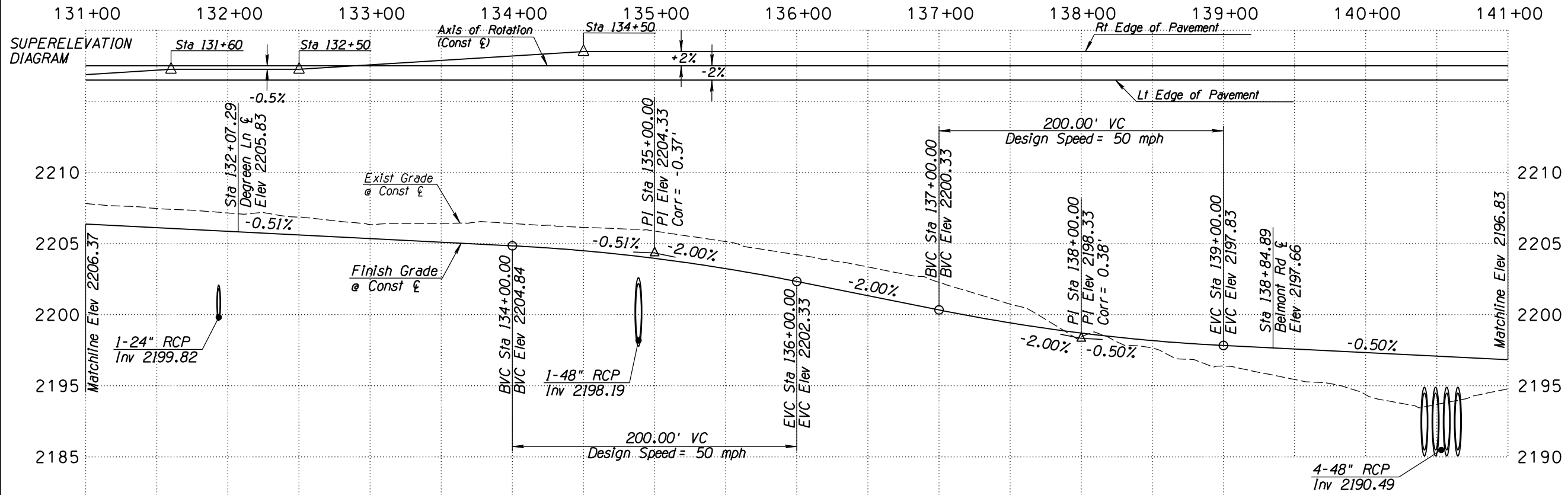
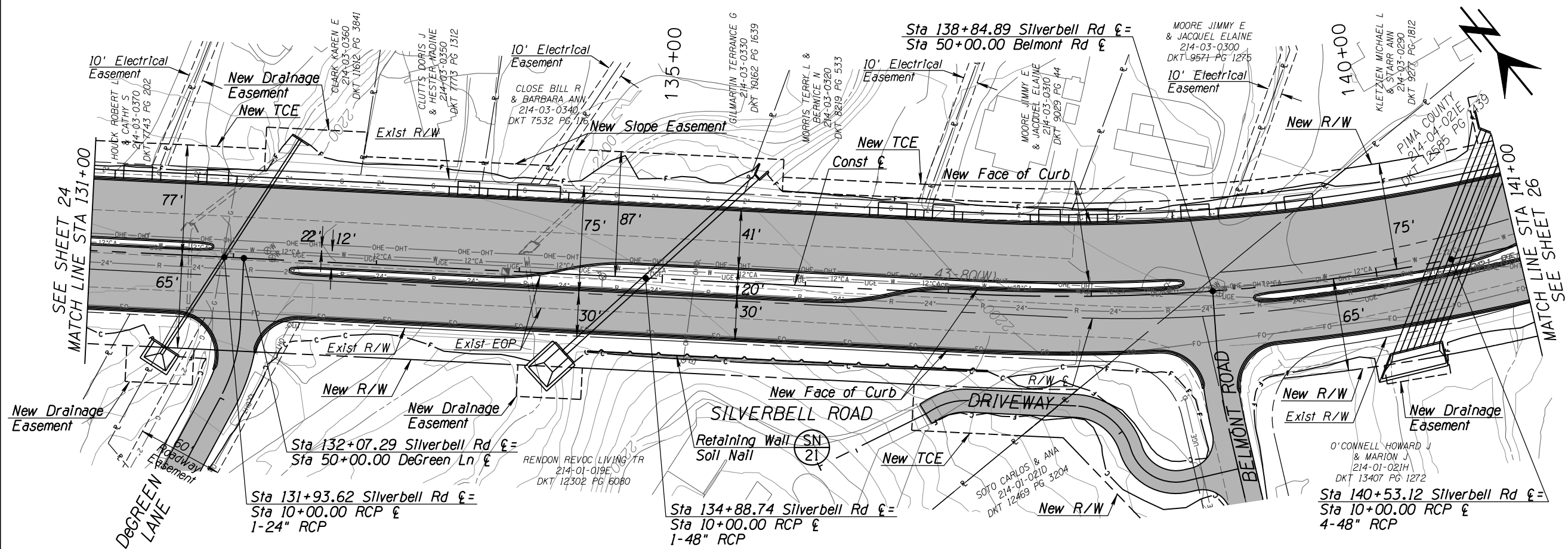
PP5 OF PP29

DRWN. BY LAS/TMR 9/10
DSGN. BY JBB/JAS 9/10
CHKD. BY JAS 9/10

SCALE: 1" = 40'
1" = 4'

PLAN NO. I-2010-005

24 OF 81

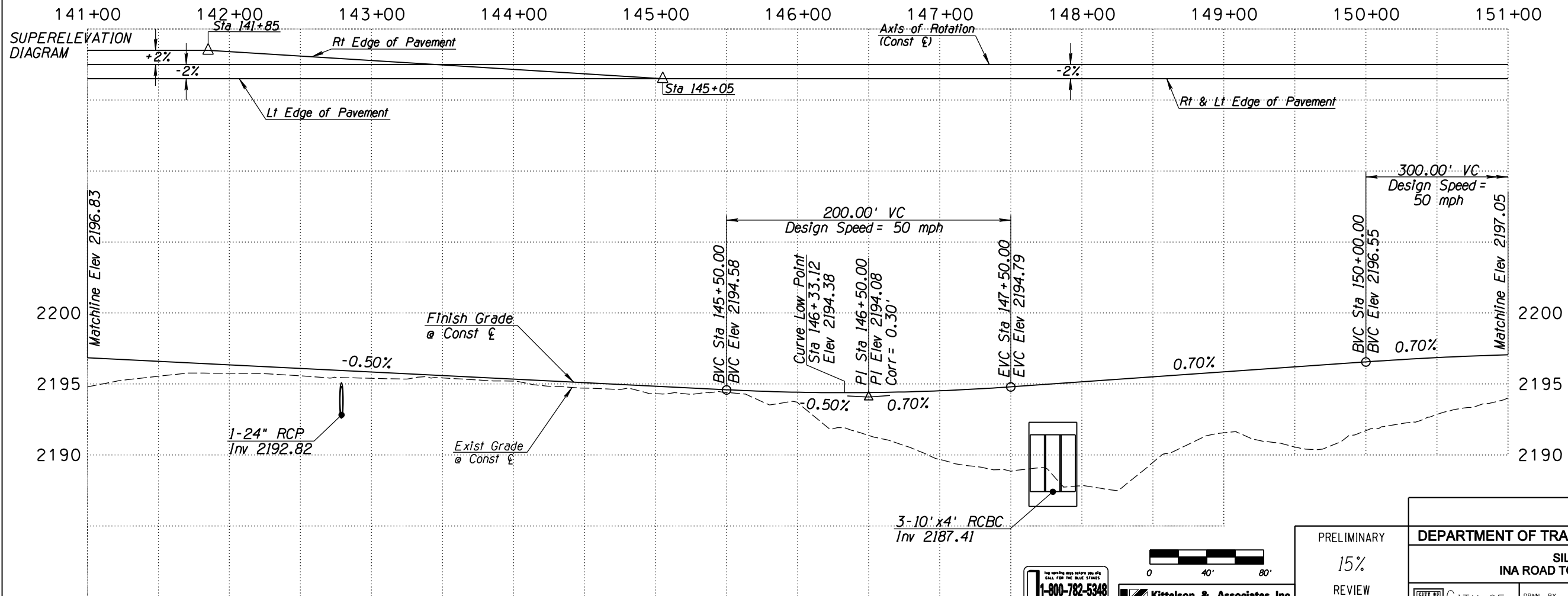
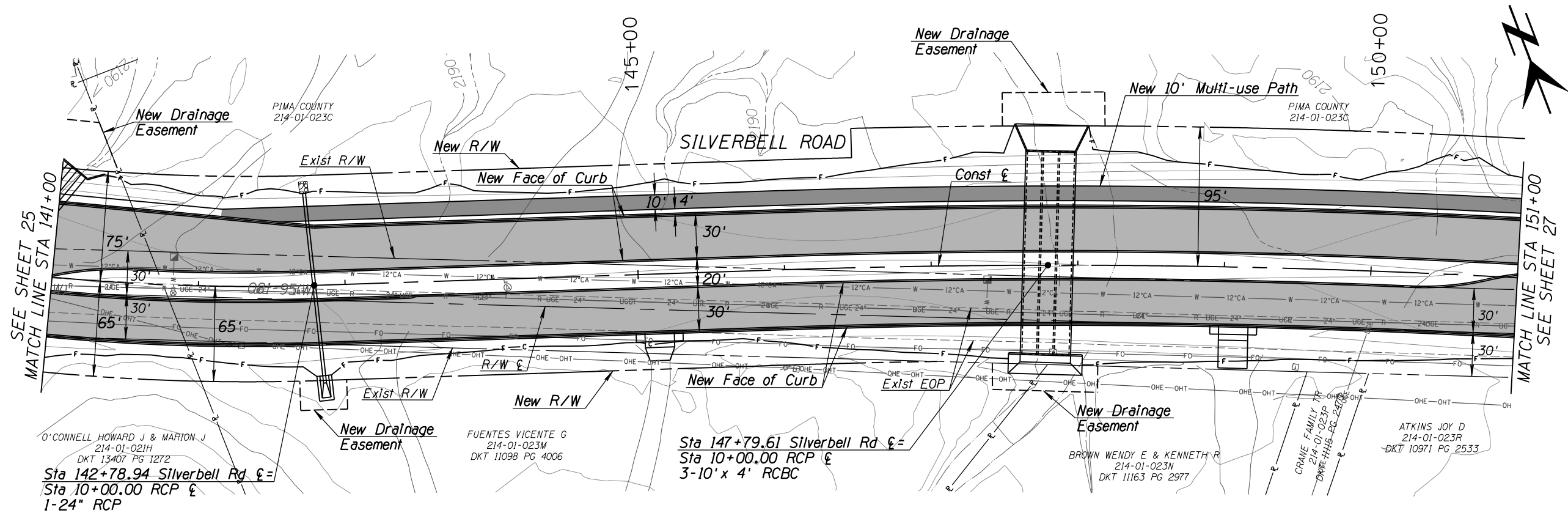


1-800-782-5348

Blue State Center
CALL COLLECT

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

PRELIMINARY		15%		REVIEW NOT FOR CONSTRUCTION OR RECORDING	
PLAN & PROFILE DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO					
DRWN. BY LAS/TMR DSGN. BY JBB/JAS CHKD. BY JAS		9/10 9/10 9/10		REF. _____ SCALE: 1" = 40' 1" = 4'	
CITY OF TUCSON		PLAN NO. I-2010-005			

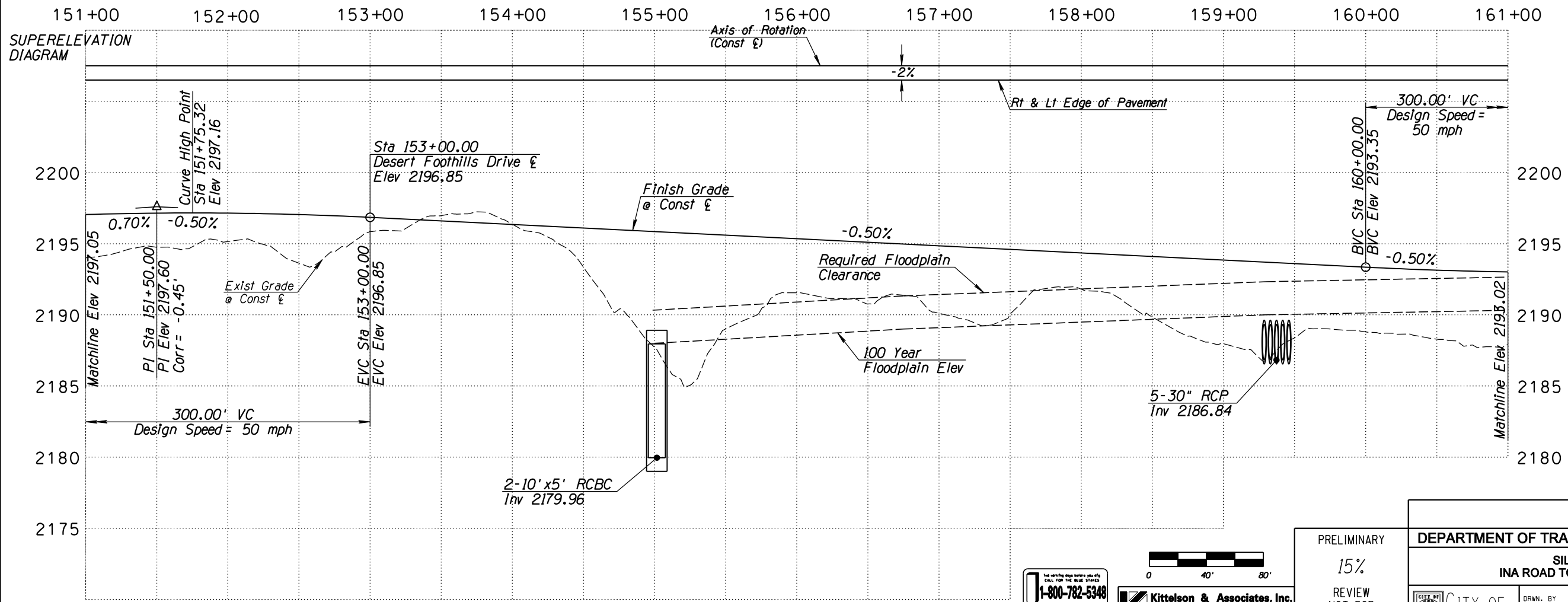
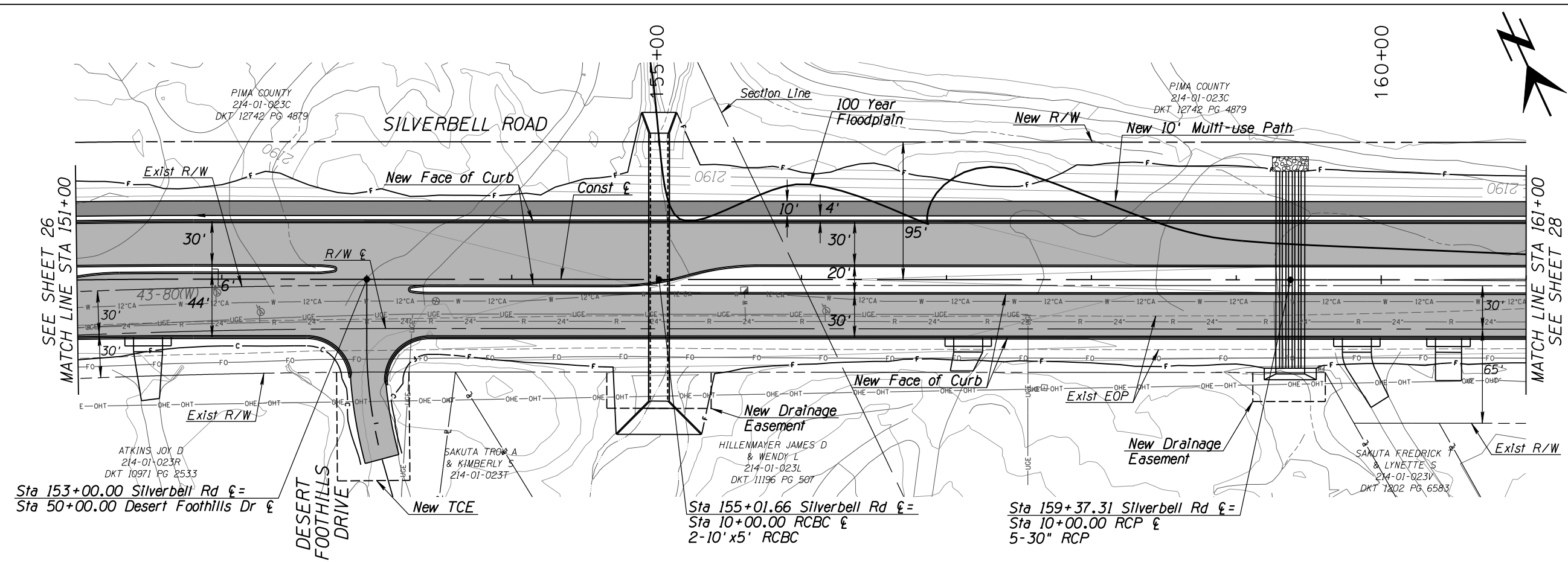


Kittelson & Associates, Inc.
 33 N. Stone Ave., Suite 900
 Tucson, AZ 85701
 (520) 844-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.

PRELIMINARY
 15%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PLAN & PROFILE					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO				PP7 OF PP29	26 OF 81
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'	
DSGN. BY	JBB/JAS	9/10		1" = 4'	
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005	



6/24/2011
H:\profile\9589 - Silverbell Road DCR\15%-North\06 PnP\svb-pnp-08.dgn

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

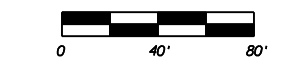
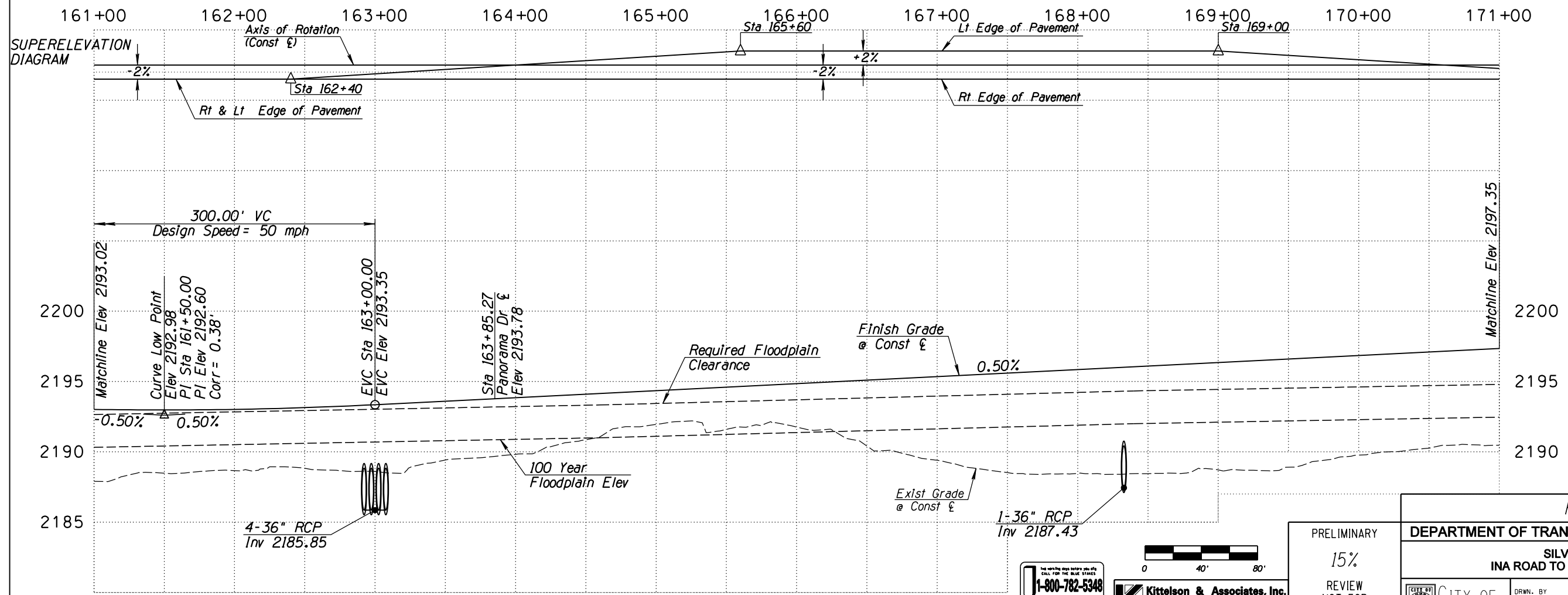
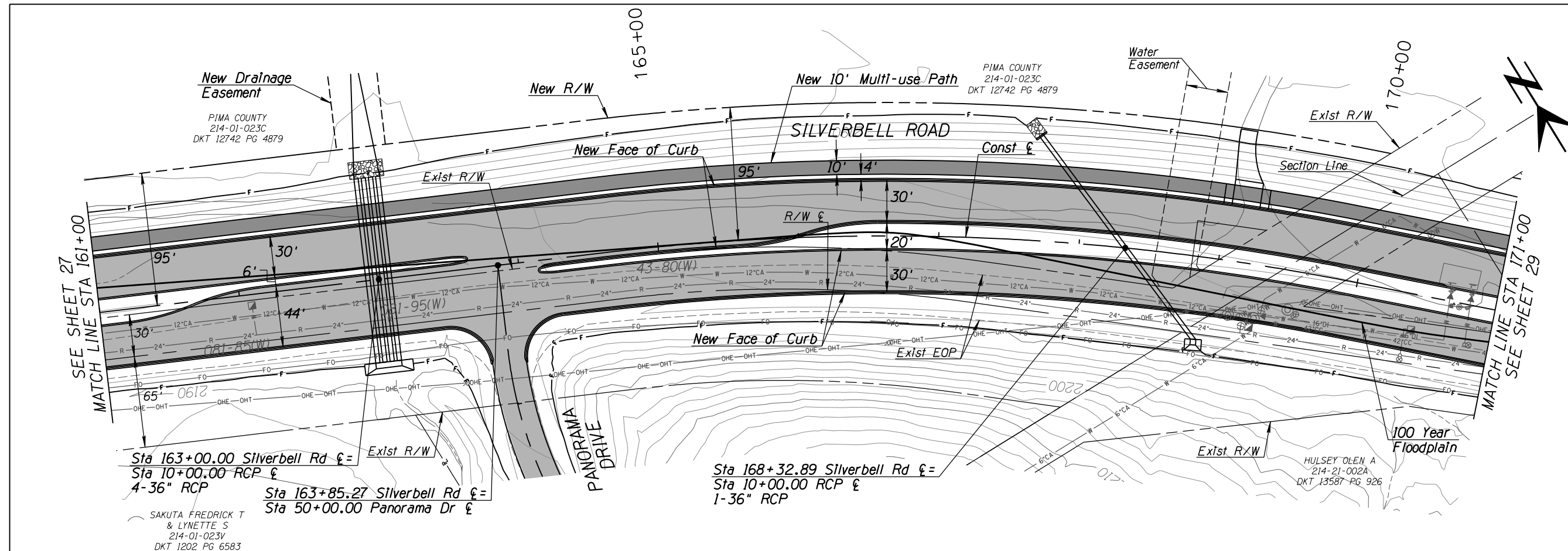
0 40' 80'

1-800-782-5348

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

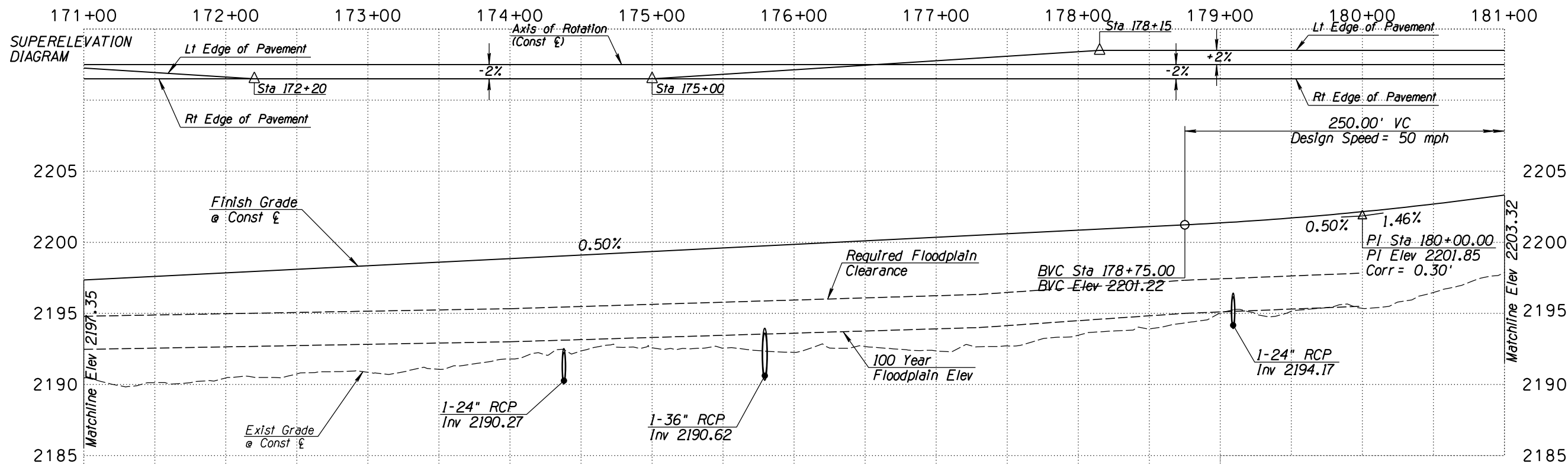
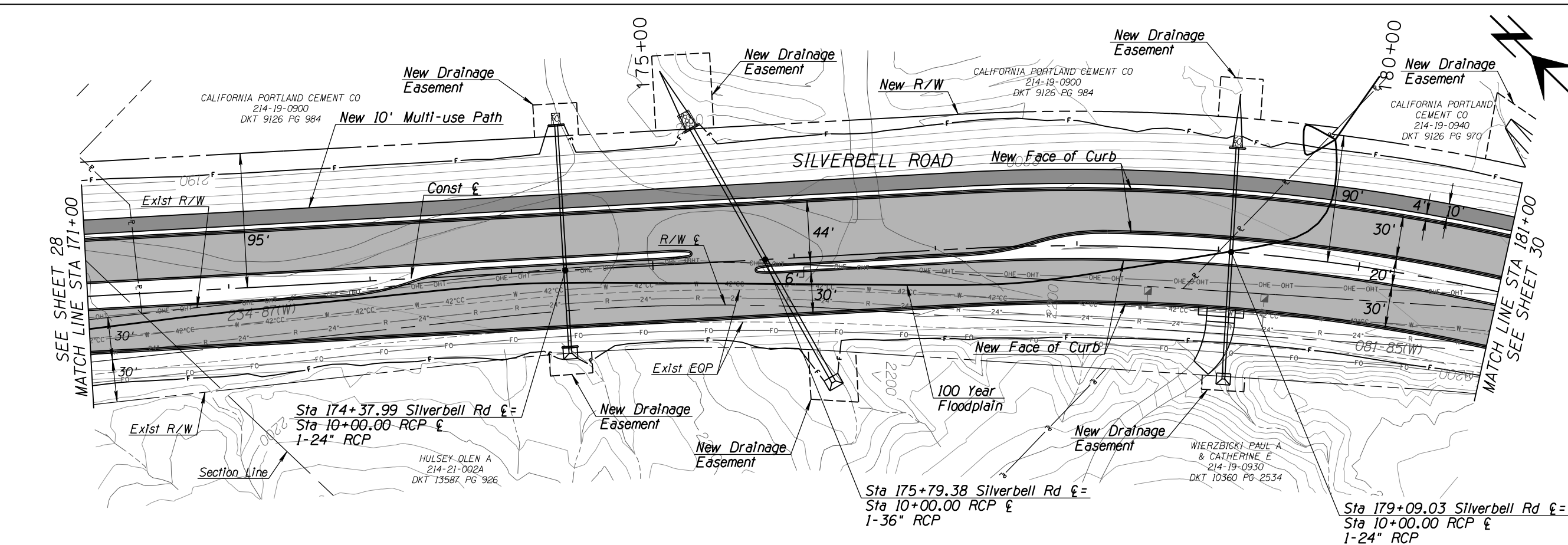
PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION		27
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO		PP8 OF 81
DRWN. BY	LAS/TMR	9/10
DSGN. BY	JBB/JAS	9/10
CHKD. BY	JAS	9/10
PLAN NO. I-2010-005		



PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

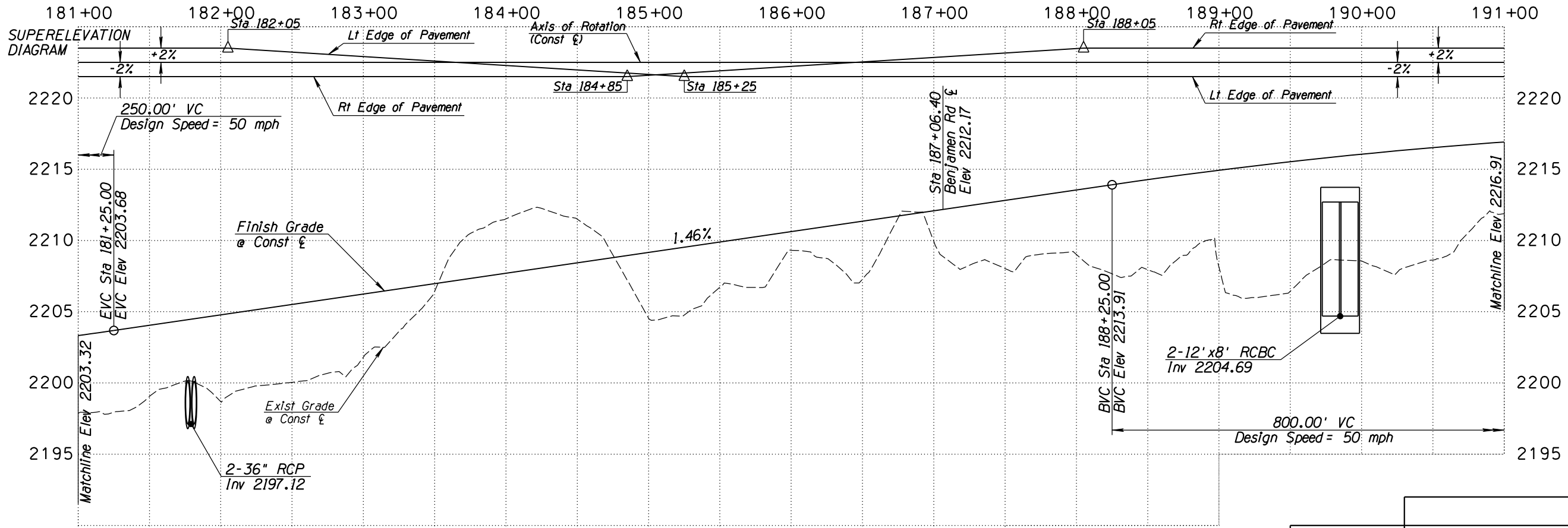
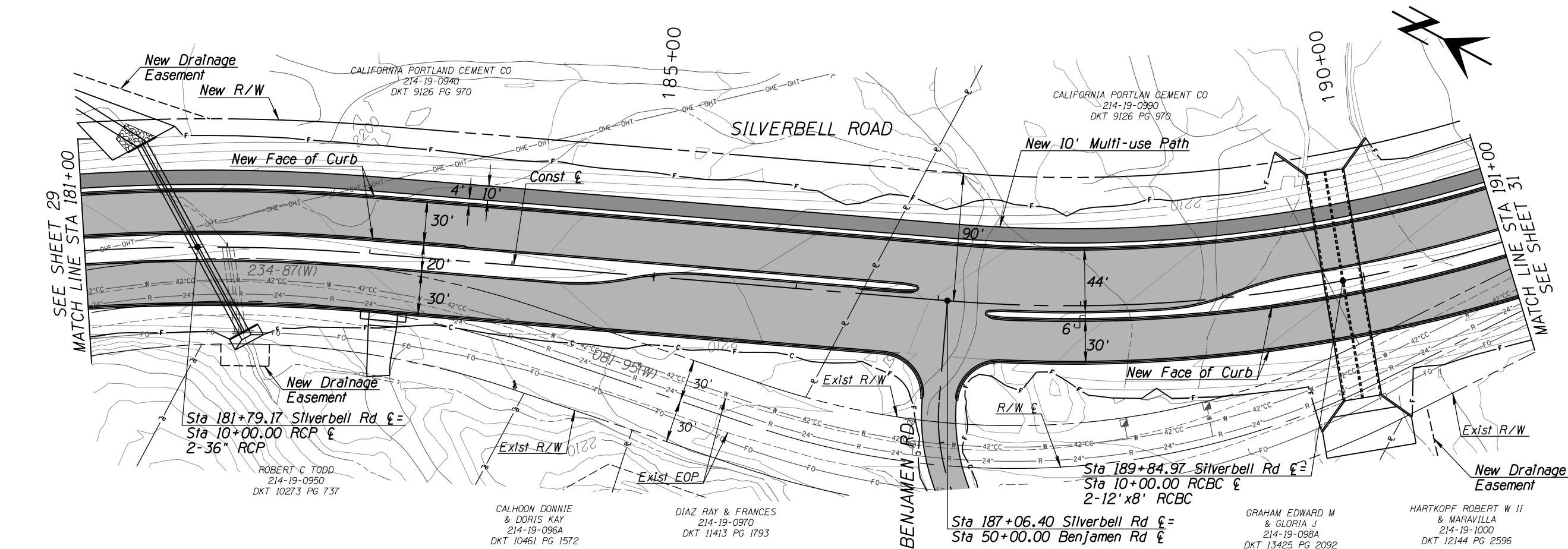
PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO		PP9 OF PP29	28 OF 81
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	JBB/JAS	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON		PLAN NO. I-2010-005	



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	JBB/JAS	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON			PP10 OF PP29
PLAN NO.			I-2010-005



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

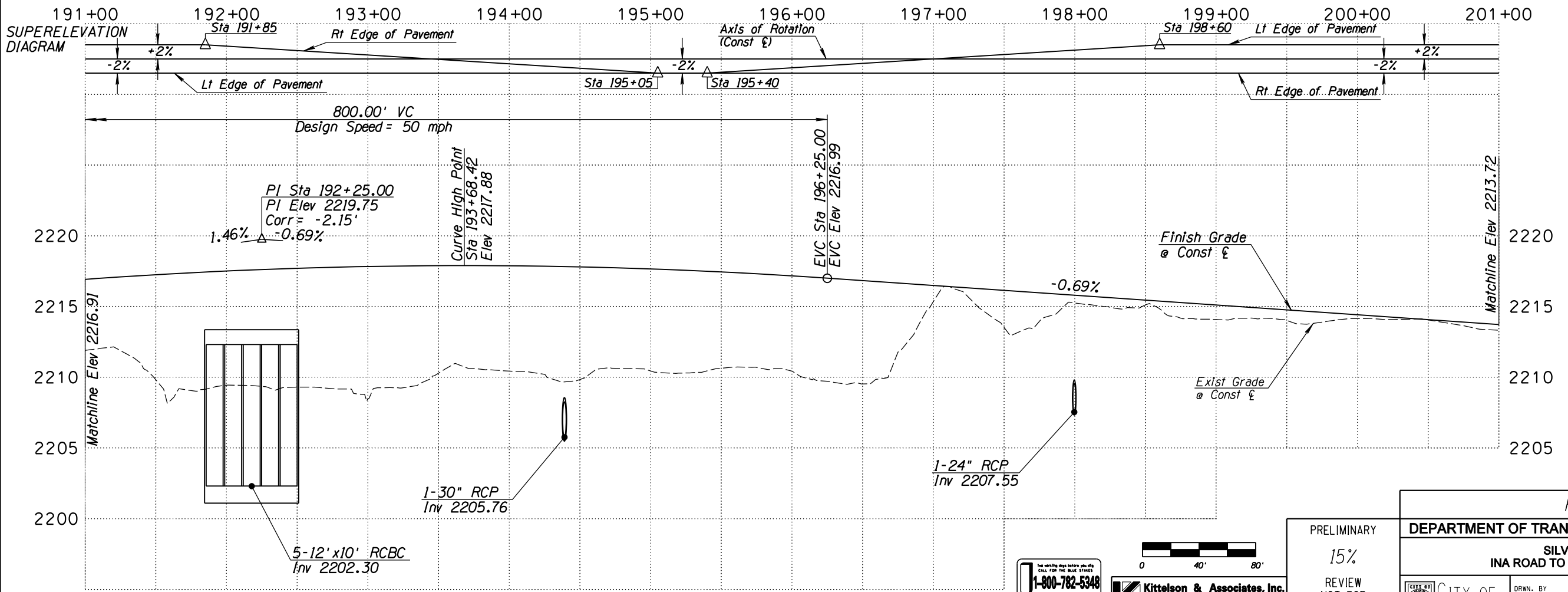
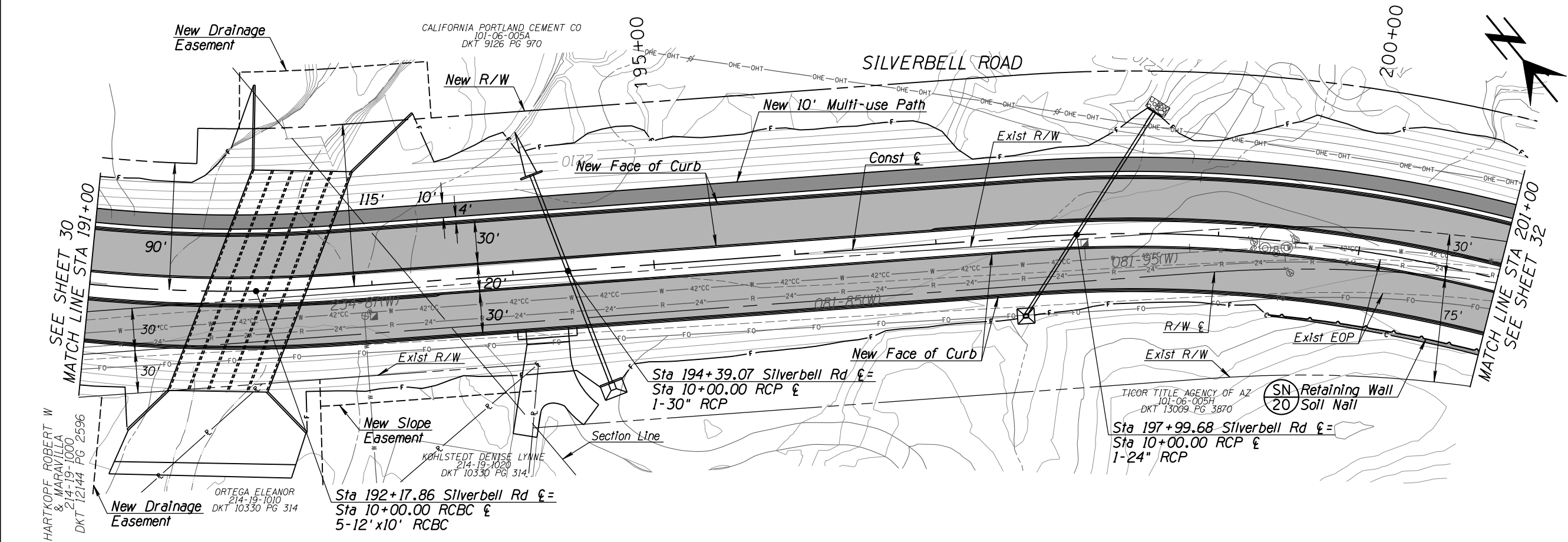
NO. DATE REVISION BY CHKD. APPR.

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION
SILVERBELL ROAD
INA ROAD TO EL CAMINO DEL CERRO

DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
DSGN. BY	JBB/JAS	9/10		1" = 4'
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005

30 OF 81
PP11 OF PP29



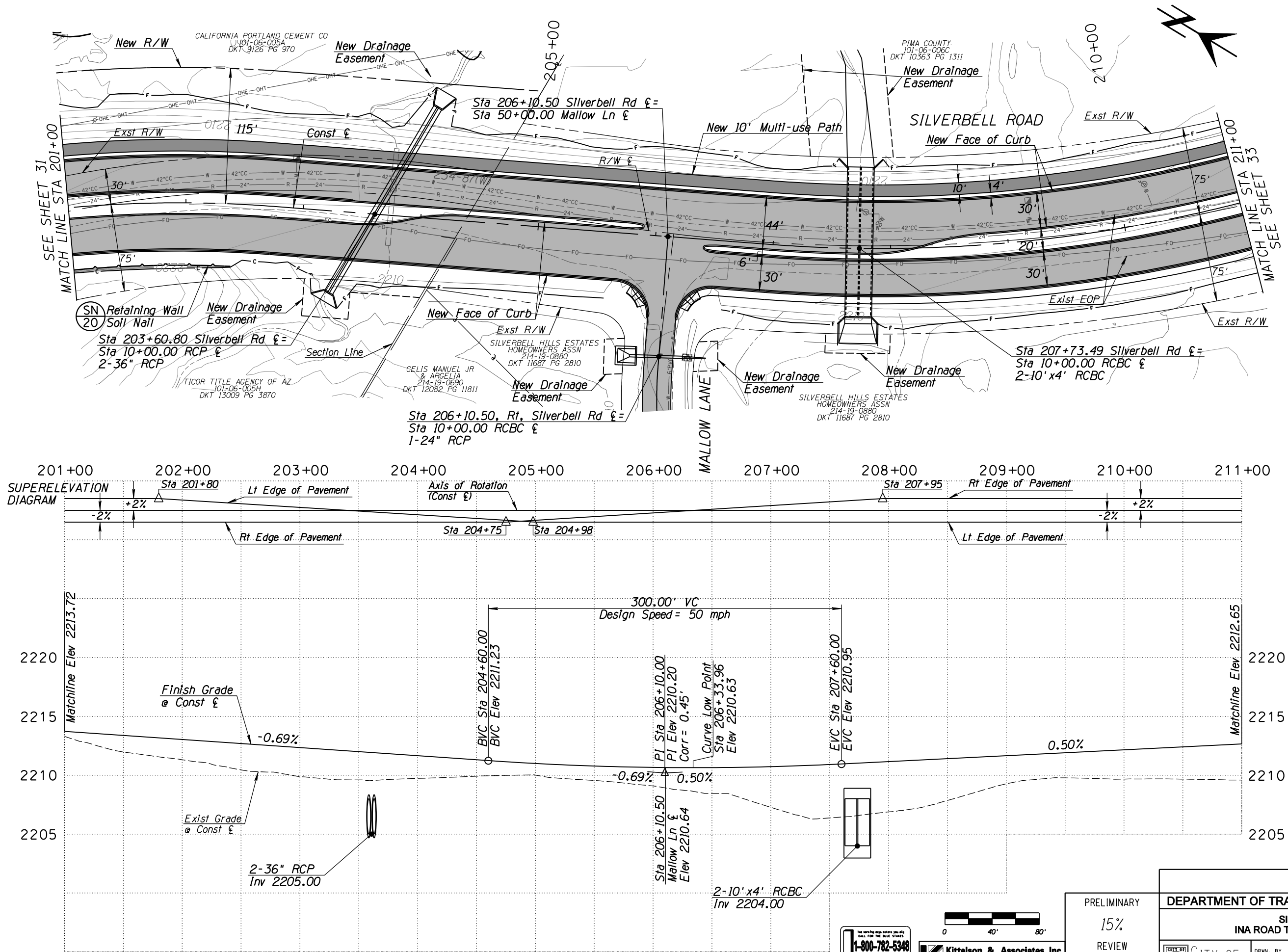
Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

NO. DATE REVISION BY CHKD. APPR.

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

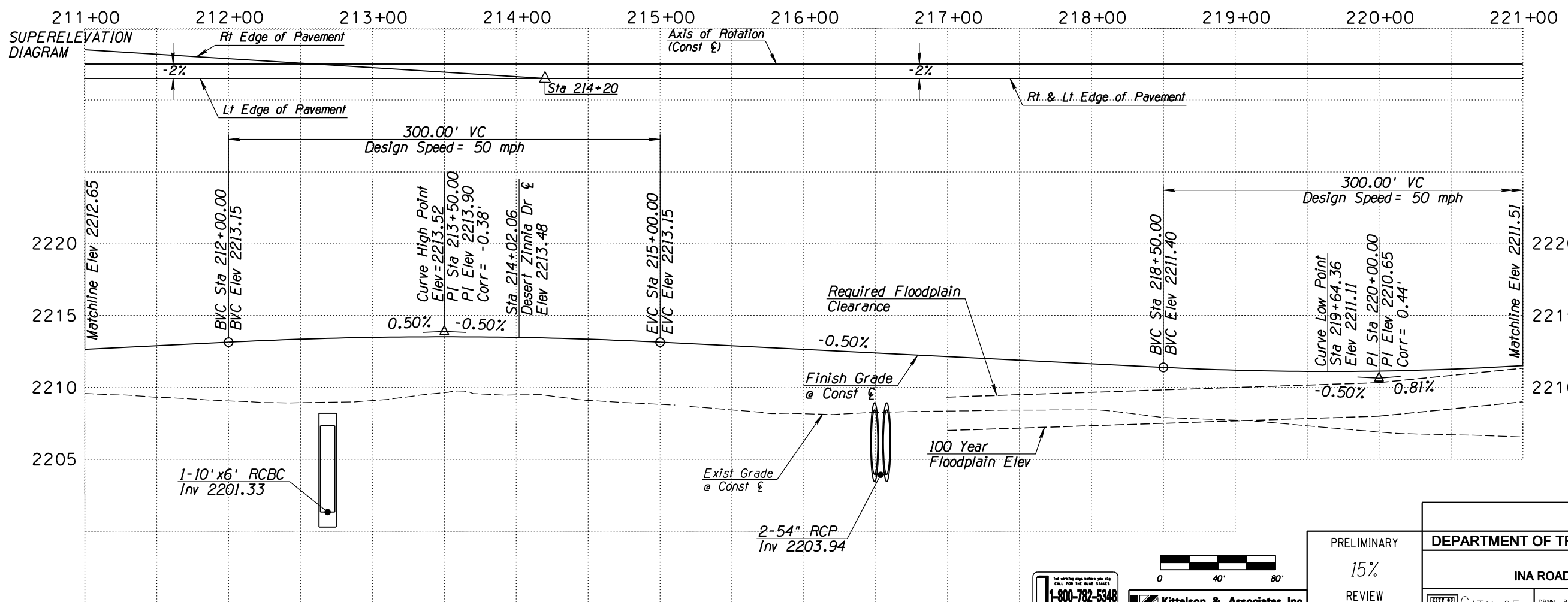
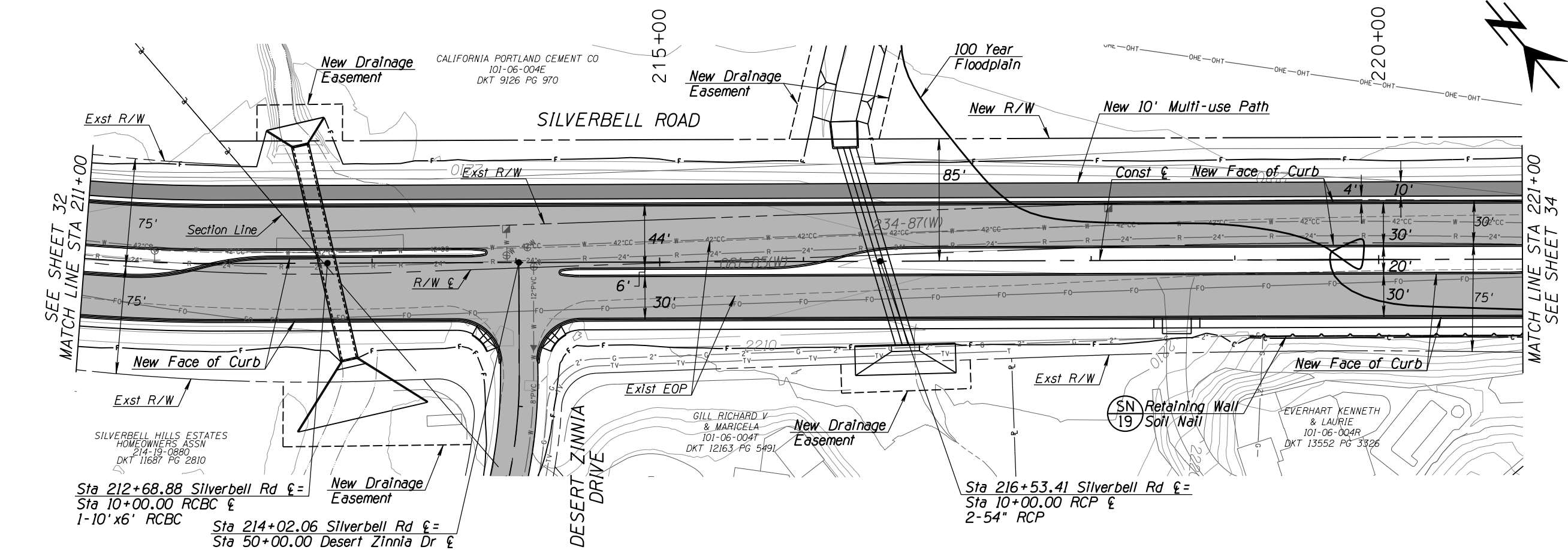
PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION		31 OF 81
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO		PP12 OF PP29
DRWN. BY LAS/TMR	9/10	REF. SCALE: 1" = 40' 1" = 4'
DSGN. BY JBB/JAS	9/10	
CHKD. BY JAS	9/10	
CITY OF TUCSON		PLAN NO. I-2010-005



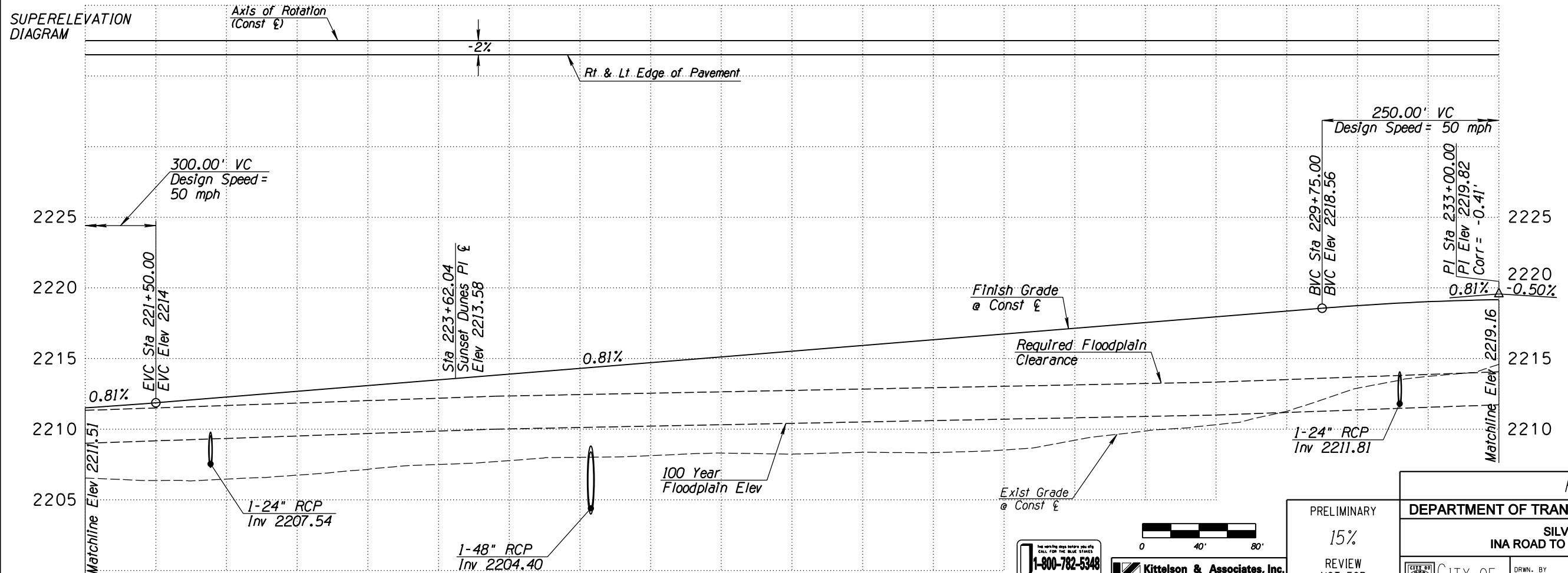
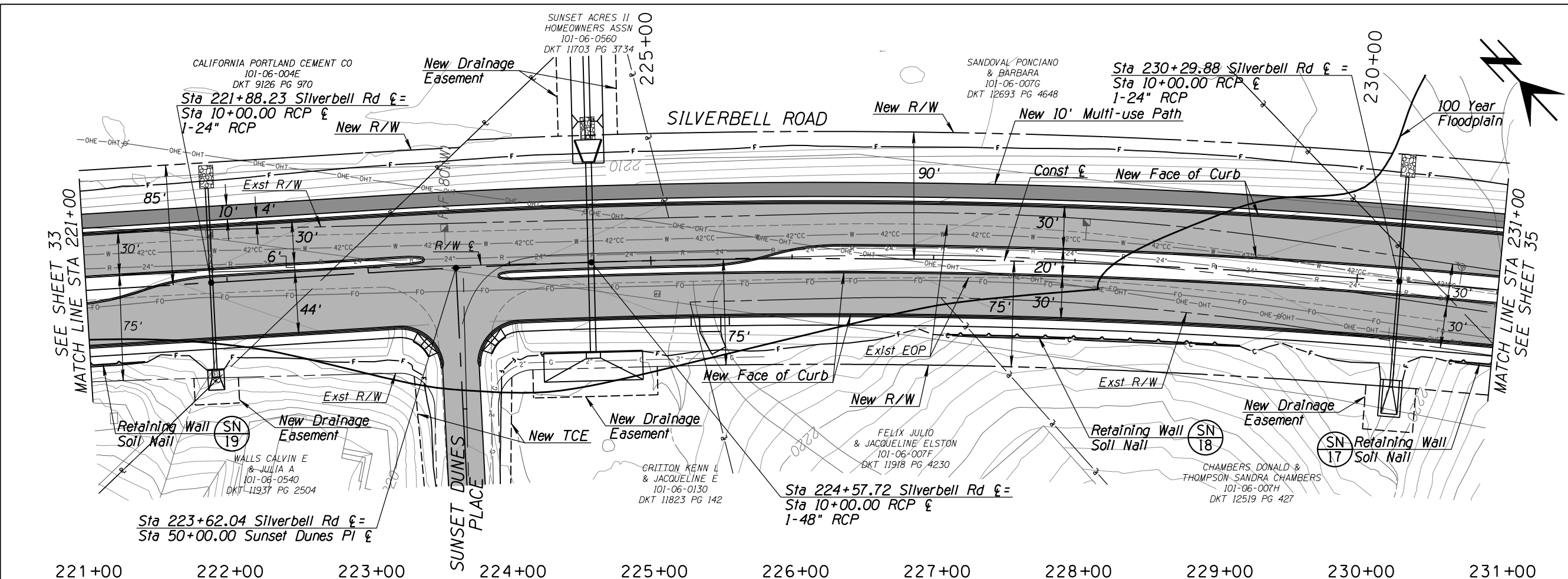
PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO		PP13 OF PP29	32 OF 81
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	JBB/JAS	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON		PLAN NO. I-2010-005	



PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD		PP14	OF
INA ROAD TO EL CAMINO DEL CERRO		PP29	81
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	JBB/JAS	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON		PLAN NO. I-2010-005	



6/24/2011
H:\profile\9589 - Silverbell Road DCR\15%-North\06 PnP\svb-pnp-15.dgn

1-800-782-5348

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

0 40' 80'

PRELIMINARY

15%

REVIEW NOT FOR CONSTRUCTION OR RECORDING

PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
INA ROAD TO EL CAMINO DEL CERRO

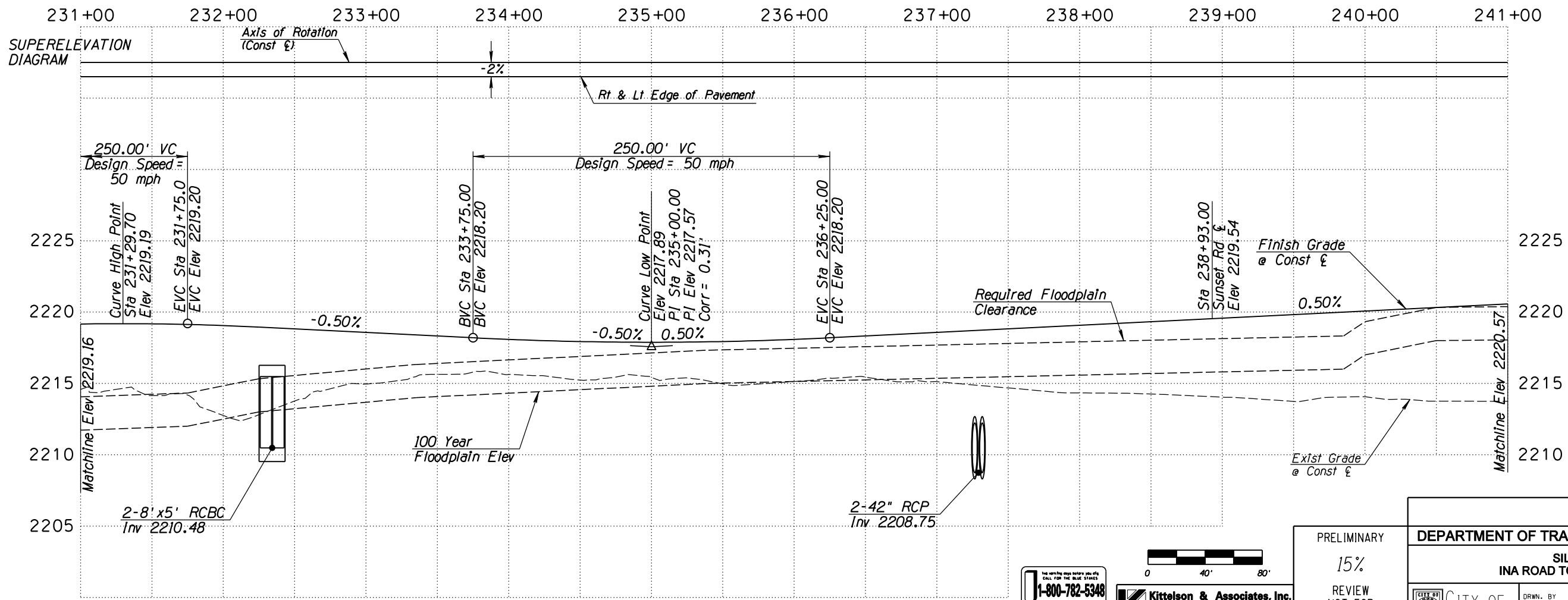
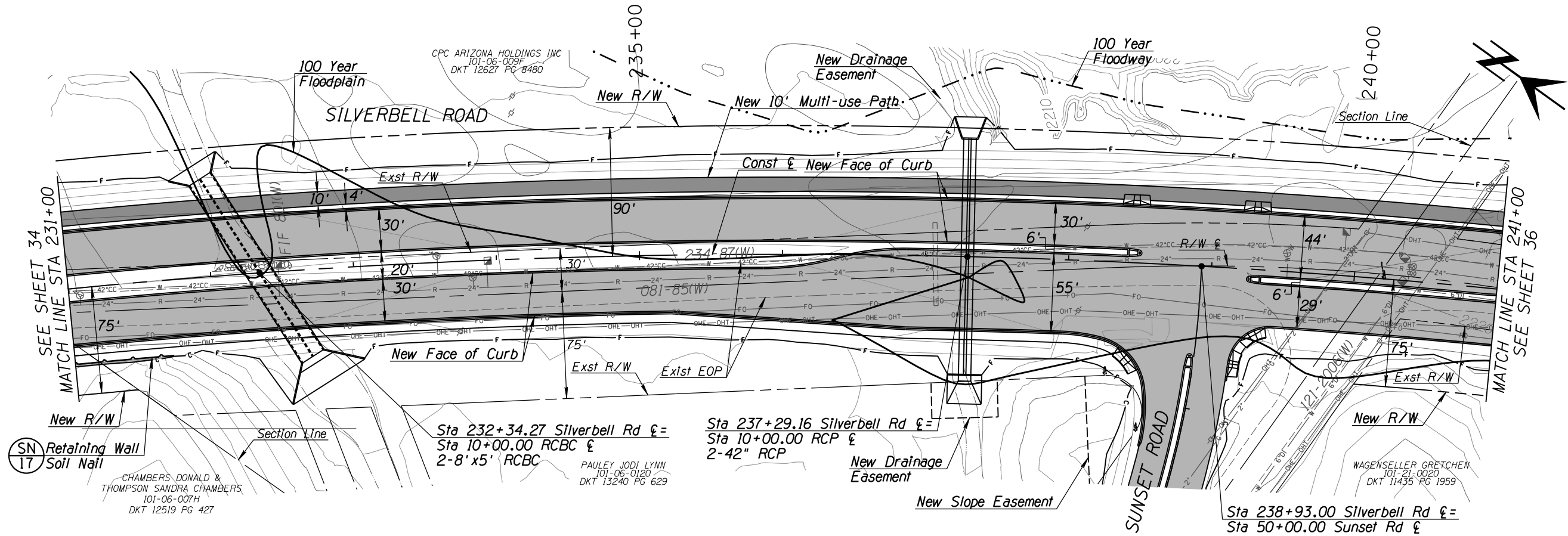
DRWN. BY LAS/TMR 9/10
DSGN. BY JBB/JAS 9/10
CHKD. BY JAS 9/10

PP15 OF PP29

SCALE: 1" = 40'
1" = 4'

PLAN NO. I-2010-005

34 OF 81



1-800-782-5348

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

NO. DATE REVISION BY CHKD. APPR.

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
INA ROAD TO EL CAMINO DEL CERRO

CITY OF TUCSON

35 OF 81

PP16 OF PP29

SCALE: 1" = 40'

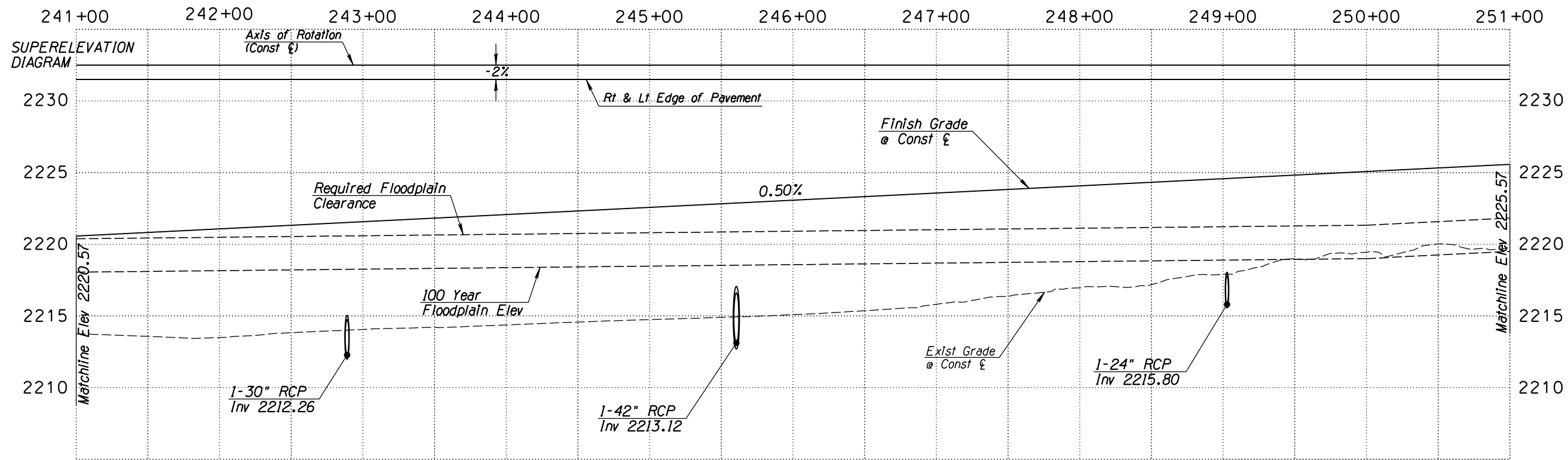
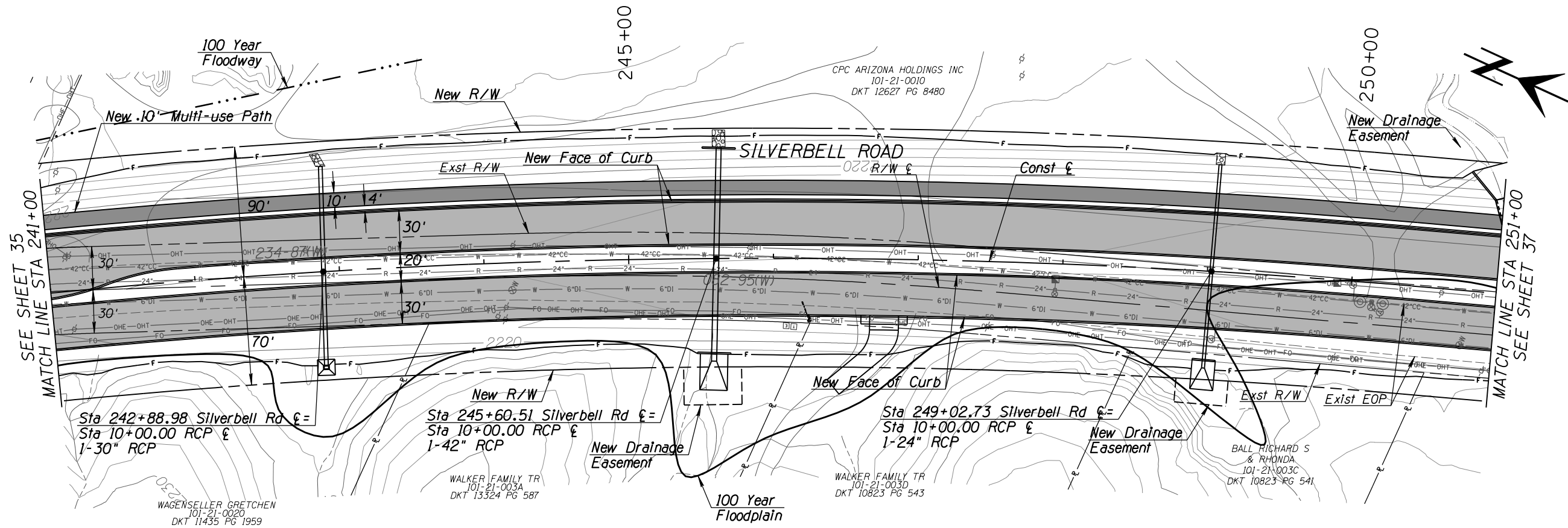
PLAN NO. I-2010-005

DRWN. BY LAS/TMR 9/10

DSGN. BY JBB/JAS 9/10

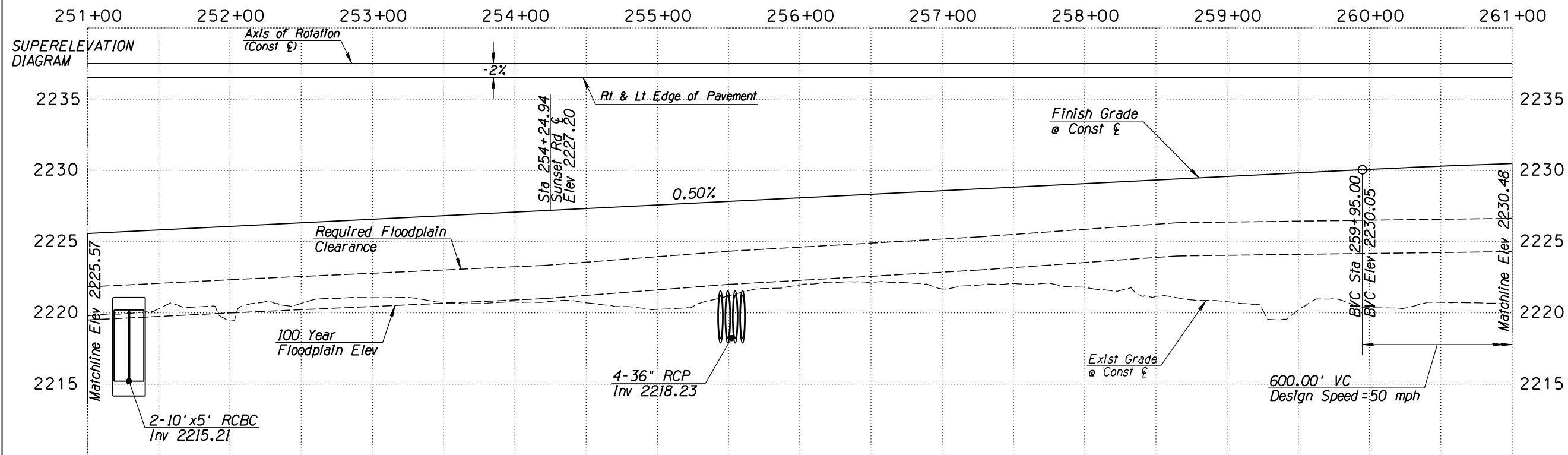
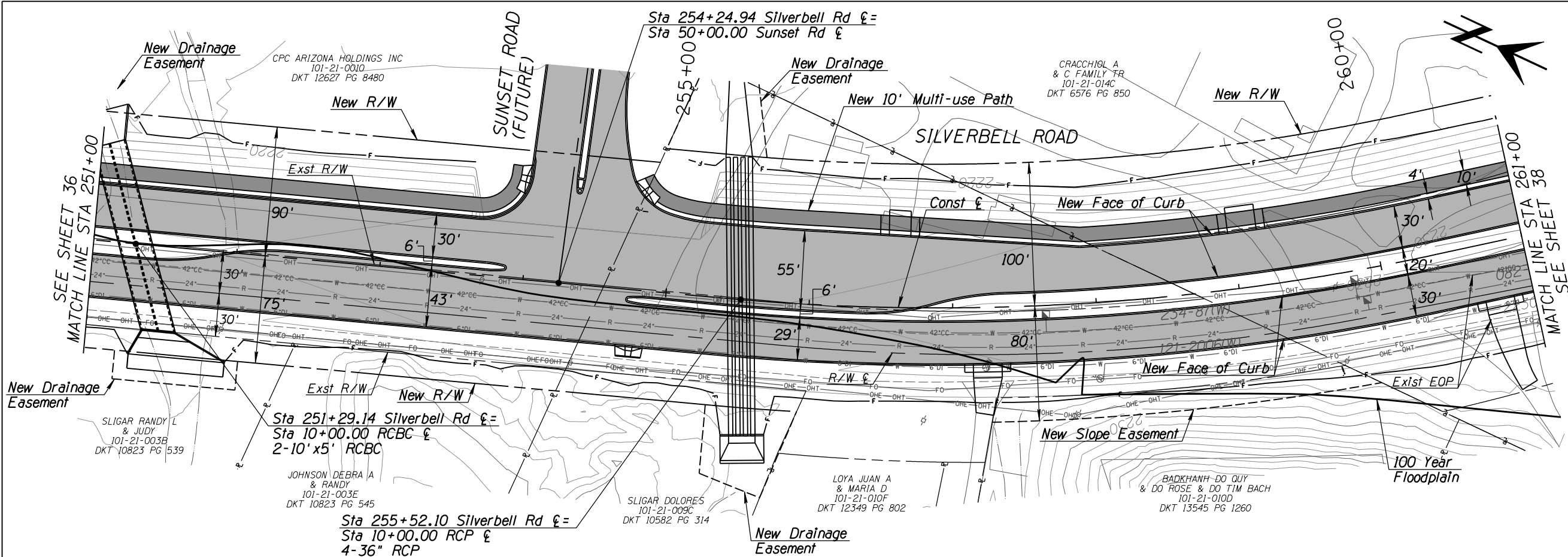
CHKD. BY JAS 9/10

REF. _____



PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

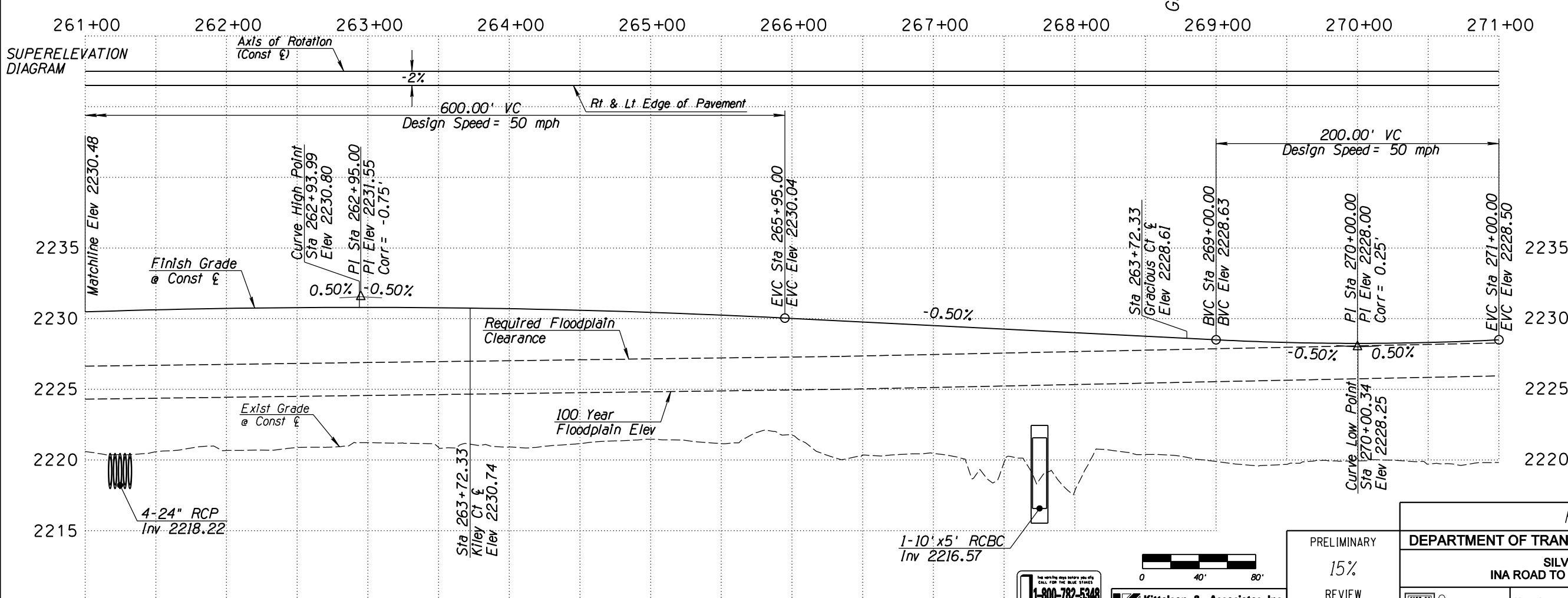
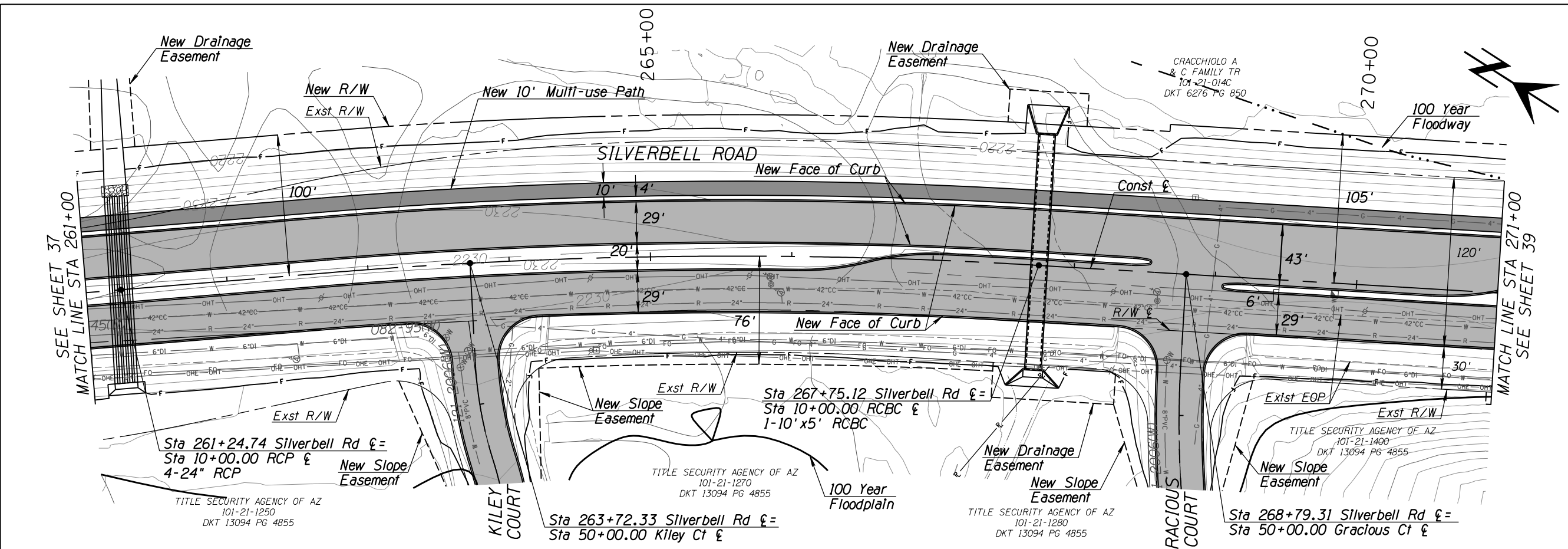
PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			36 OF 81
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	JBB/JAS	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON			PLAN NO. I-2010-005



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			
DRWN. BY	LAS/TMR	9/10	PP18 OF 81
DSGN. BY	JBB/JAS	9/10	PP29 OF 81
CHKD. BY	JAS	9/10	
PLAN NO. I-2010-005			



PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION
SILVERBELL ROAD
INA ROAD TO EL CAMINO DEL CERRO

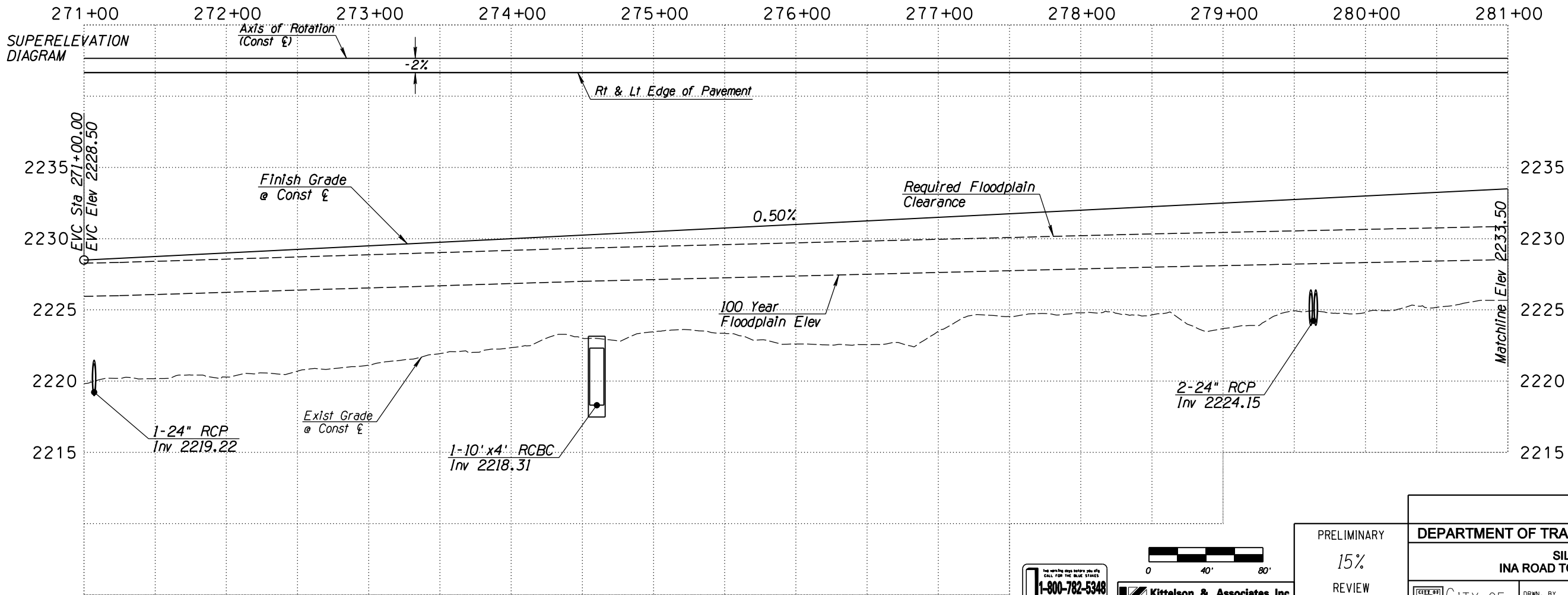
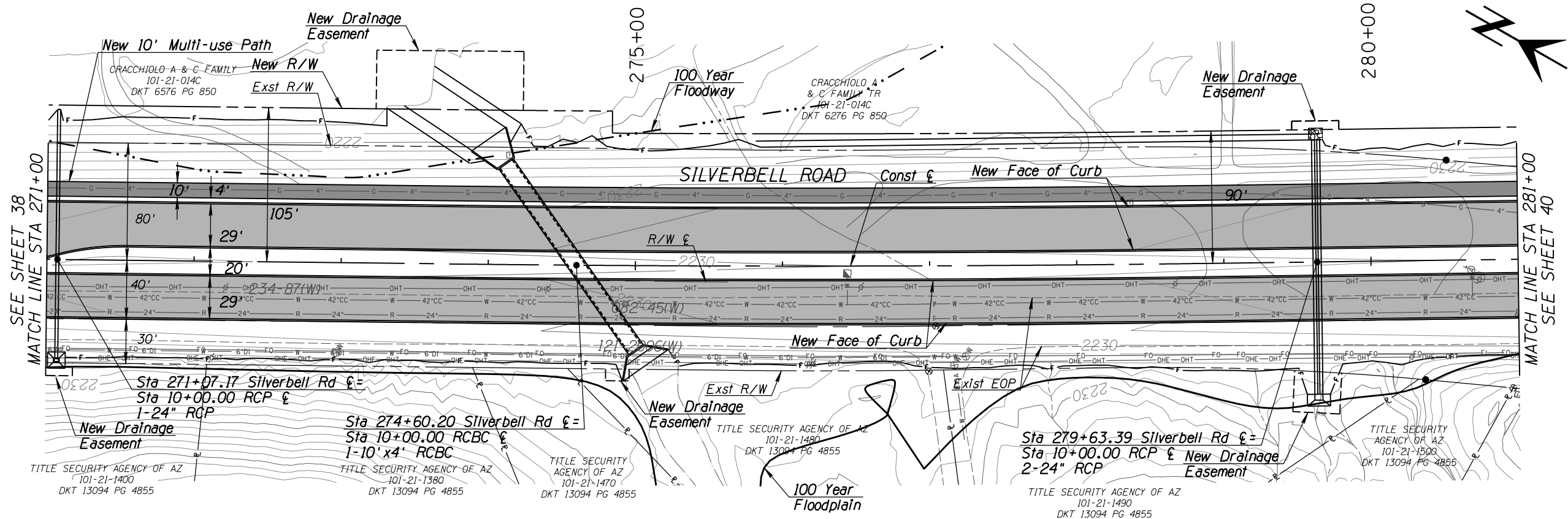
38 OF 81
PP19 OF PP29
SCALE: 1" = 40'
1" = 4'

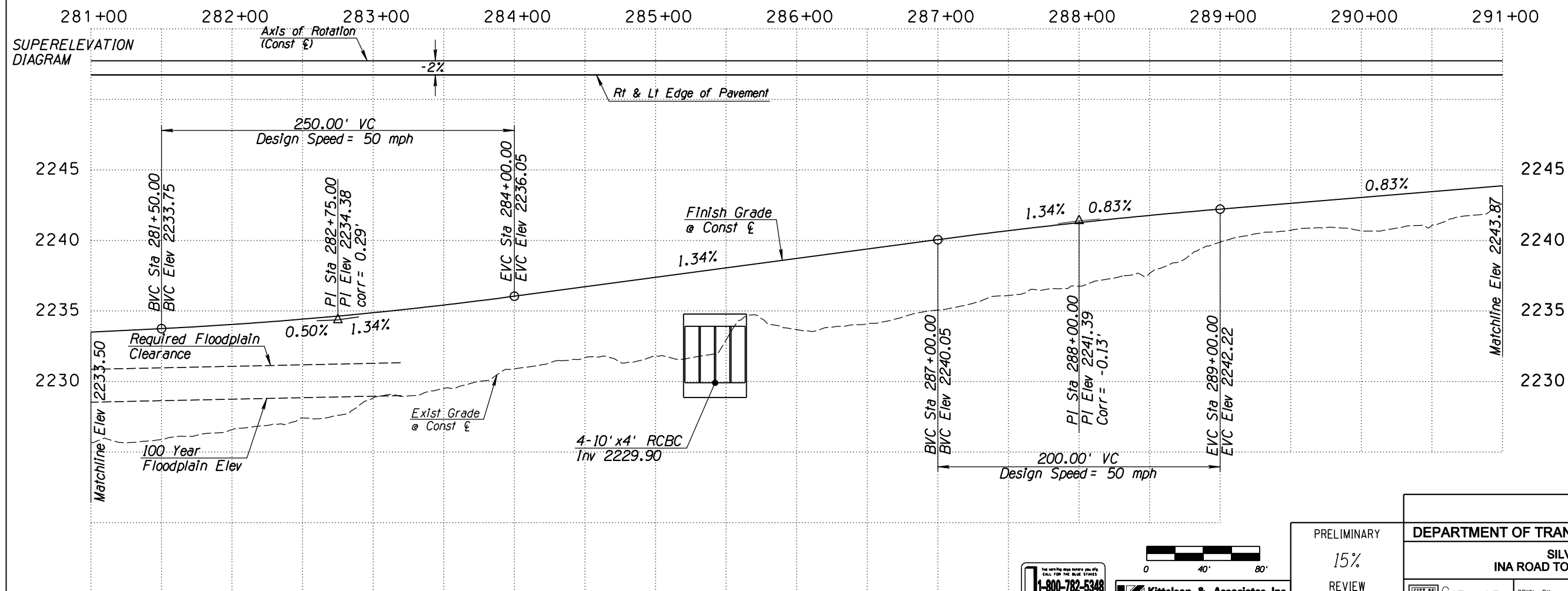
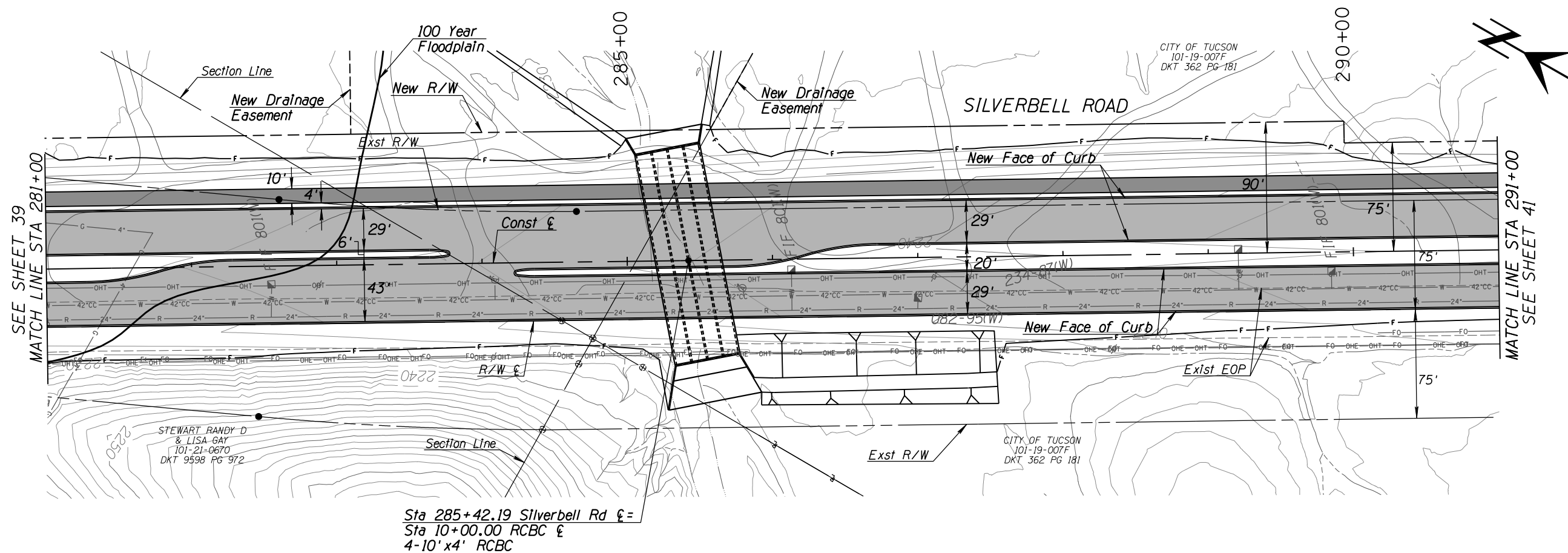
DRWN. BY LAS/TMR 9/10
DSGN. BY JBB/JAS 9/10
CHKD. BY JAS 9/10

REF. _____
PLAN NO. I-2010-005

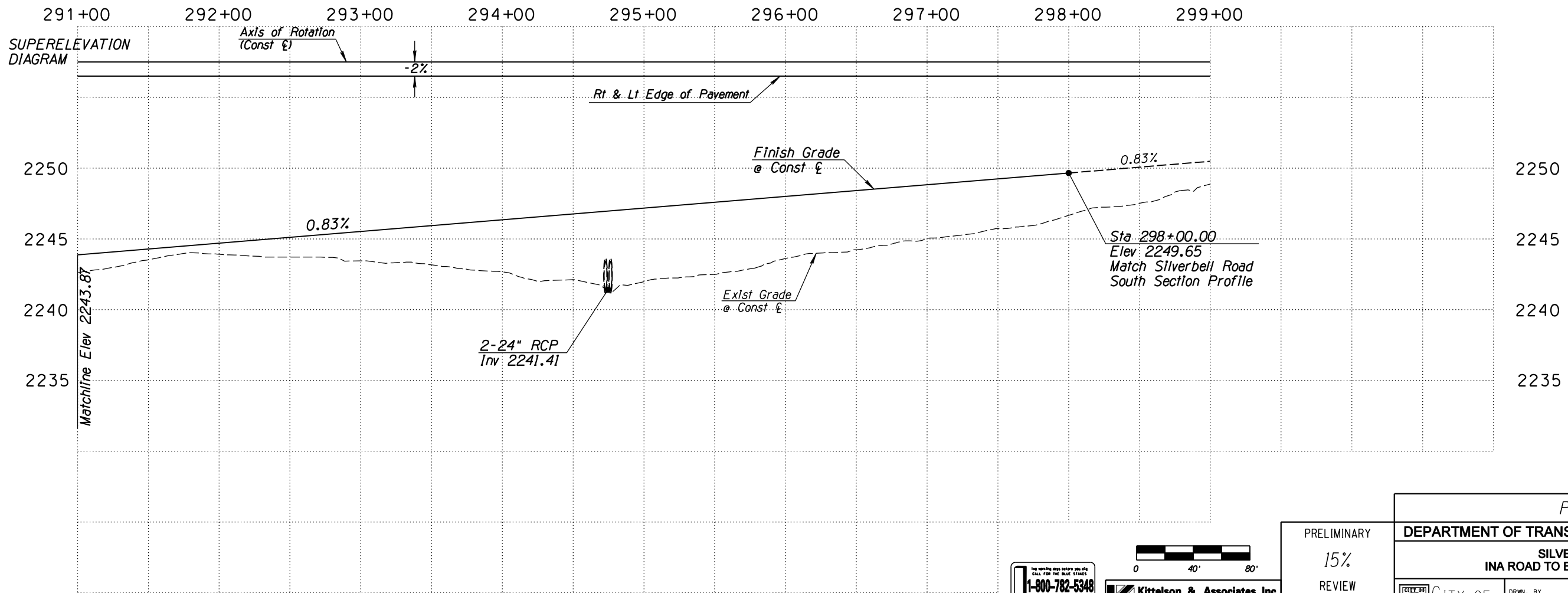
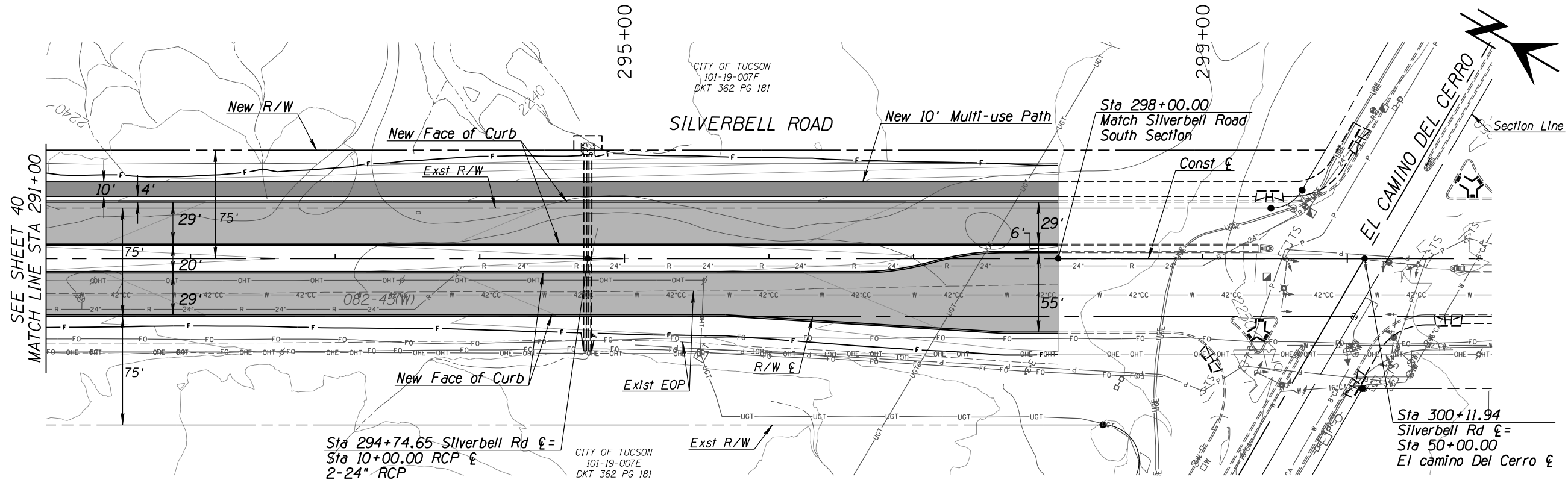
Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701
(520) 844-4067

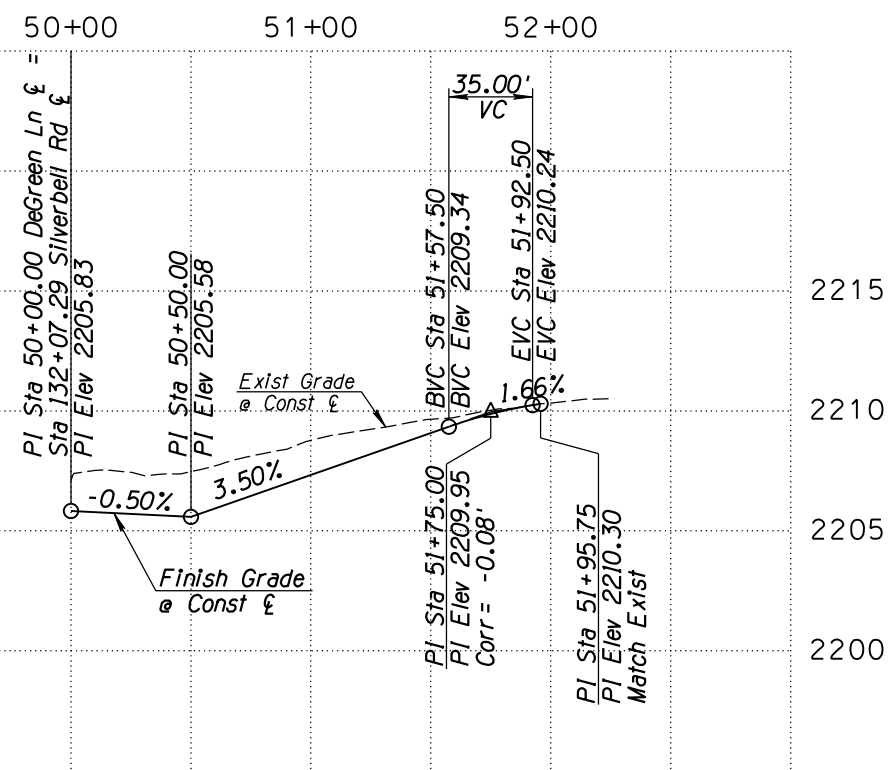
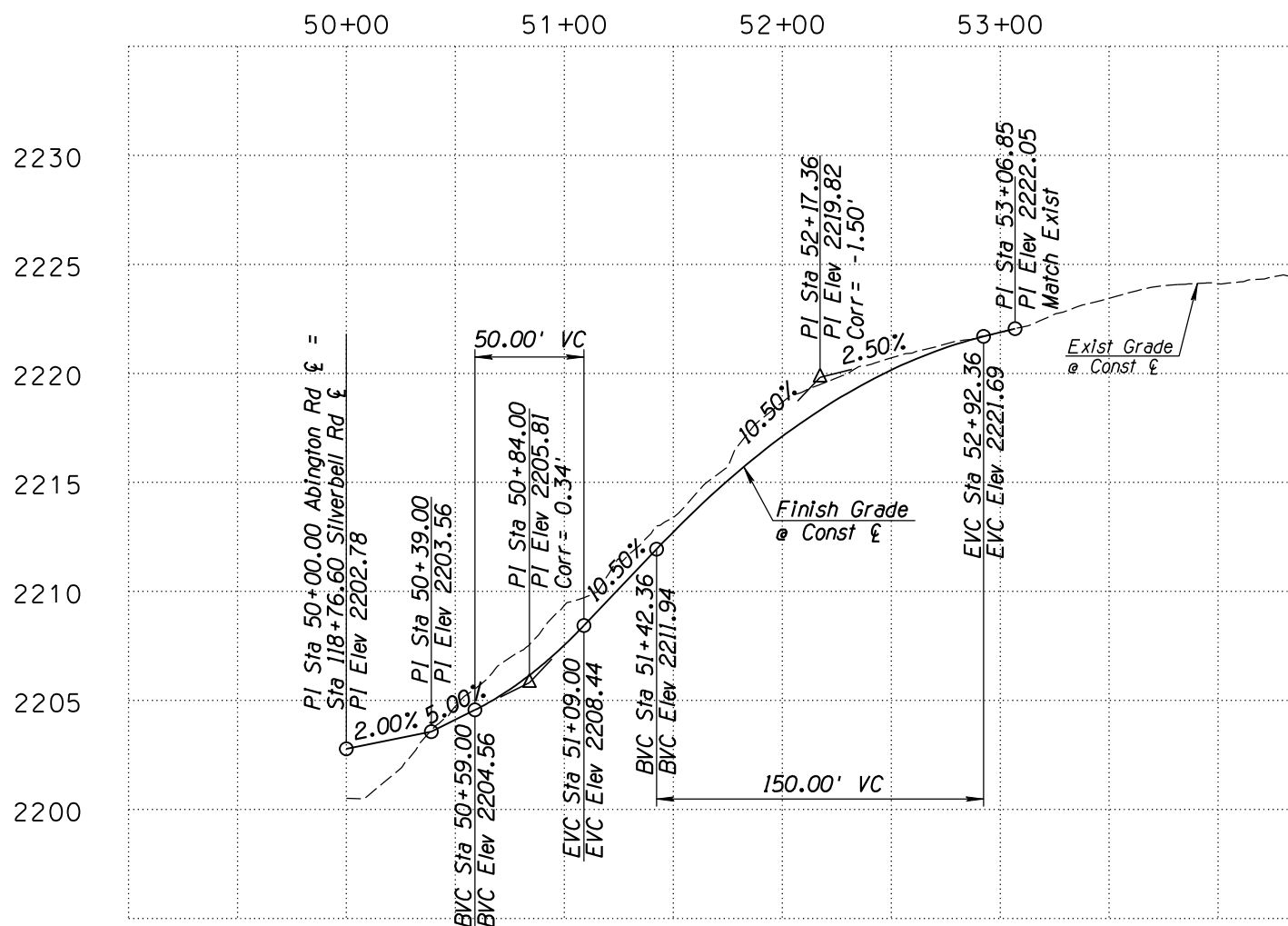
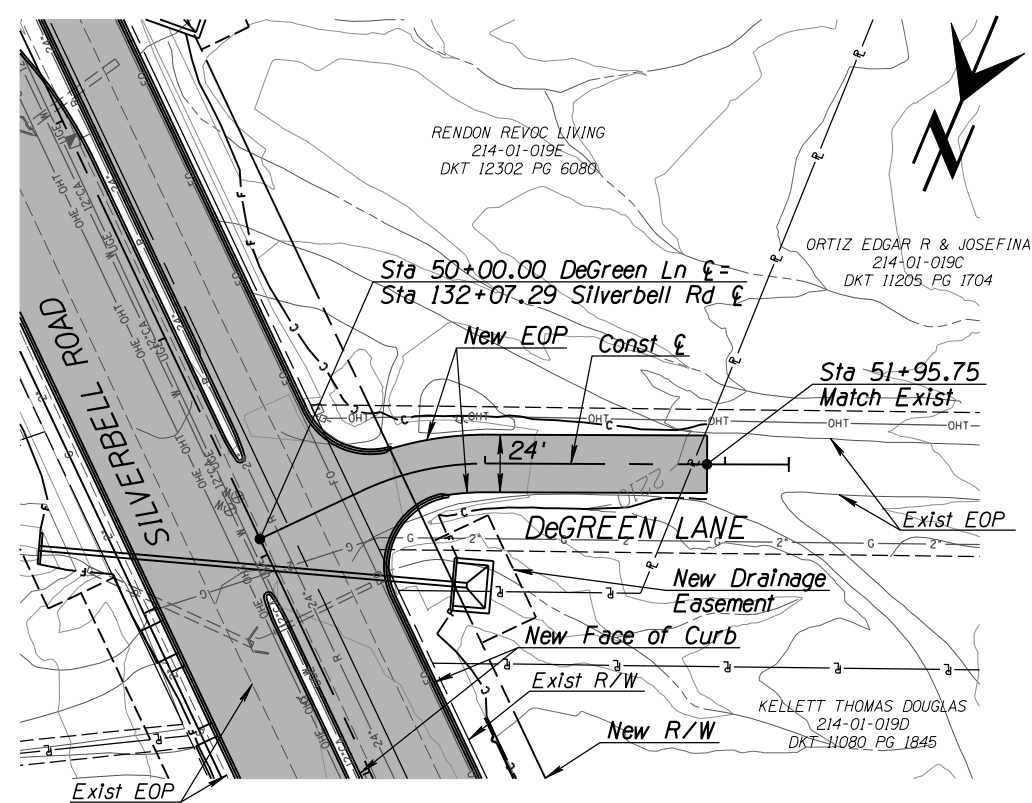
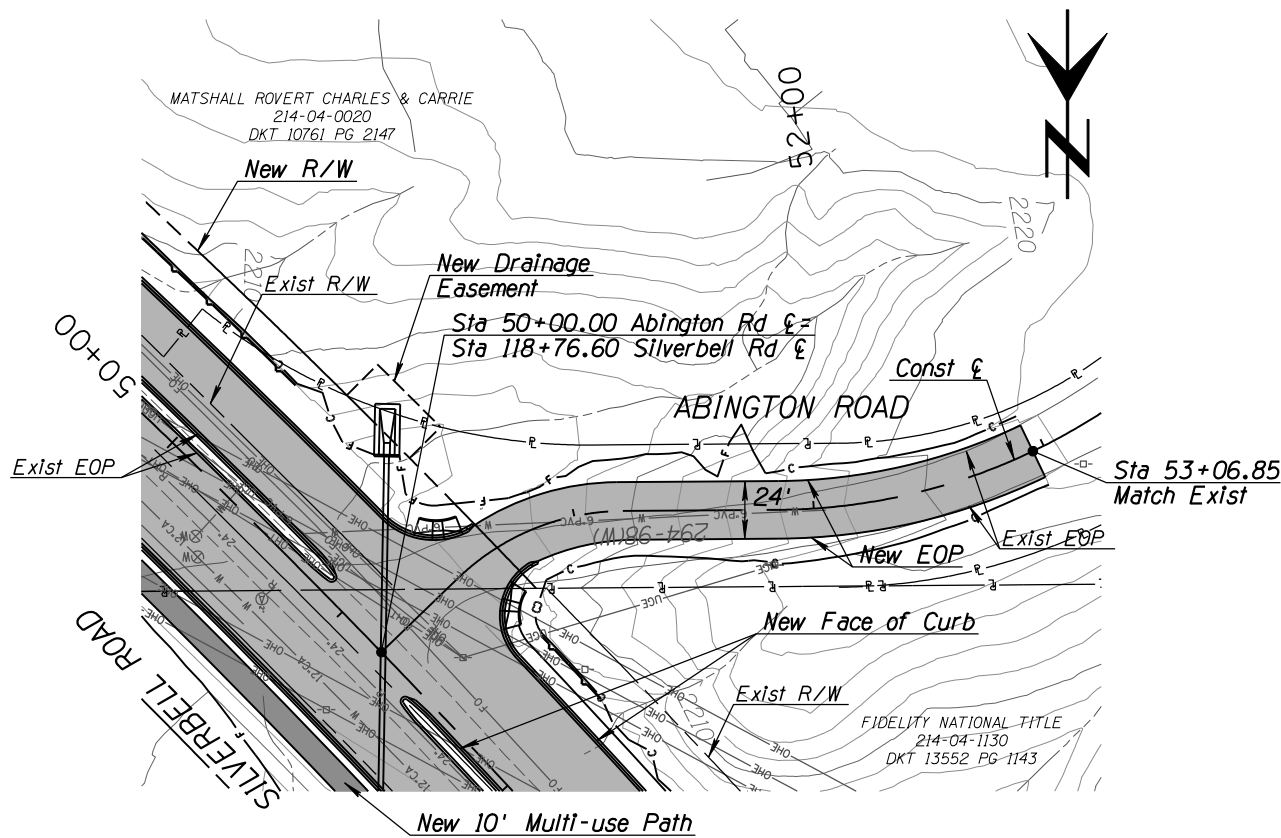
NO. DATE REVISION BY CHKD. APPR.





6/24/2011
H:\profile\9589 - Silverbell Road DCR\15%-North\06 Pn\svb-pnp-21.dgn

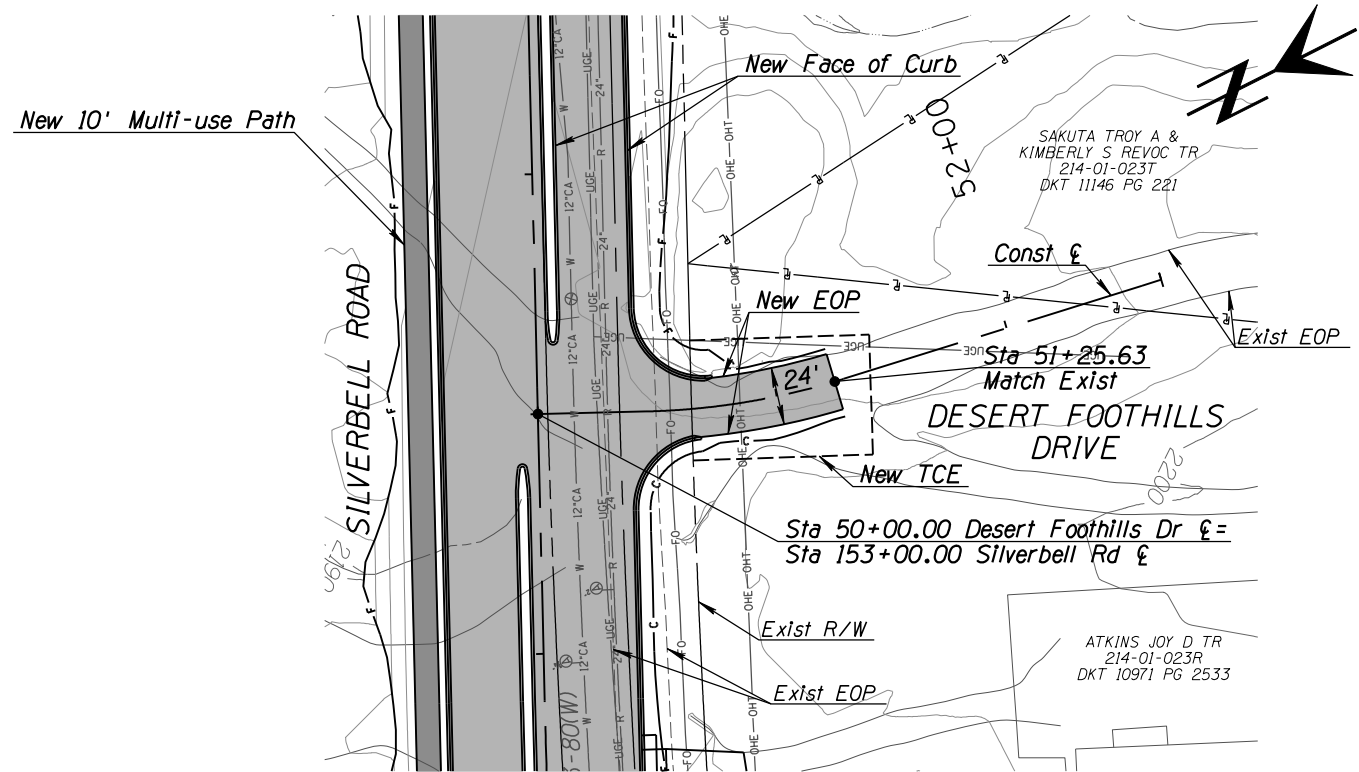
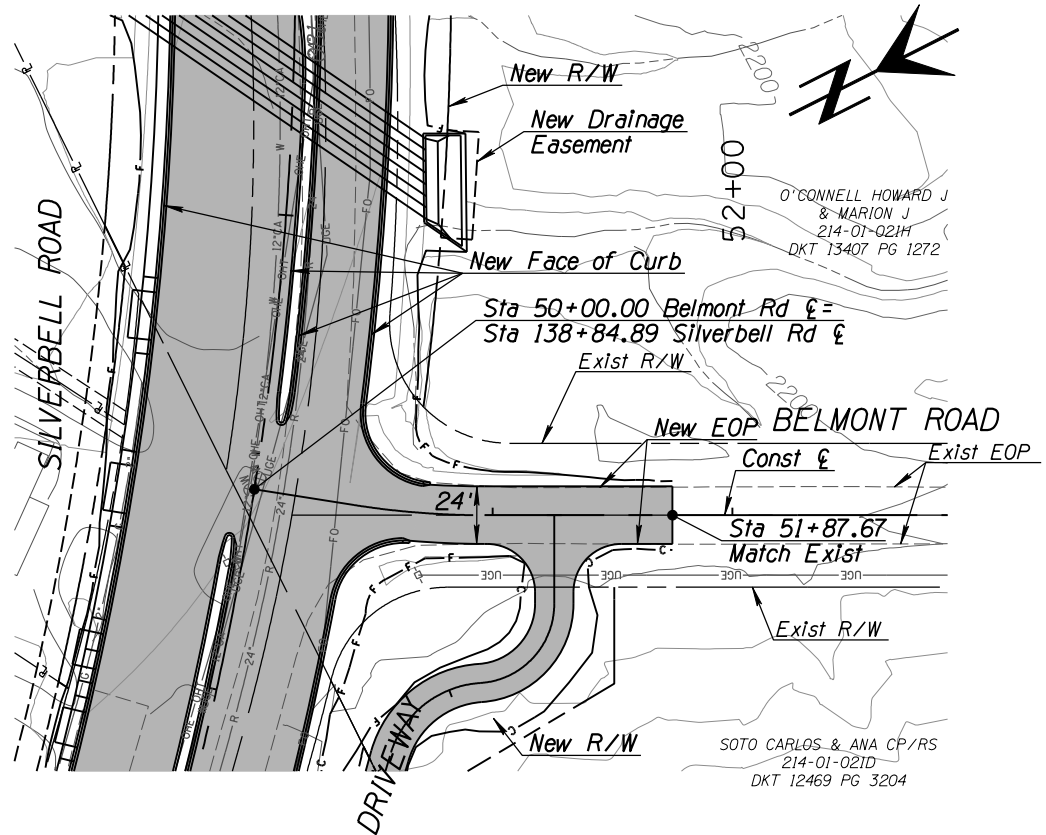




Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

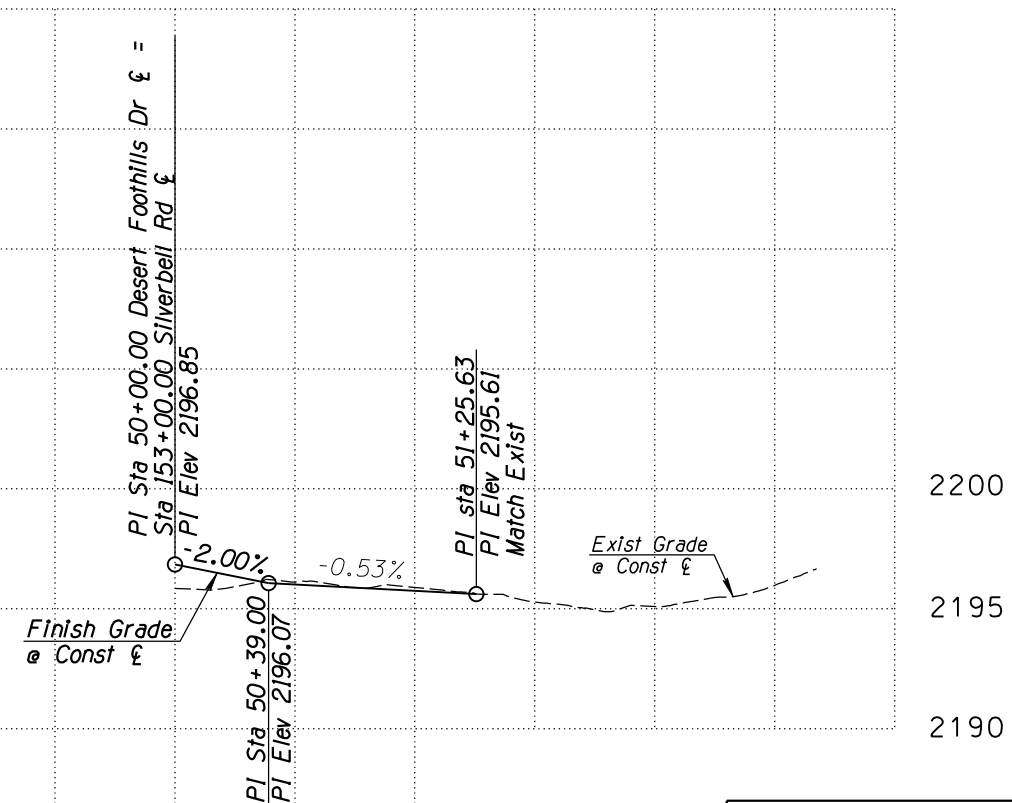
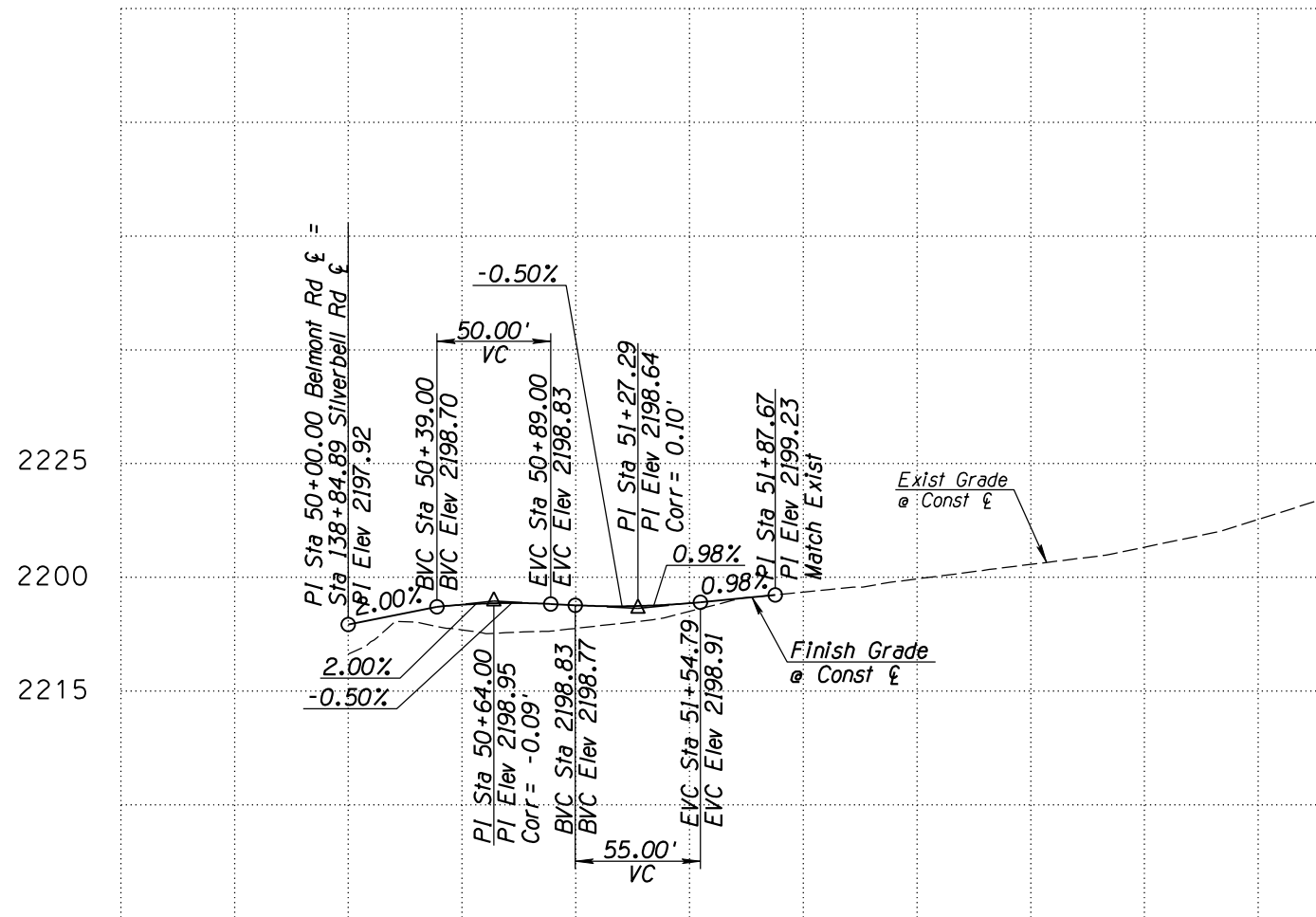
PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			42
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			PP23 OF 81
DRWN. BY	LAS/TMR	REF.	SCALE: 1" = 40'
DSGN. BY	JBB/JAS		1" = 4'
CHKD. BY	JAS		
CITY OF TUCSON			PP29
PLAN NO.			I-2010-005



50+00 51+00 52+00

50+00 51+00 52+00



PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO		PP24 OF PP29	43 OF 81
DRWN. BY	LAS/TMR	REF.	SCALE: 1" = 40'
DSGN. BY	JBB/JAS		1" = 4'
CHKD. BY	JAS	PLAN NO.	I-2010-005

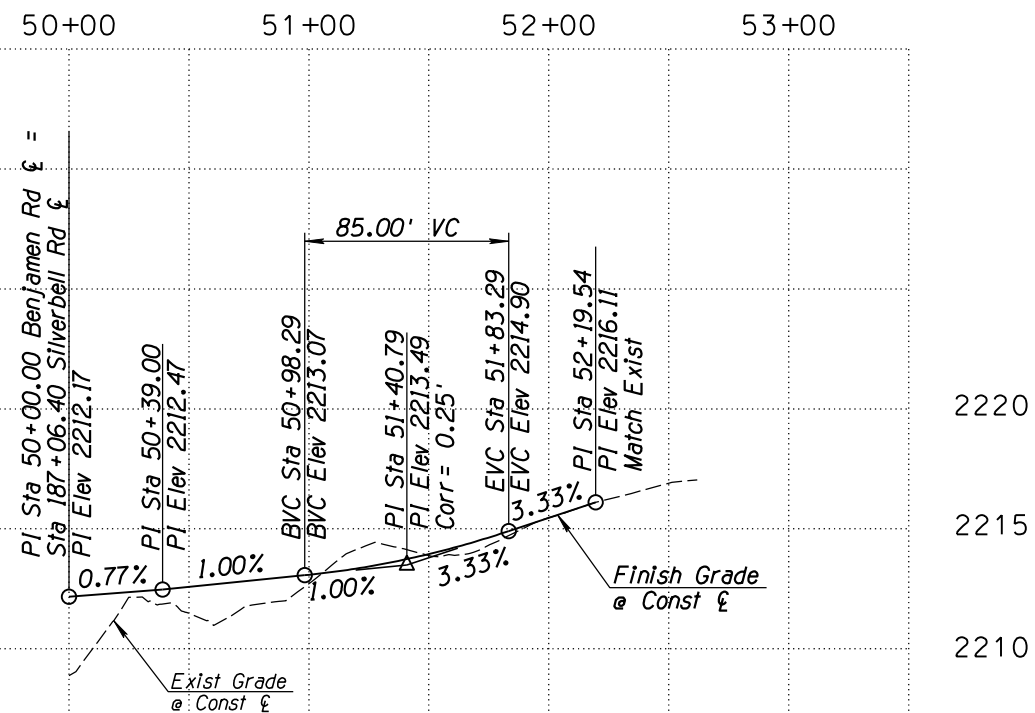
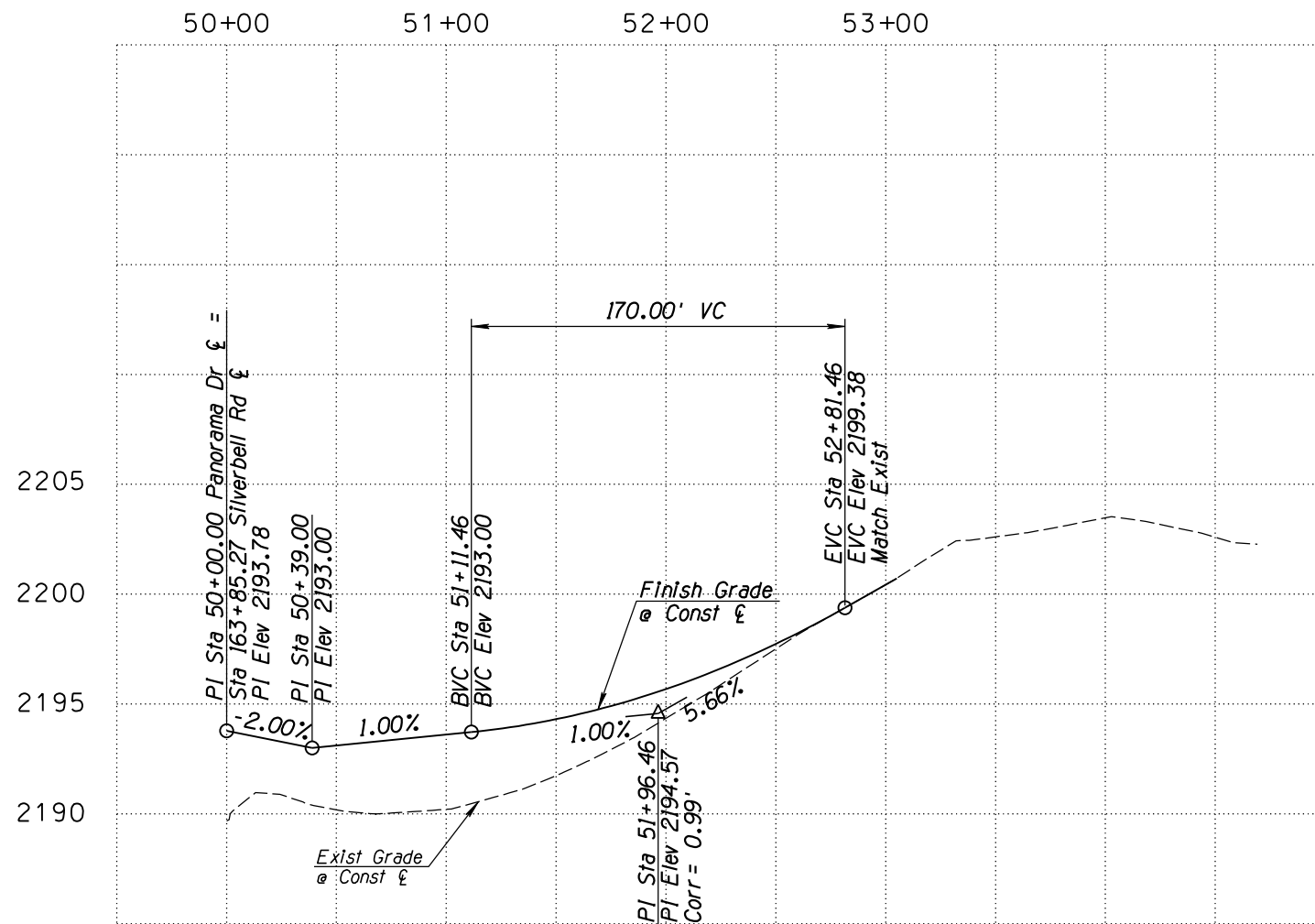
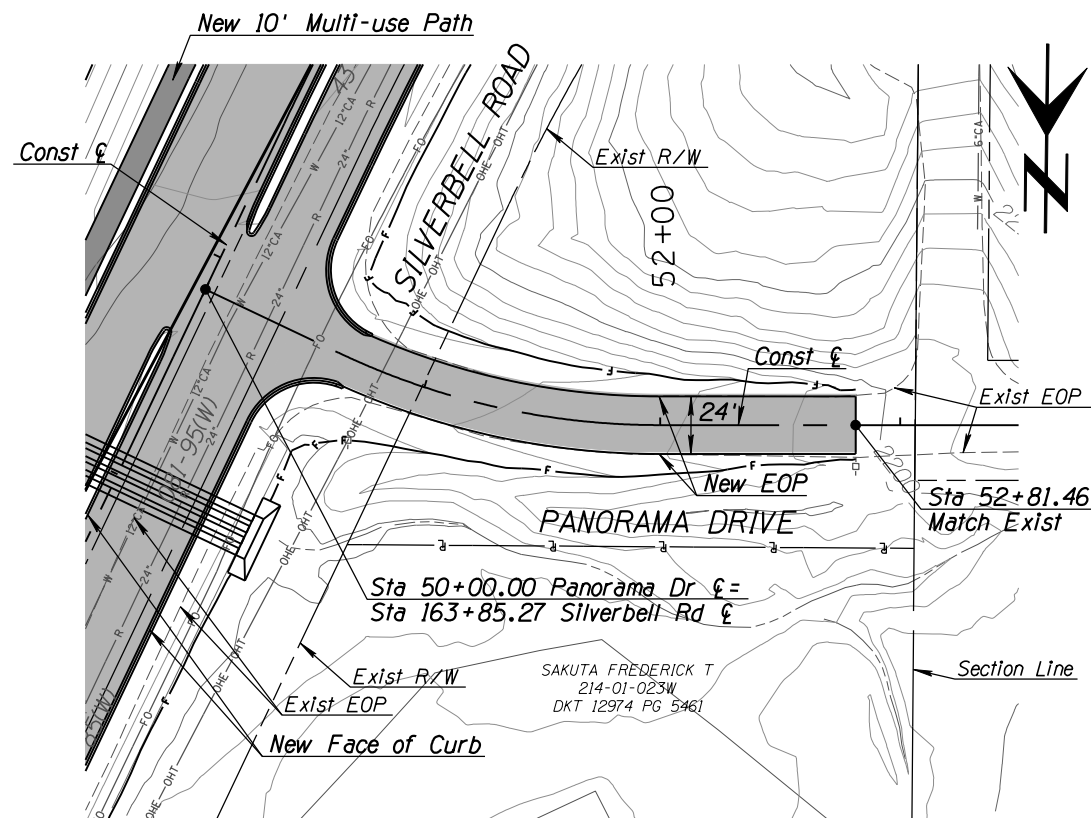
PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

1-800-782-5348
Blue Stone Center
CALL COLLECT

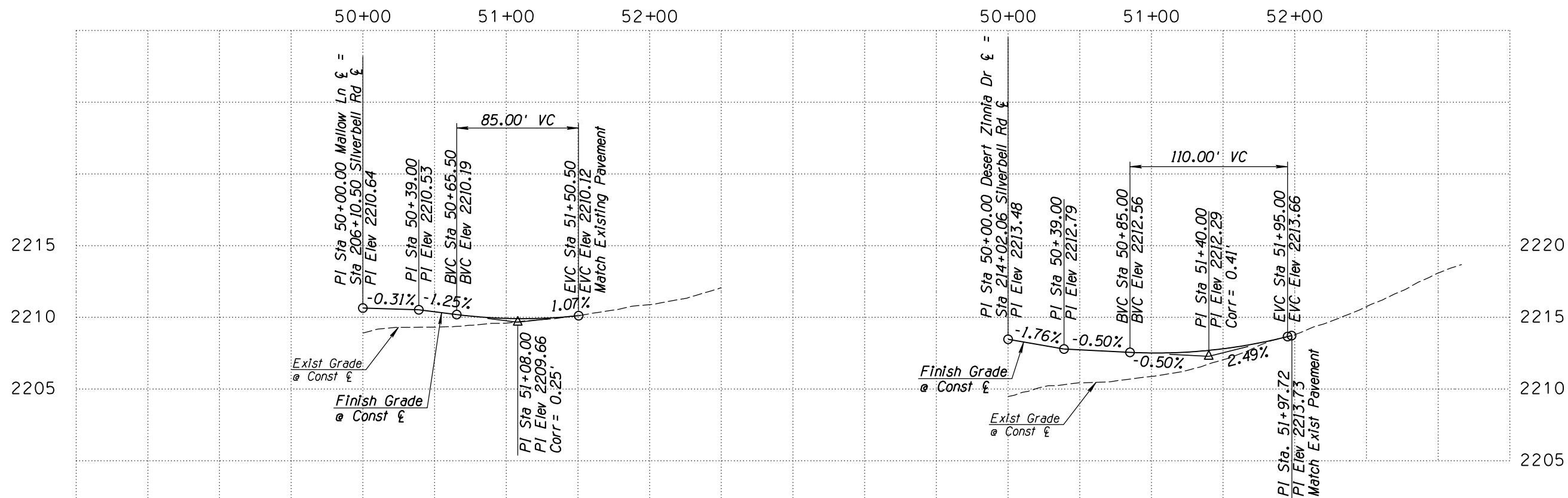
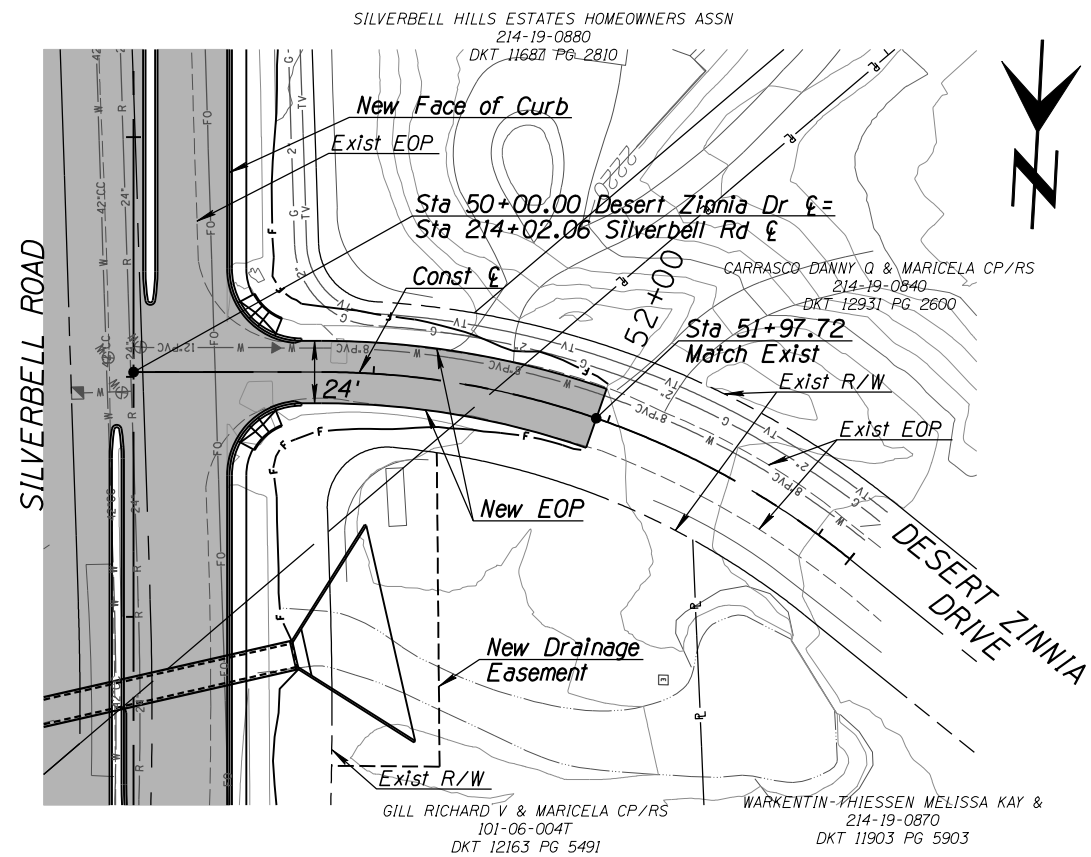
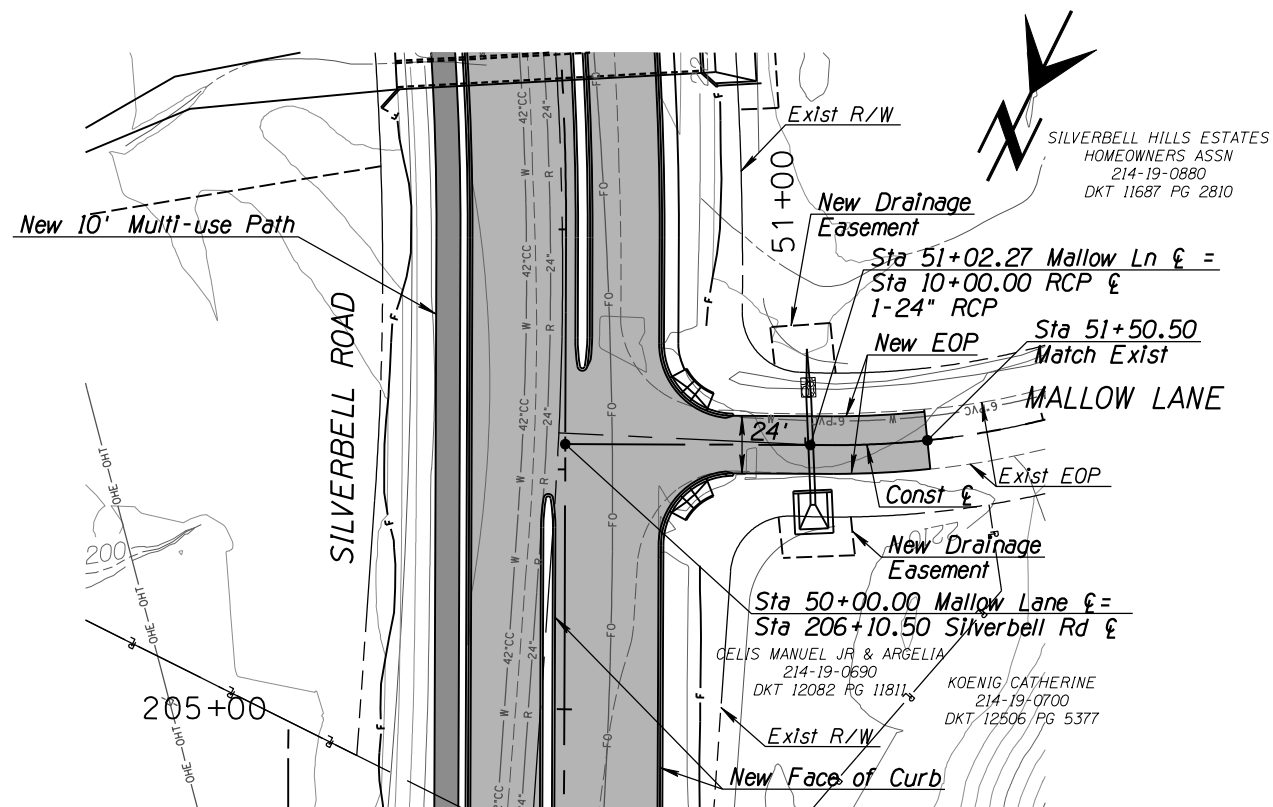
0 40' 80'

NO.	DATE	REVISION	BY	CHKD.	APPR.



PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

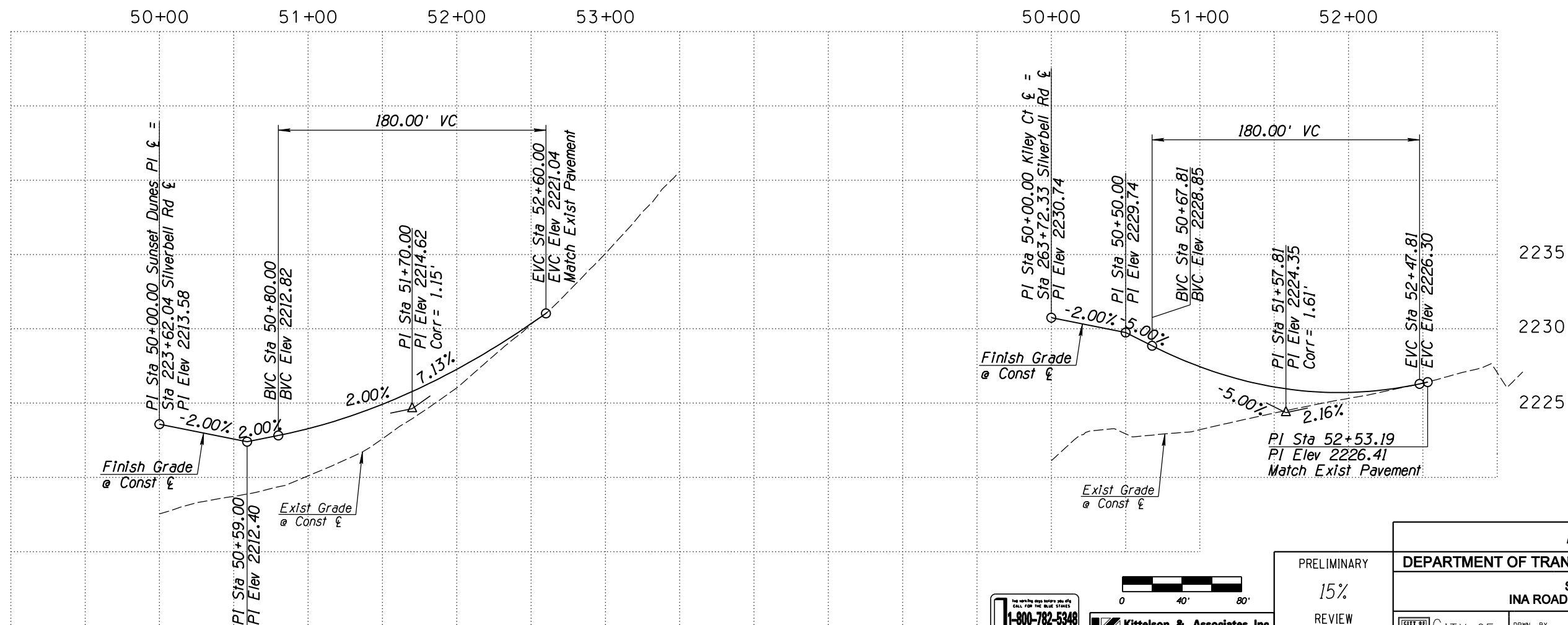
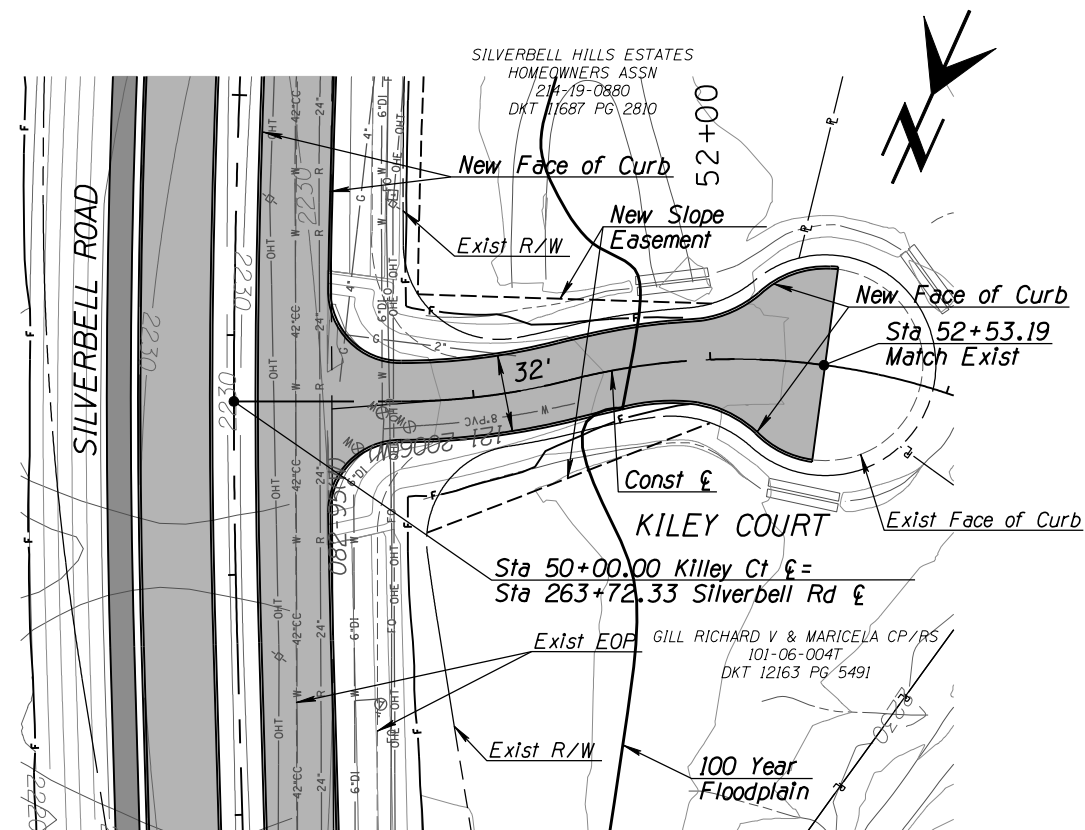
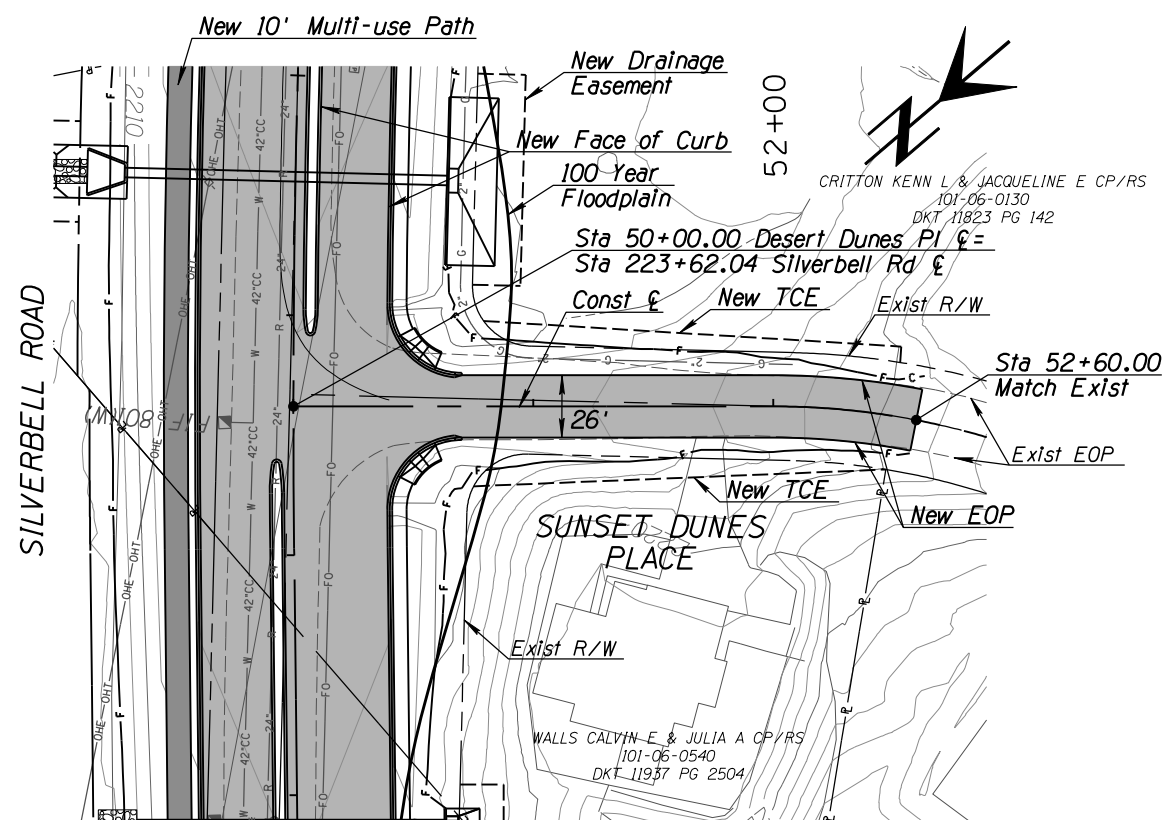
PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			44 OF 81
DRWN. BY	LAS/TMR	REF.	SCALE: 1" = 40'
DSGN. BY	JBB/JAS		1" = 4'
CHKD. BY	JAS		
CITY OF TUCSON			PLAN NO. I-2010-005

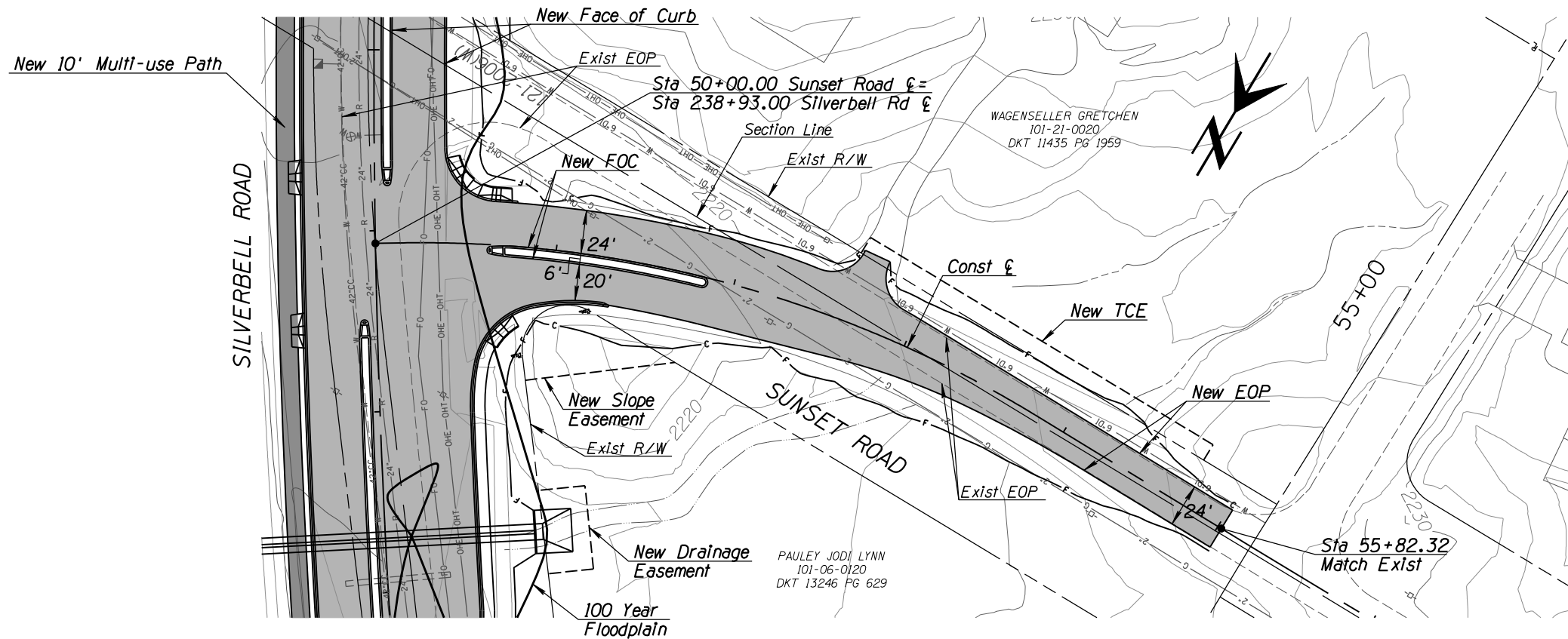


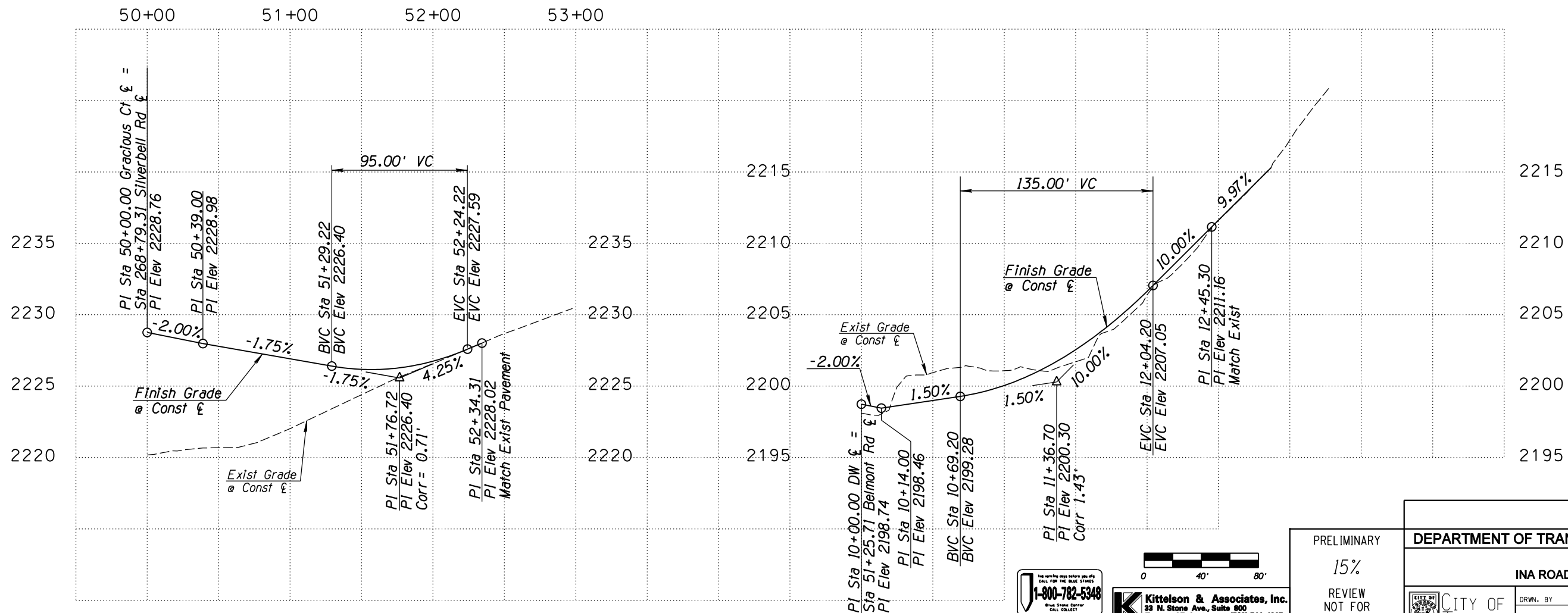
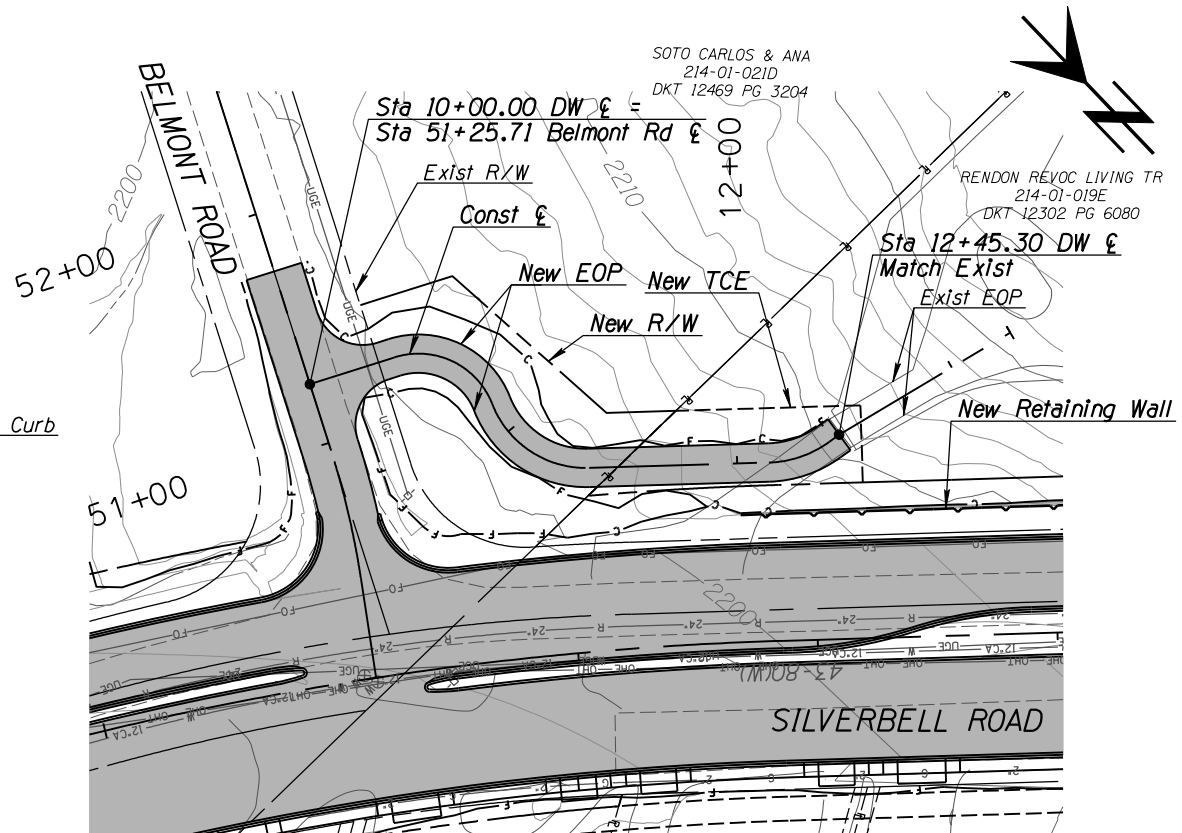
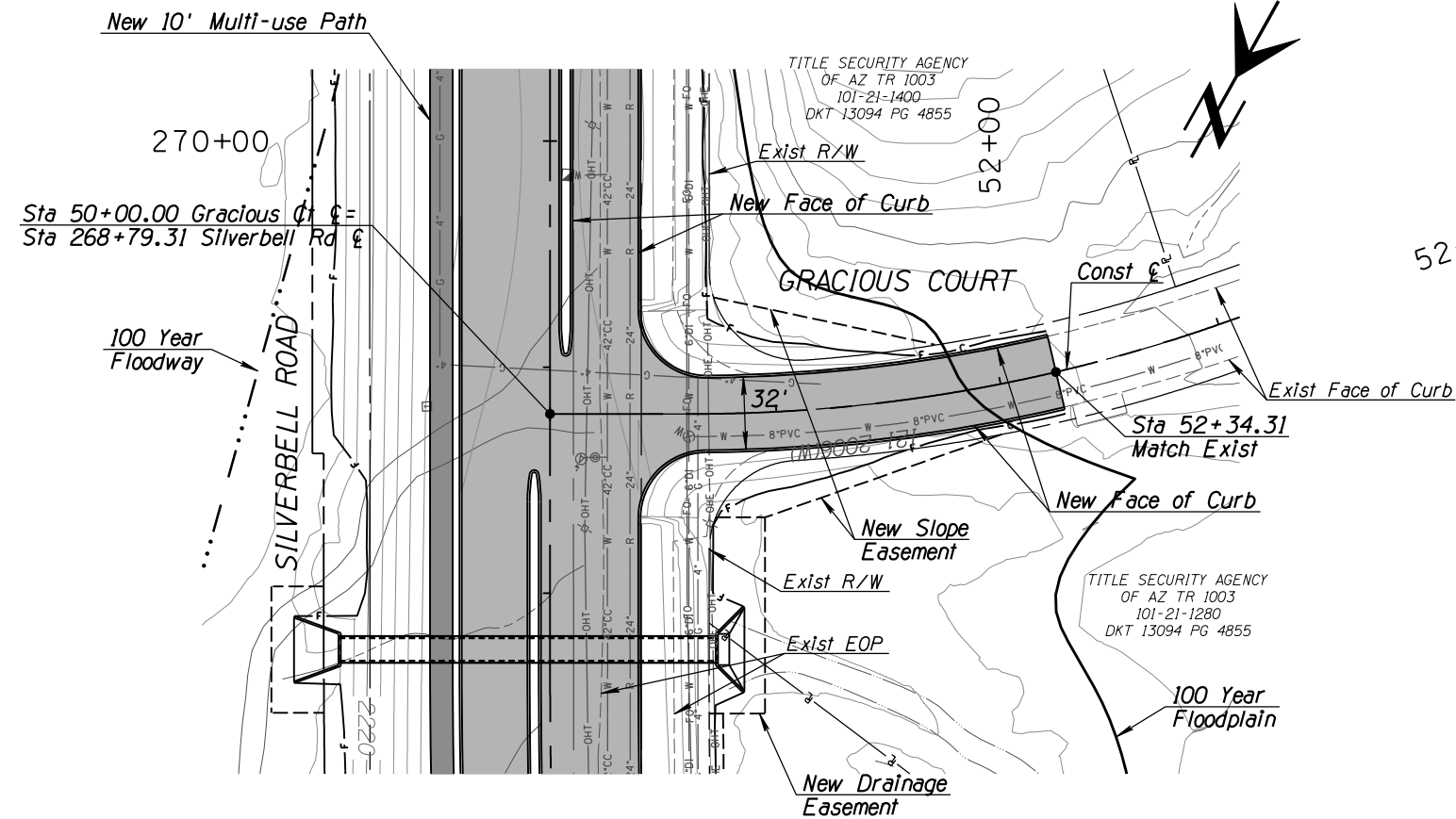
NO.	DATE	REVISION	BY	CHKD.	APPR.

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			PP26 OF PP29
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	JBB/JAS	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005







6/24/2011
H:\profile\9589 - Silverbell Road DCR\15%-North\06 PnP\svb-pnp-29.dgn

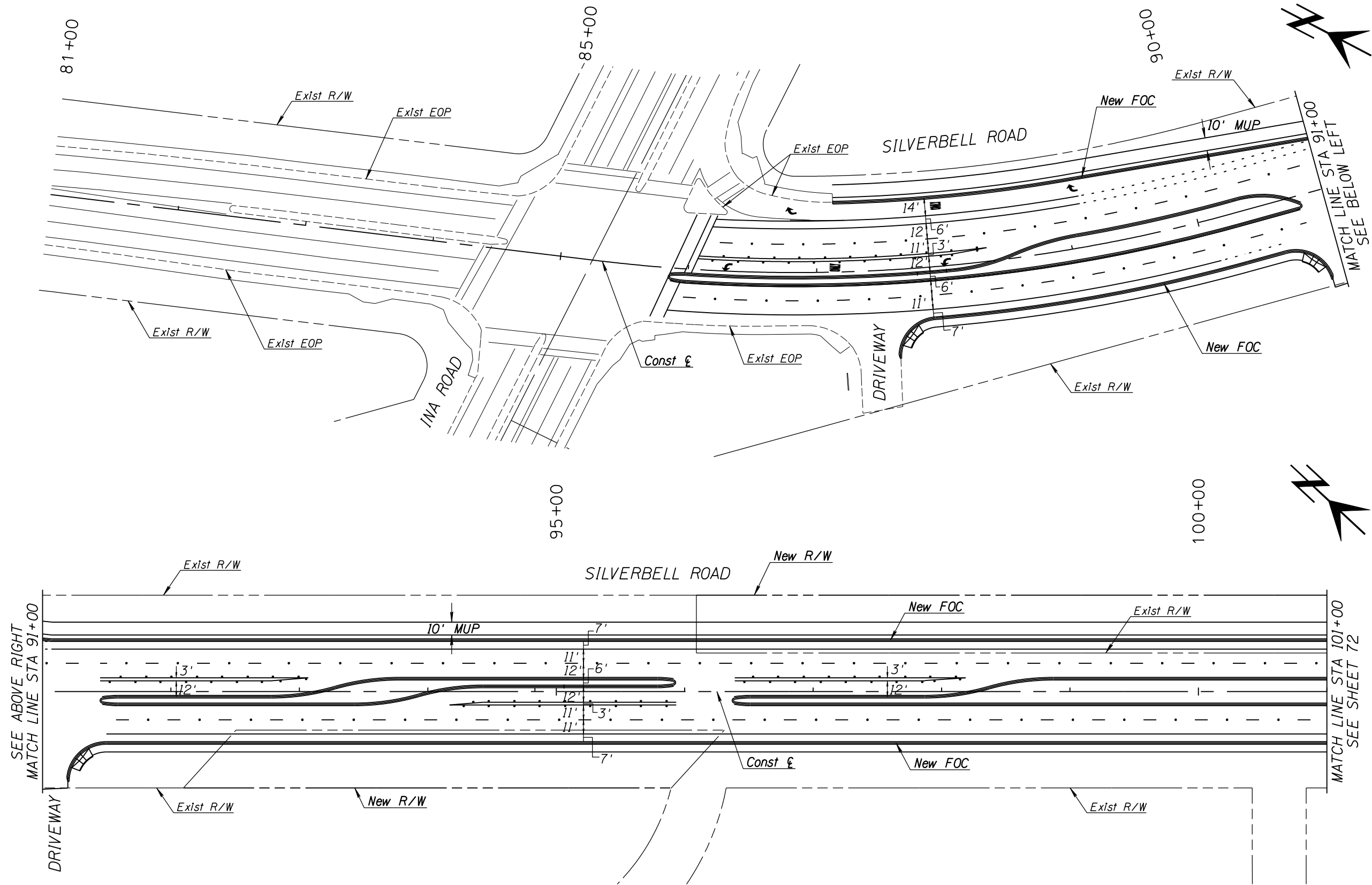


Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701
(520) 844-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO			PP29 OF PP29
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	JBB/JAS	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON			PLAN NO. I-2010-005

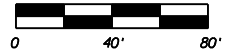
48
OF
81



6/24/2011
H:\profile\9589 - Silverbell Road DCR\15%-North\07 Stripe\svb-str-01.dgn




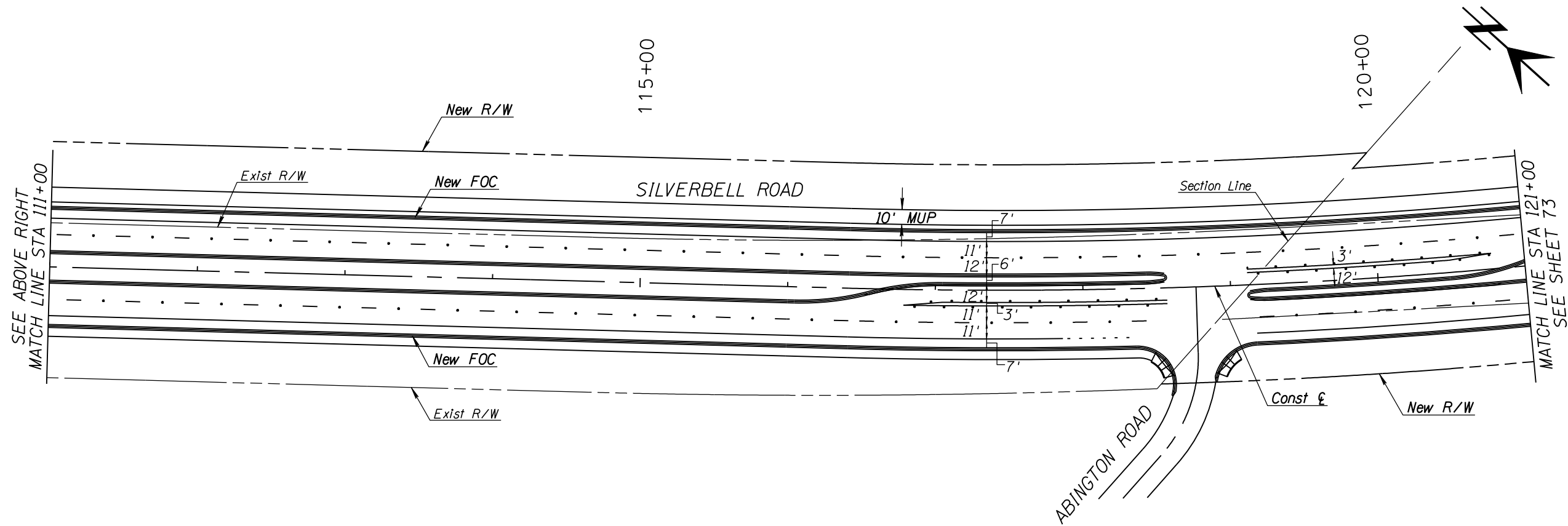
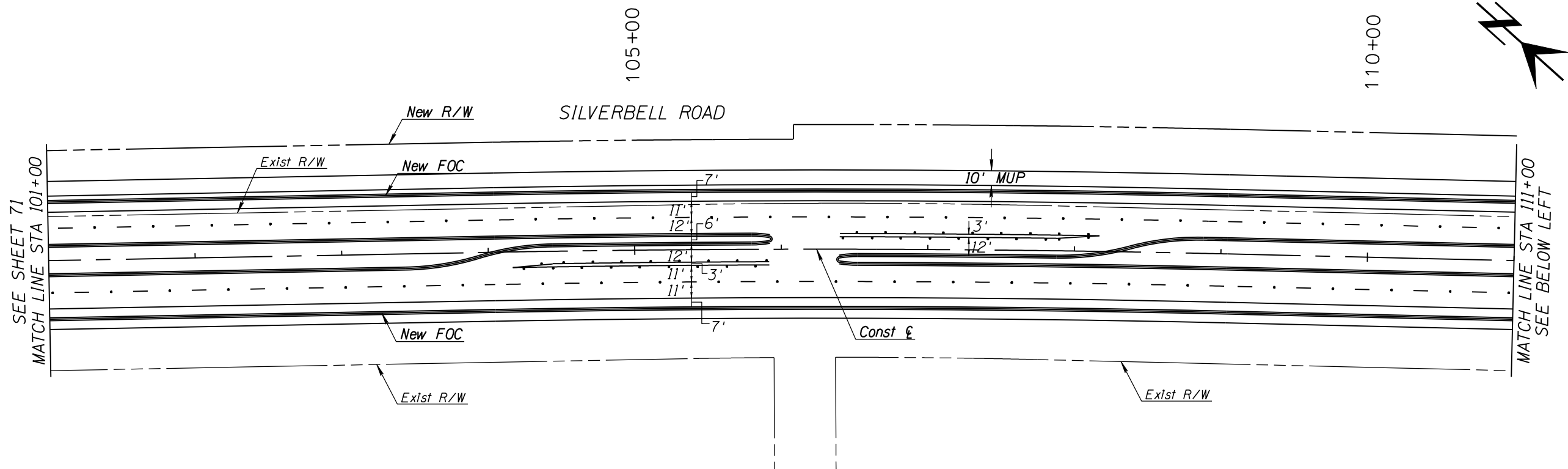
Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067



PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

NO.	DATE	REVISION	BY	CHKD.	APPR.

PAVEMENT MARKING PLAN					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					71
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO					PM1 OF PM11 81
 CITY OF TUCSON	DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
	DSGN. BY	JBB/JAS	9/10		
	CHKD. BY	JAS	9/10	PLAN NO. I-2010-005	

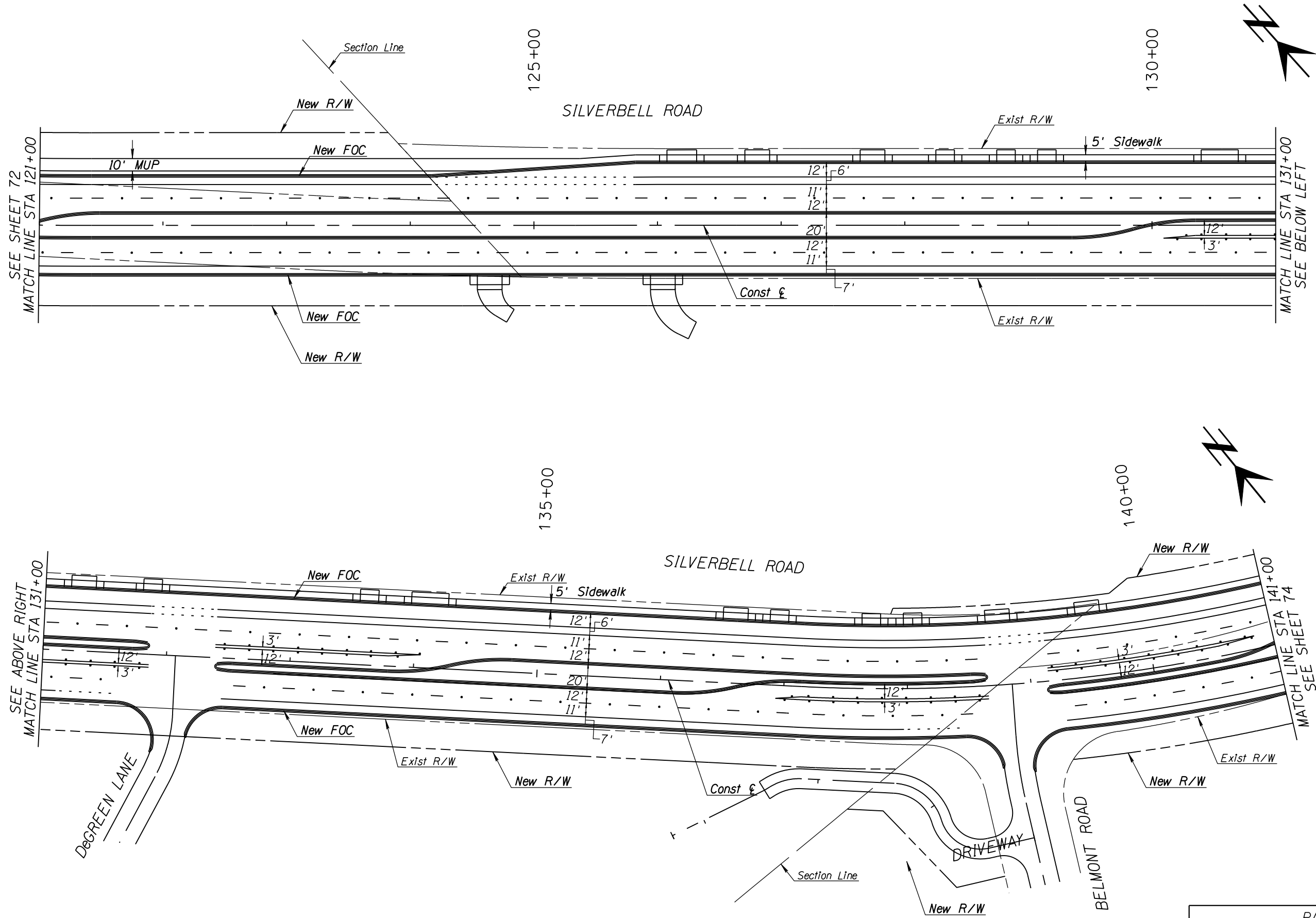


For more info, call 1-800-782-5348
Blue Stamp Center
CALL COLLECT

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN				
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				72 OF 81
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO				PM2 OF PM11
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
DSGN. BY	JBB/JAS	9/10		
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005



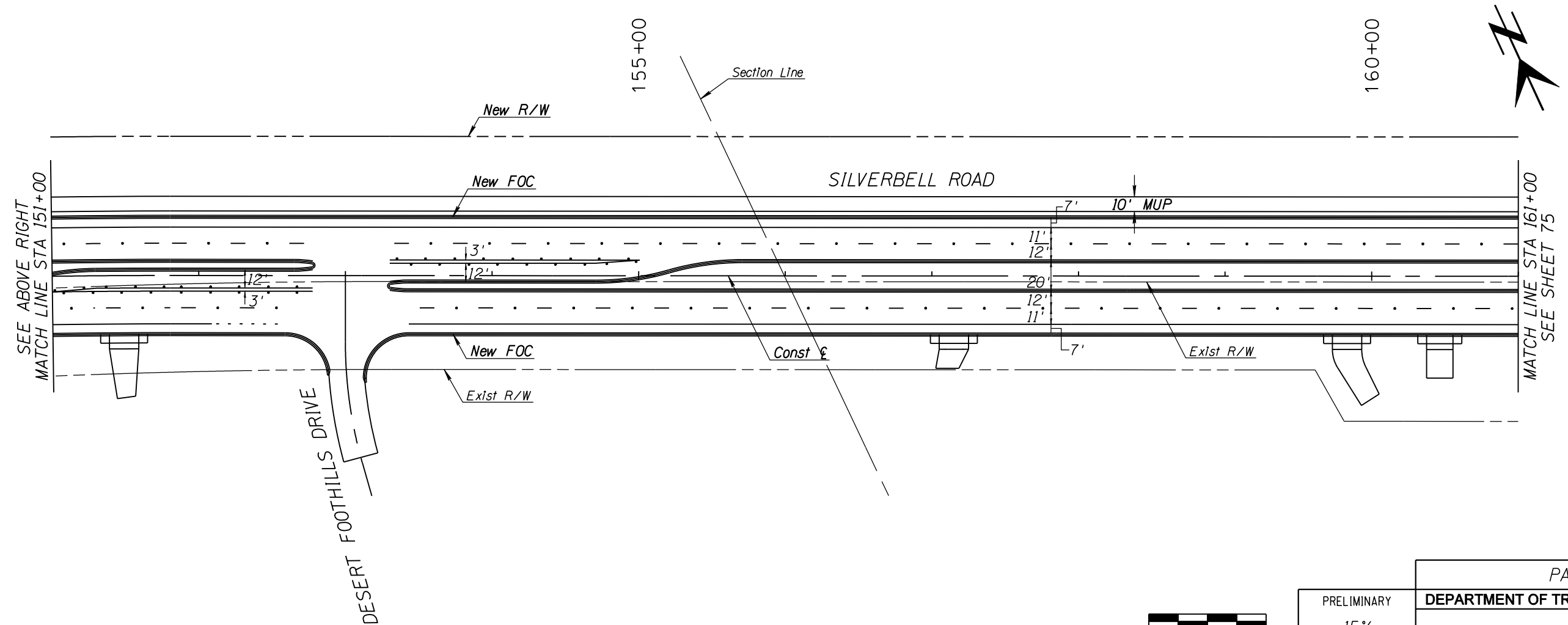
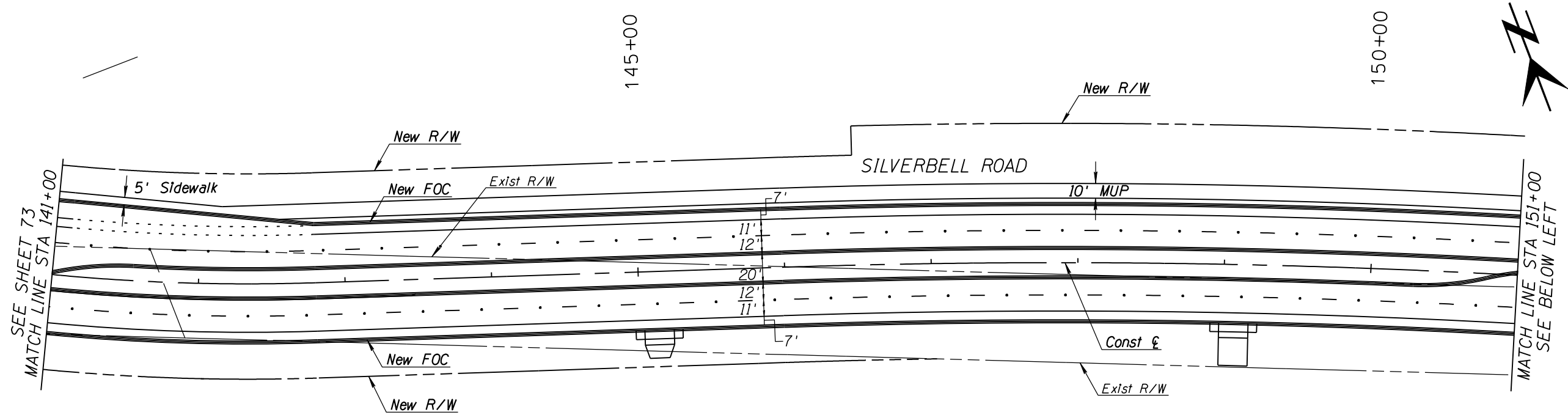
1-800-782-5348
Blue State Center
CALL COLLECT

K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

0 40' 80'

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN				
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				73
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO				PM3 OF PM11 81
	DRWN. BY	LAS/TMR	9/10	REF. _____ SCALE: 1" = 40' PLAN NO. I-2010-005
	DSGN. BY	JBB/JAS	9/10	
	CHKD. BY	JAS	9/10	



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

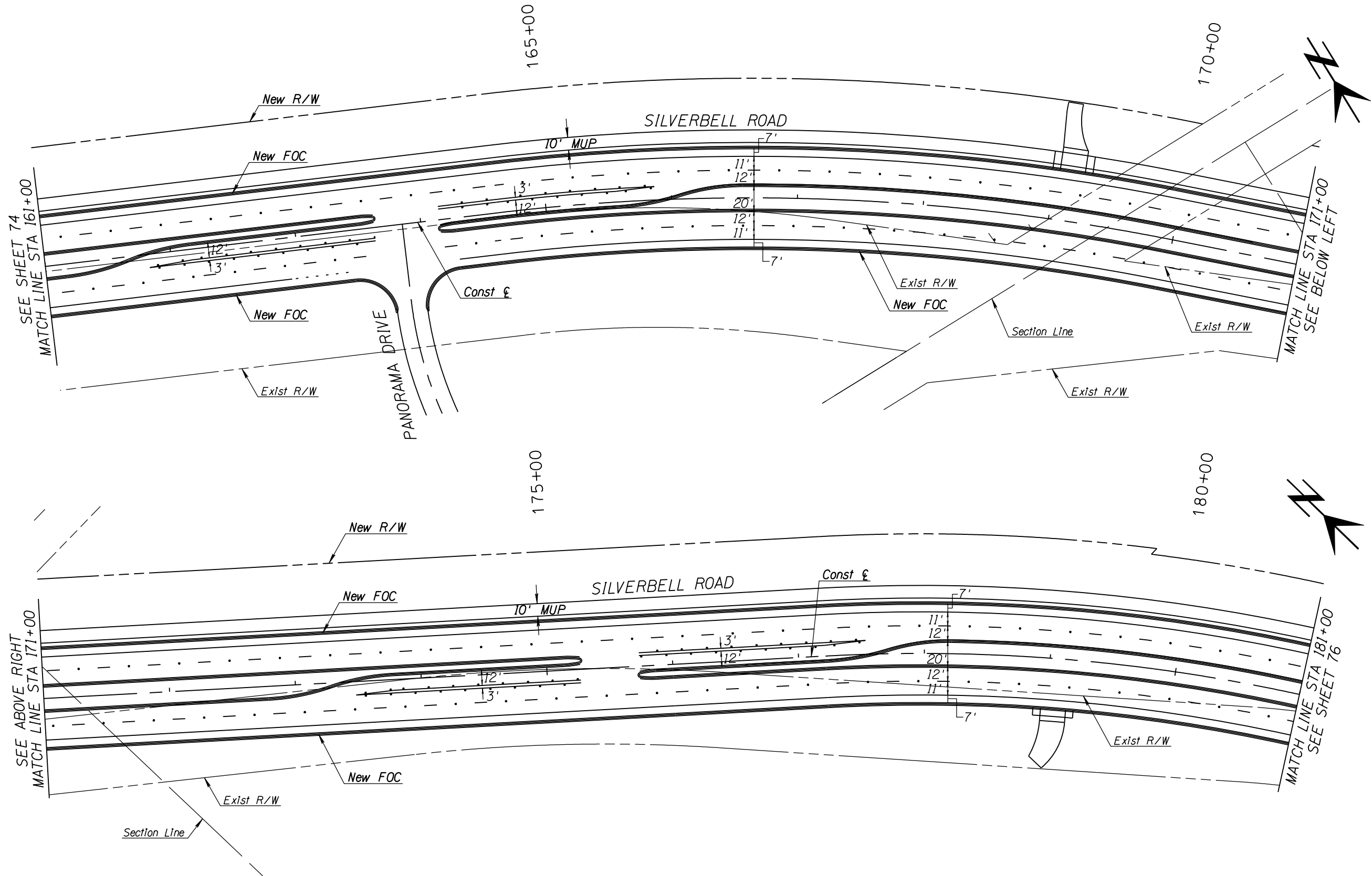
PAVEMENT MARKING PLAN
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION
SILVERBELL ROAD
INA ROAD TO EL CAMINO DEL CERRO

74
OF
81

PM4
OF
PM11

DRWN. BY	LAS/TMR	9/10
DSGN. BY	JBB/JAS	9/10
CHKD. BY	JAS	9/10

REF. _____ SCALE: 1" = 40'
PLAN NO. **I-2010-005**

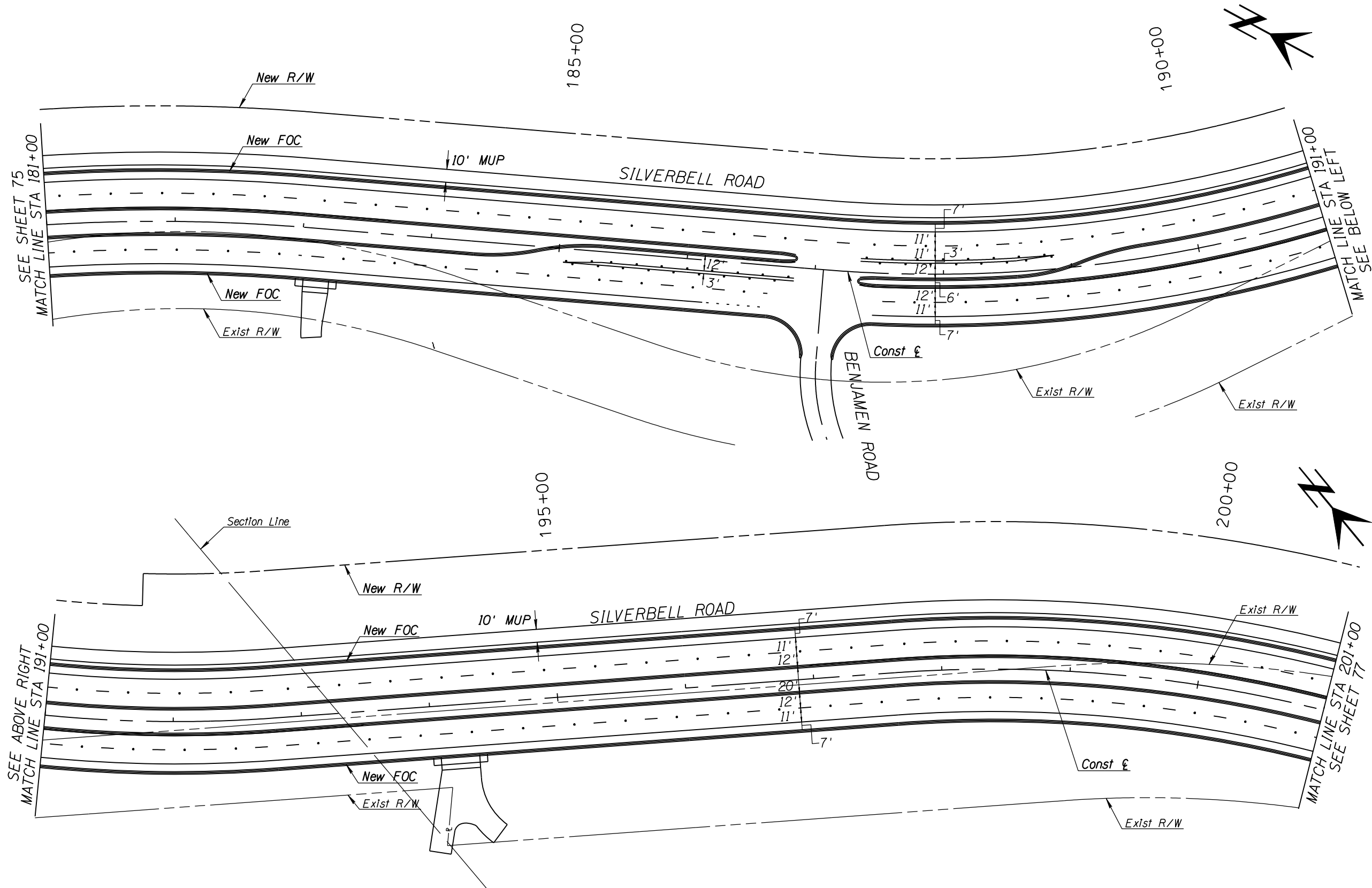


NO. DATE REVISION BY CHKD. APPR.

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN		
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION		
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO		
DRWN. BY LAS/TMR	9/10	REF. _____ SCALE: 1" = 40'
DSGN. BY JBB/JAS	9/10	
CHKD. BY JAS	9/10	
CITY OF TUCSON		PLAN NO. I-2010-005

75 OF 81



1-800-782-5348
Not working? Stop before you die.
CALL FOR THE BLUE STRIPE

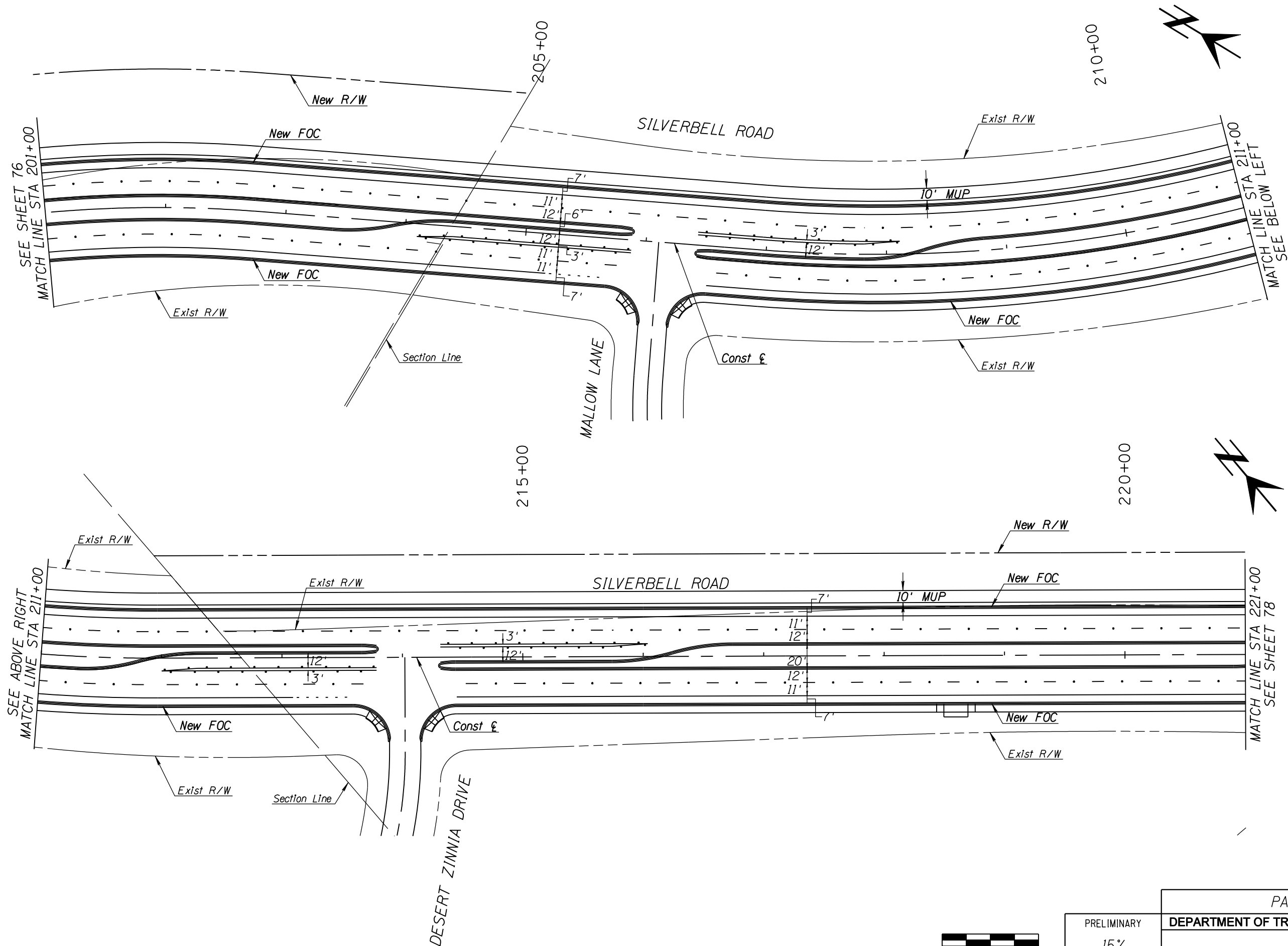
0 40' 80'

K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN				
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				76 OF 81
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO				PM6 OF PM11
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
DSGN. BY	JBB/JAS	9/10		
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005





1-800-782-5348
Blue State Center
CALL COLLECT

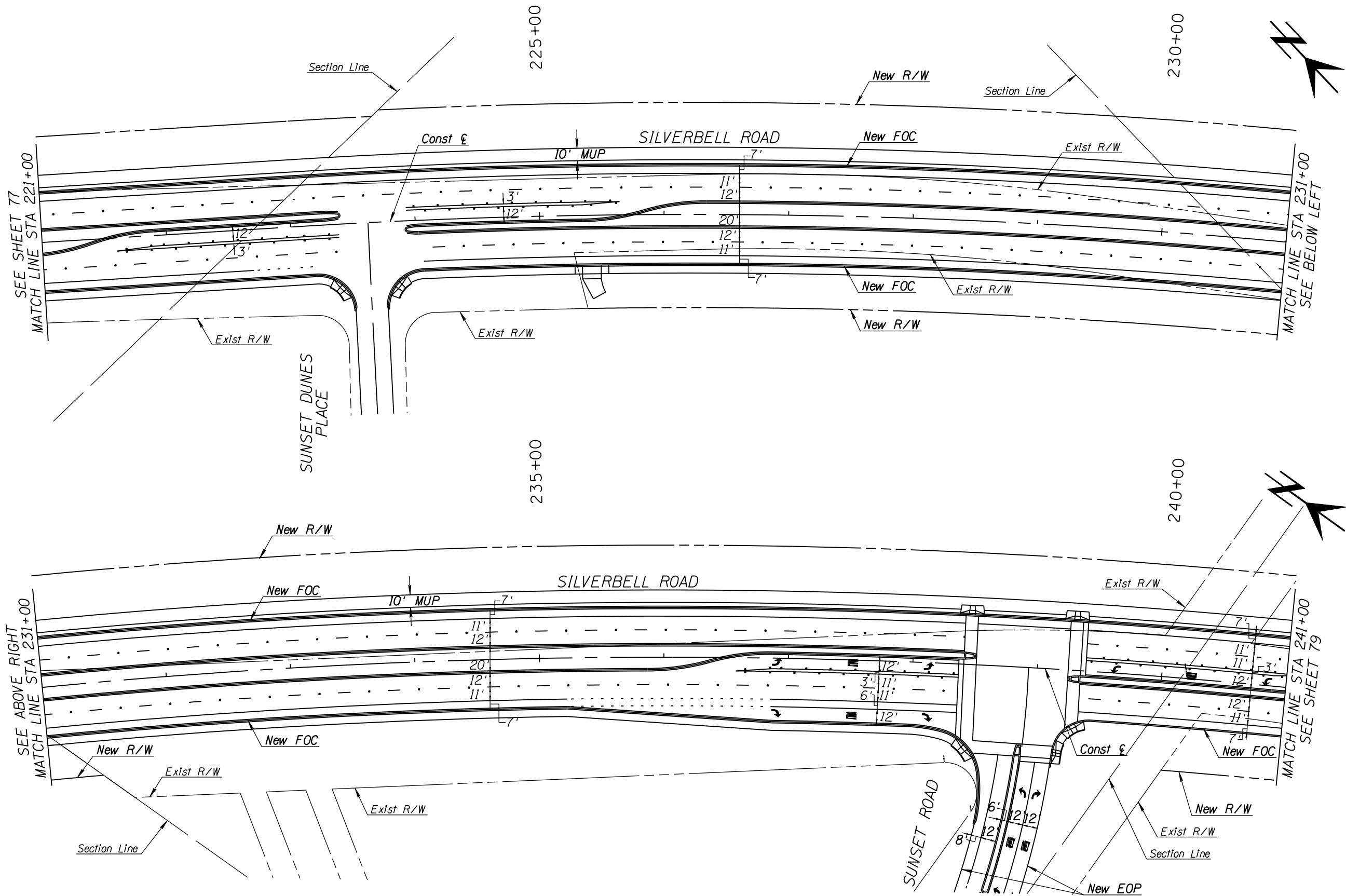
K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

0 40' 80'

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN				
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				77 OF 81
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO				PM7 OF PM11
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
DSGN. BY	JBB/JAS	9/10		
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005





0 40' 80'

PRELIMINARY

15%

REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
INA ROAD TO EL CAMINO DEL CERRO

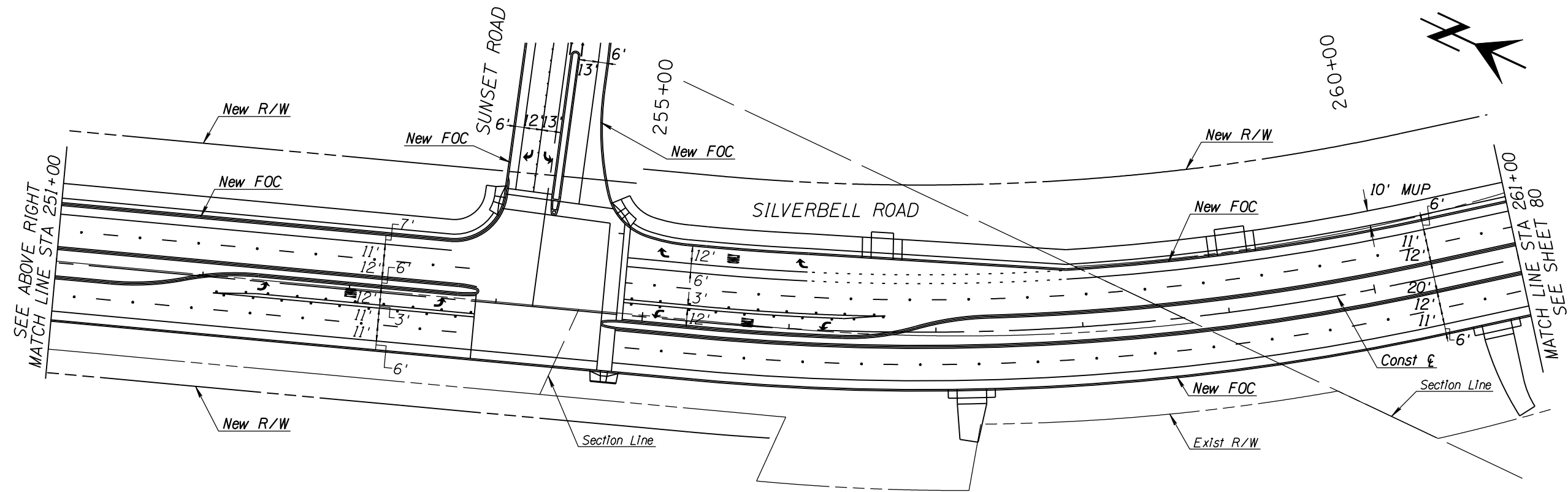
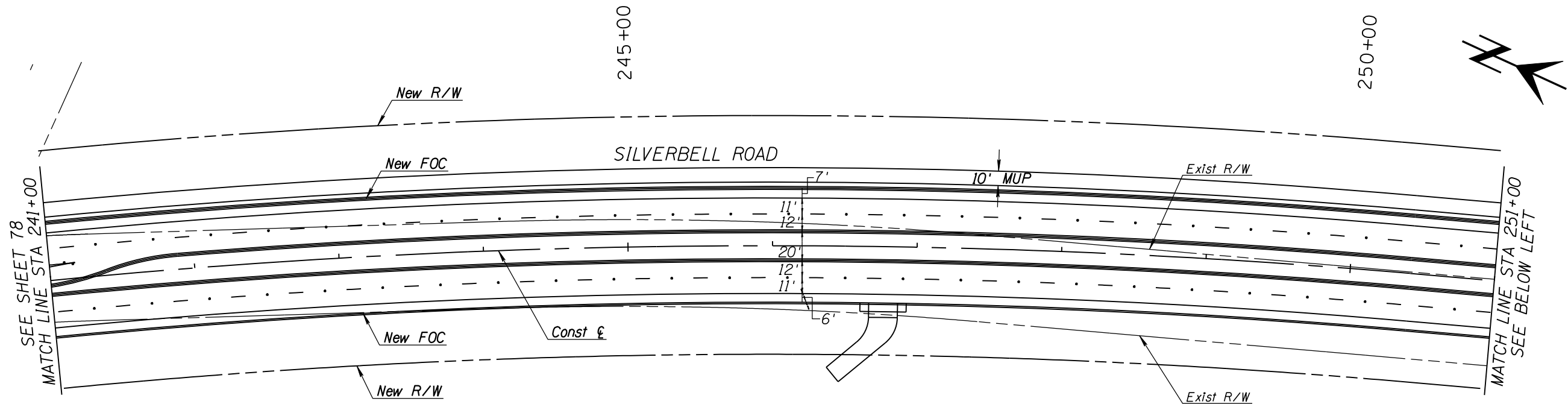
78 OF 81

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

CITY OF TUCSON

DRWN. BY	LAS/TMR	9/10
DSGN. BY	JBB/JAS	9/10
CHKD. BY	JAS	9/10

REF.	SCALE: 1" = 40'
PLAN NO.	I-2010-005



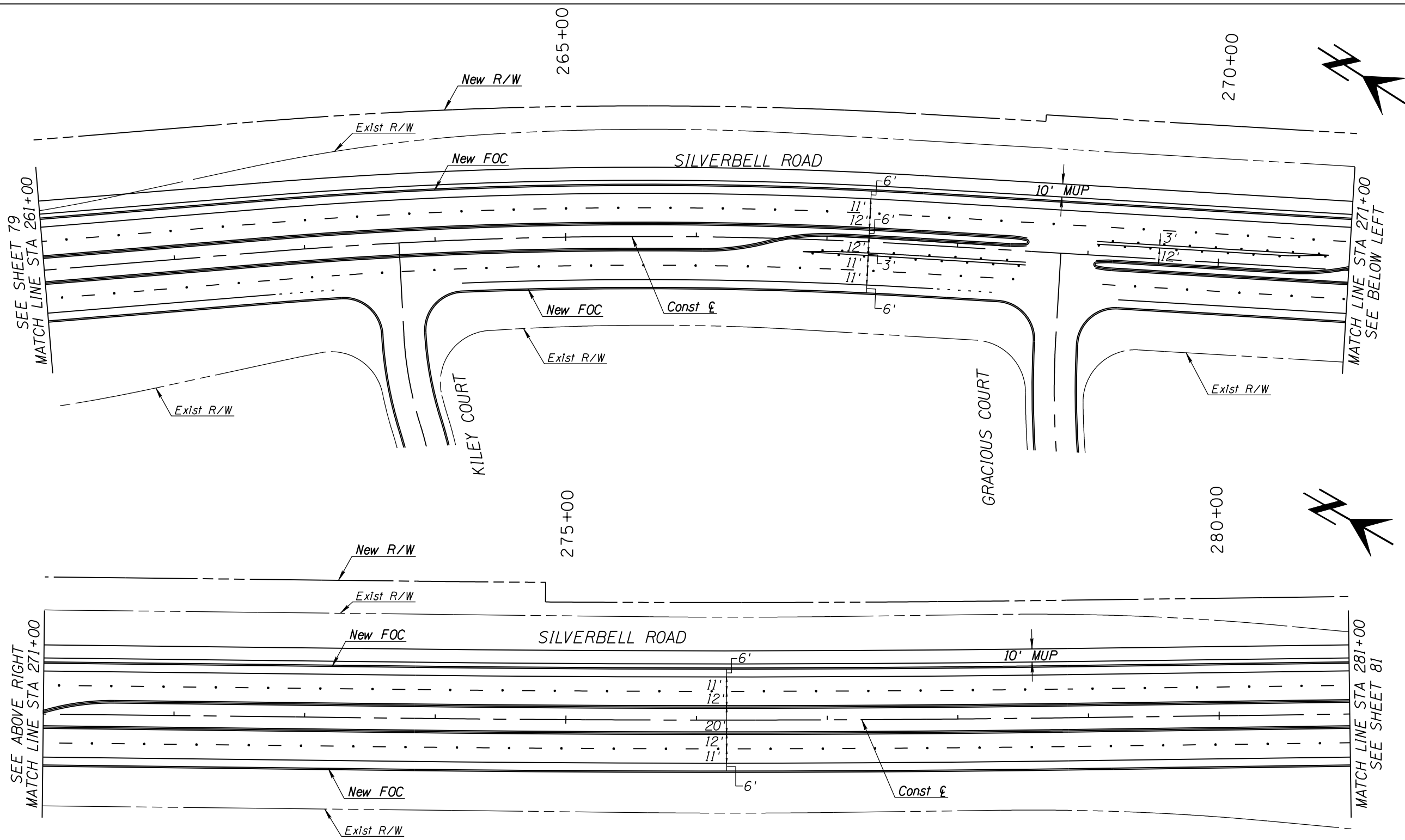
Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067



NO.	DATE	REVISION	BY	CHKD.	APPR.

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING


PAVEMENT MARKING PLAN					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					79 OF 81
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO					PM9 OF PM11
CITY OF TUCSON	DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
	DSGN. BY	JBB/JAS	9/10		
	CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005



6/24/2011
H:\profile\9589 - Silverbell Road DCR\15%-North\07 Stripe\svb-str-10.dgn




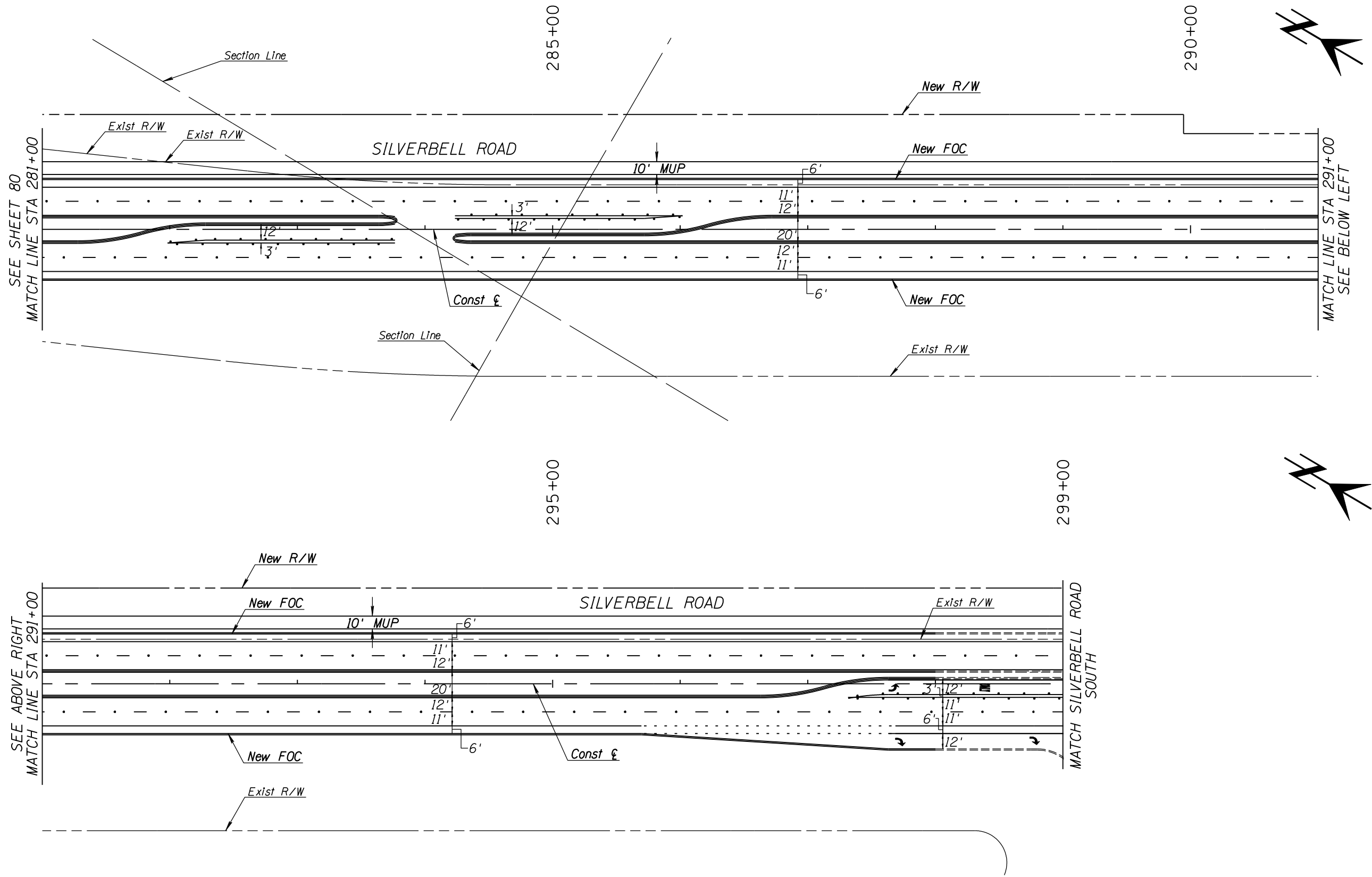
1-800-782-5348
Blue State Center
CALL COLLECT



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					80 OF 81
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO					PM10 OF PM11
 CITY OF TUCSON	DRWN. BY	LAS/TMR	9/10	REF. _____	SCALE: 1" = 40'
	DSGN. BY	JBB/JAS	9/10	_____	
	CHKD. BY	JAS	9/10	PLAN NO. I-2010-005	



6/24/2011
H:\profile\9589 - Silverbell Road DCR\15%-North\07 Stripe\svb-str-11.dgn

Get writing tips before you die
CALL FOR THE BLUE STRIPE
1-800-782-5348
Blue Stripe Center
CALL COLLECT

K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 900
Tucson, AZ 85701 (520) 844-4067

PRELIMINARY
15%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

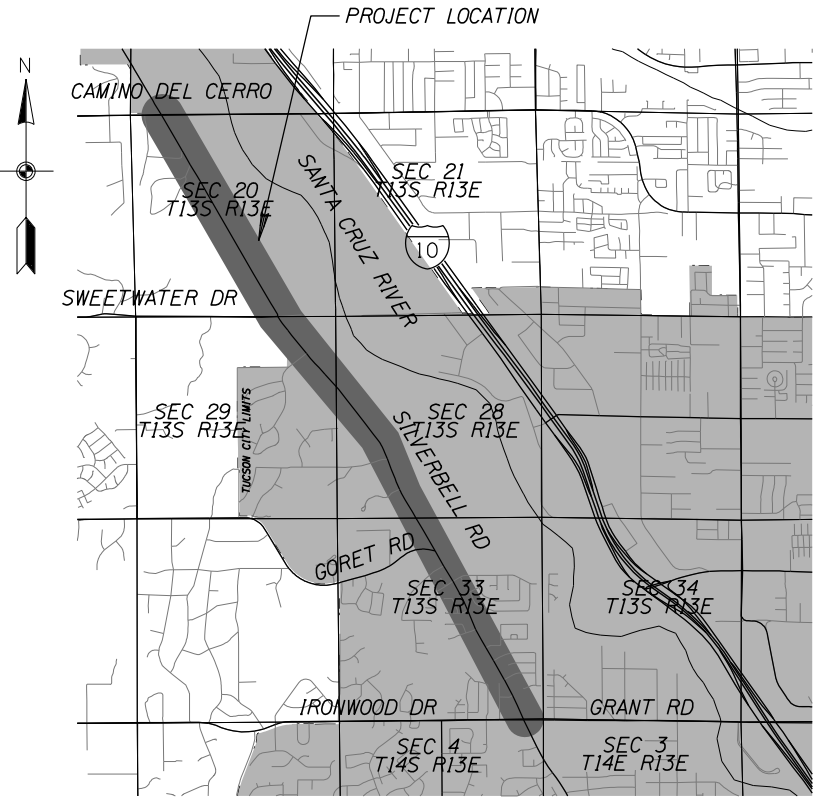
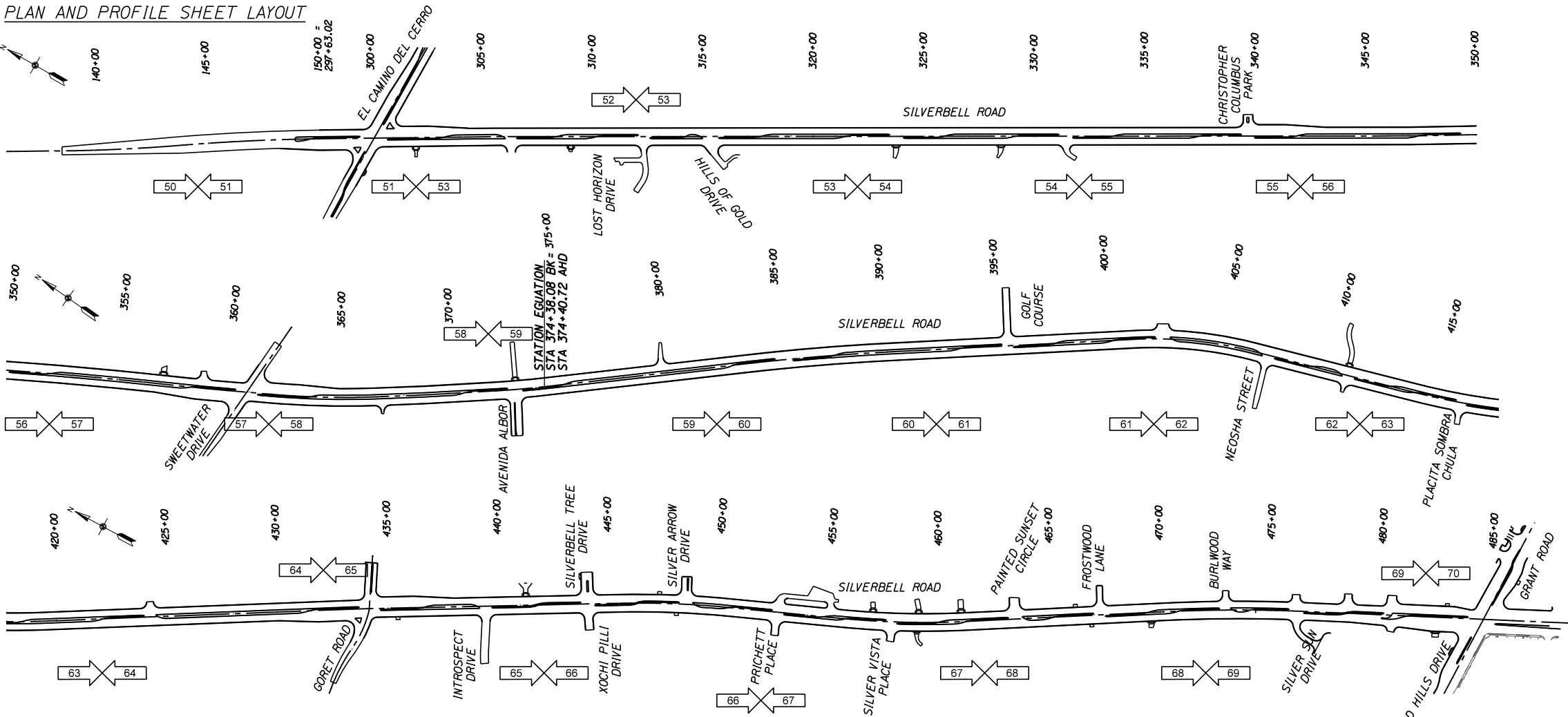
PAVEMENT MARKING PLAN				
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				81
SILVERBELL ROAD INA ROAD TO EL CAMINO DEL CERRO				PM11 OF 81
 CITY OF TUCSON	DRWN. BY	LAS/TMR	9/10	REF. _____ SCALE: 1" = 40' PLAN NO. I-2010-005
	DSGN. BY	JBB/JAS	9/10	
	CHKD. BY	JAS	9/10	

Appendix B
Preliminary (30%) Roadway Plans –El Camino del Cerro to Grant Road

CITY OF TUCSON, ARIZONA
SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD
ROADWAY AND DRAINAGE IMPROVEMENTS
C.O.T JOB NO. SR6A

PROPOSED PROJECT BEGINS NORTH OF CAMINO DEL CERRO AND ENDS SOUTH OF GRANT ROAD
THE 4 MILES OF NEW ROADWAY IMPROVEMENTS INCLUDE A FOUR LANE DIVIDED ROADWAY,
RAISED MEDIANS, BIKE LANES, MULTI-USE PATH, PAVEMENT MARKINGS,
STRIPING AND SIGNING, AND DRAINAGE IMPROVEMENTS.

PLAN AND PROFILE SHEET LAYOUT



LOCATION MAP
SCALE: 1" = 1 MILE
T-13S, R-13E
Sections 17, 20, 28, 29, 33
T-14S, R-13E
Section 4
G & SR B&M

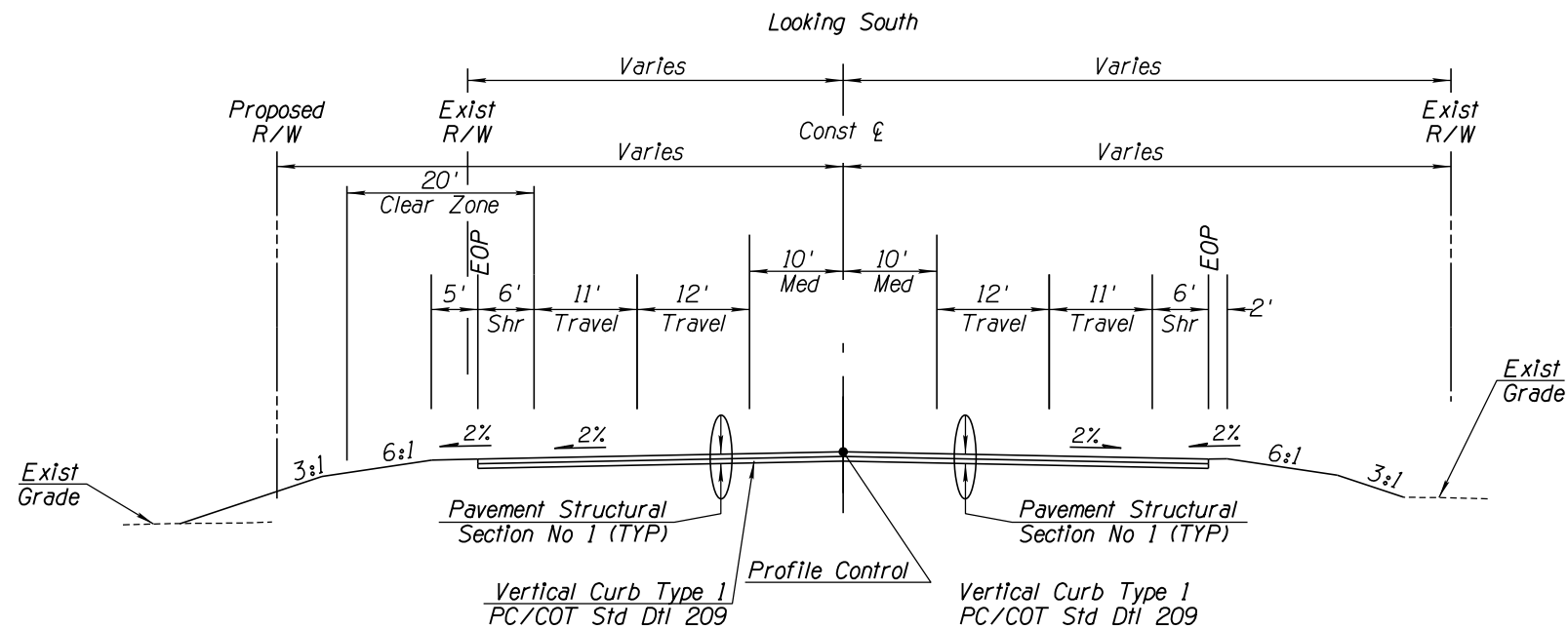
INDEX OF SHEETS

PAGE NUMBER	SHEET NUMBER	DESCRIPTION
1	CSI	COVER & INFORMATION SHEET
2-3	NOT1-NOT2	GENERAL NOTES AND LEGENDS
4-13	TYP1-TYP10	TYPICAL SECTIONS
14-22	GEO1-GEO9	SURVEY CONTROL
23-49	HORI-HOR27	HORIZONTAL CONTROL
50-85	PNP1-PNP36	ROADWAY PLAN AND PROFILE
86-106	CPPI-CCP21	CULVERT PLAN AND PROFILE
107-122	SDI-SDI6	STORM DRAIN PLAN AND PROFILE
123	LSI	LANDSCAPE PLAN
124-138	STR1-STR15	PAVEMENT MARKING PLAN

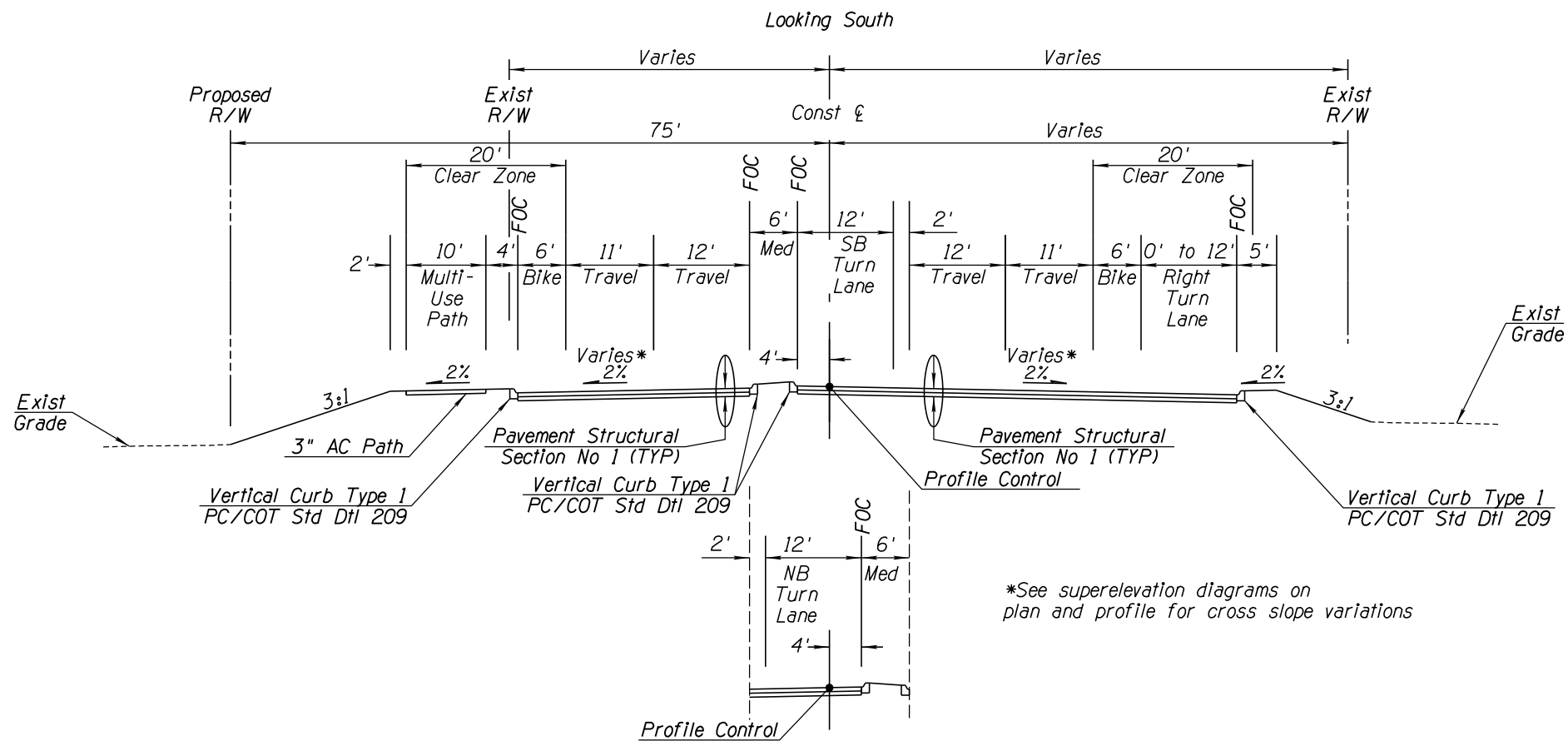


PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD				
Approvals	Signatory	Date	Approved _____ 20__	1 OF 138
DESIGN SECTION				
TRAFFIC ENGINEERING				
TRANSPORTATION PLANNING				
ENGINEERING LANDSCAPE ARCH				
ENGINEERING ADMINISTRATOR				
DRWN. BY LAS/TMR 20 10	DSGN. BY MDA/YSM 20 10	CHKD. BY JAS 20 10	REF. _____ SCALE: _____	PLAN NO. I-2010-005



1 TYPICAL SECTION
Silverbell Road
NTS
North Leg of the El Camino Del Cerro Intersection
Sta 138+40 to Sta 148+20



2 TYPICAL SECTION
Silverbell Road
NTS
Sta 148+20 to Sta 303+00



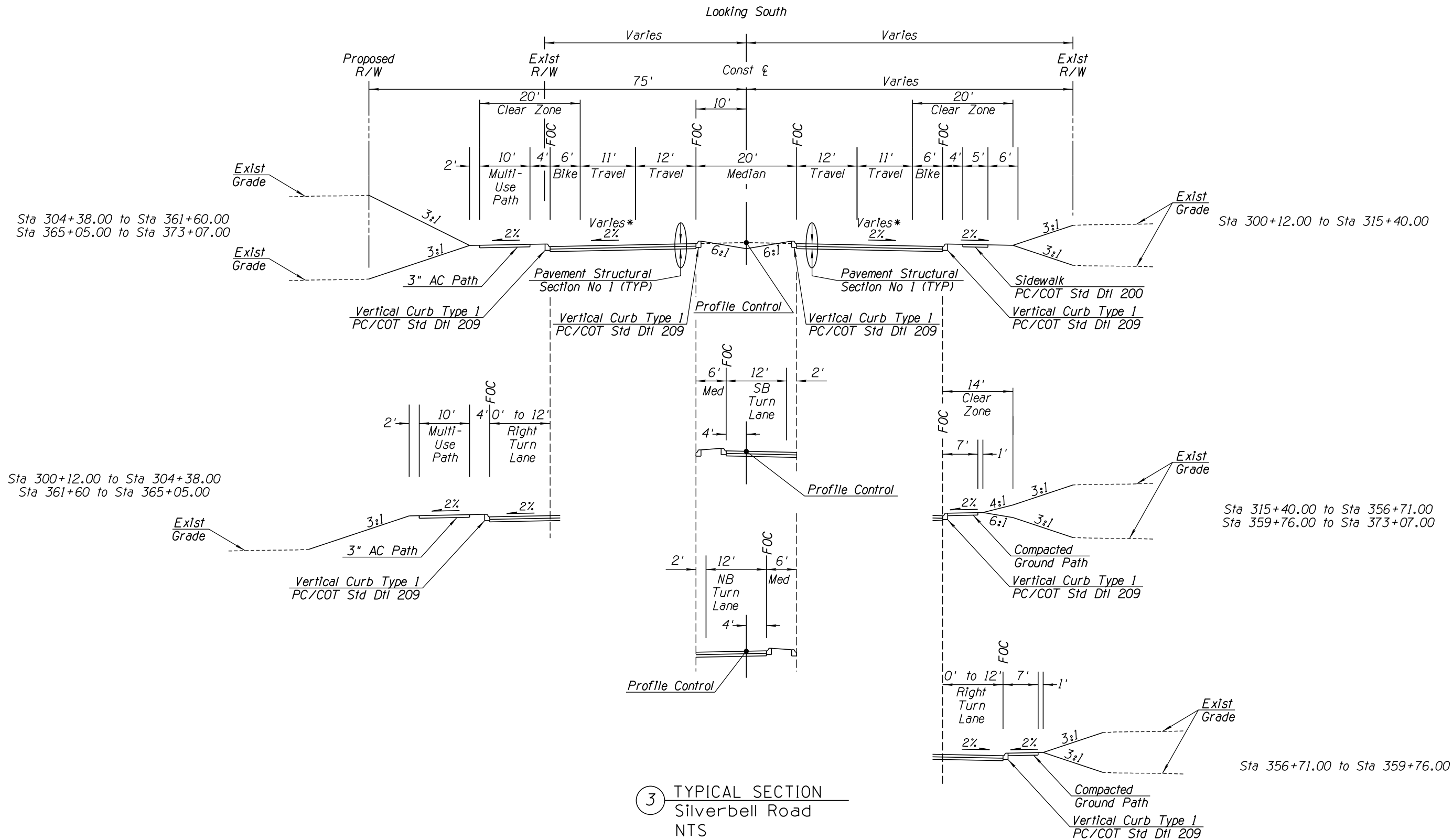
7/5/2011
H:\profile\9589 - Silverbell Road DCR\30%-South\03 Typicals\svb-typ01.dgn

K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO. DATE REVISION BY CHKD. APPR.

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

TYPICAL SECTIONS			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			4
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			TYP01 OF TYP10 138
DRWN. BY	LAS/TMR	6/11	REF. SCALE:
DSGN. BY	MDA/YSM	6/11	
CHKD. BY	JAS	6/11	PLAN NO. I-2010-005



*See superelevation diagram on plan and profile for cross slope variations



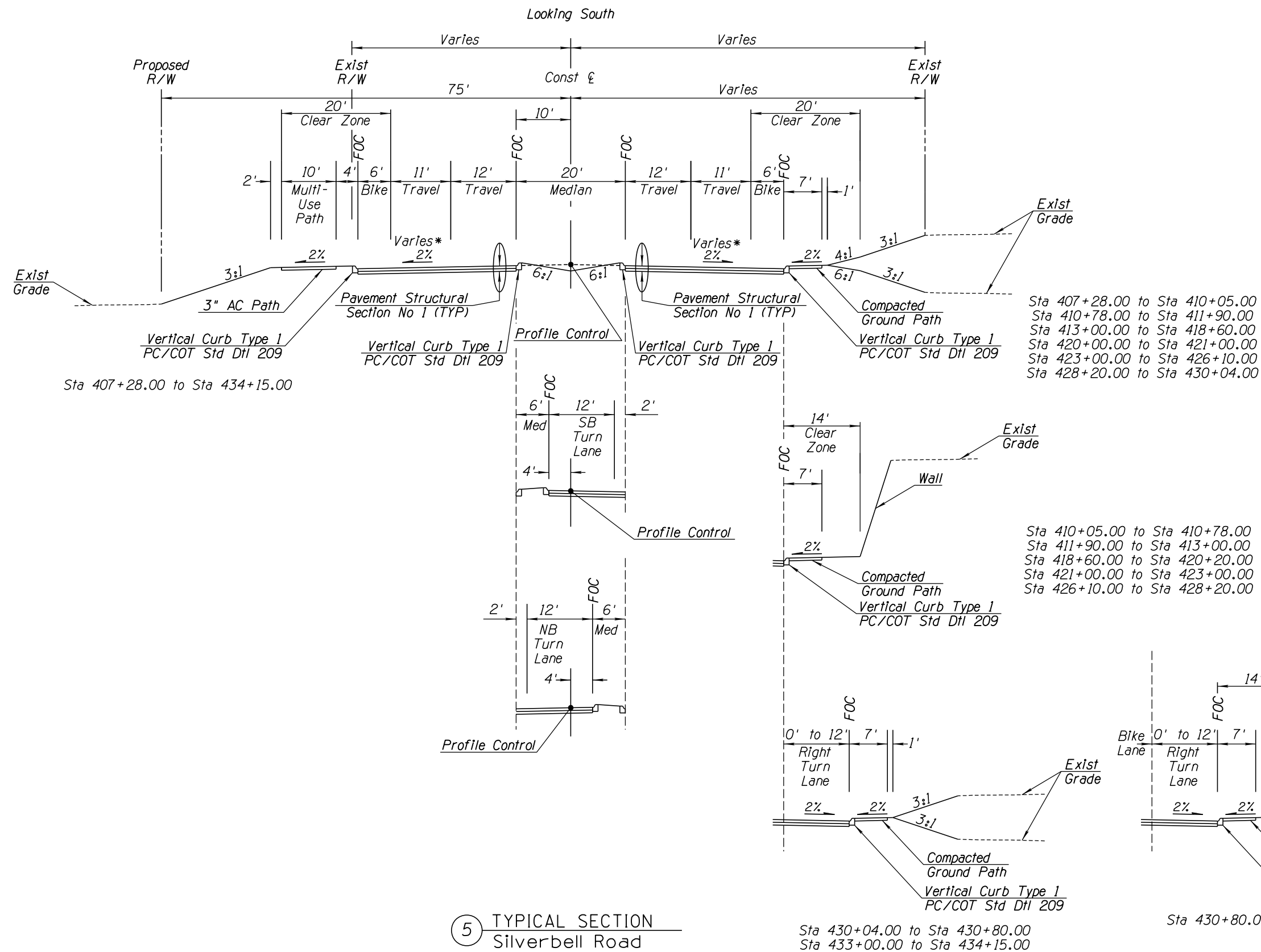
7/5/2011
H:\projfile\9589 - Silverbell Road DCR\30%-South\03 Typicals\svb-typ02.dgn

K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

TYPICAL SECTIONS			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			5
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			TYP02 OF TYP10 138
DRWN. BY	LAS/TMR	6/11	REF. _____ SCALE: _____
DSGN. BY	MDA/YSM	6/11	_____
CHKD. BY	JAS	6/11	PLAN NO. I-2010-005



*See superelevation diagram on plan and profile for cross slope variations




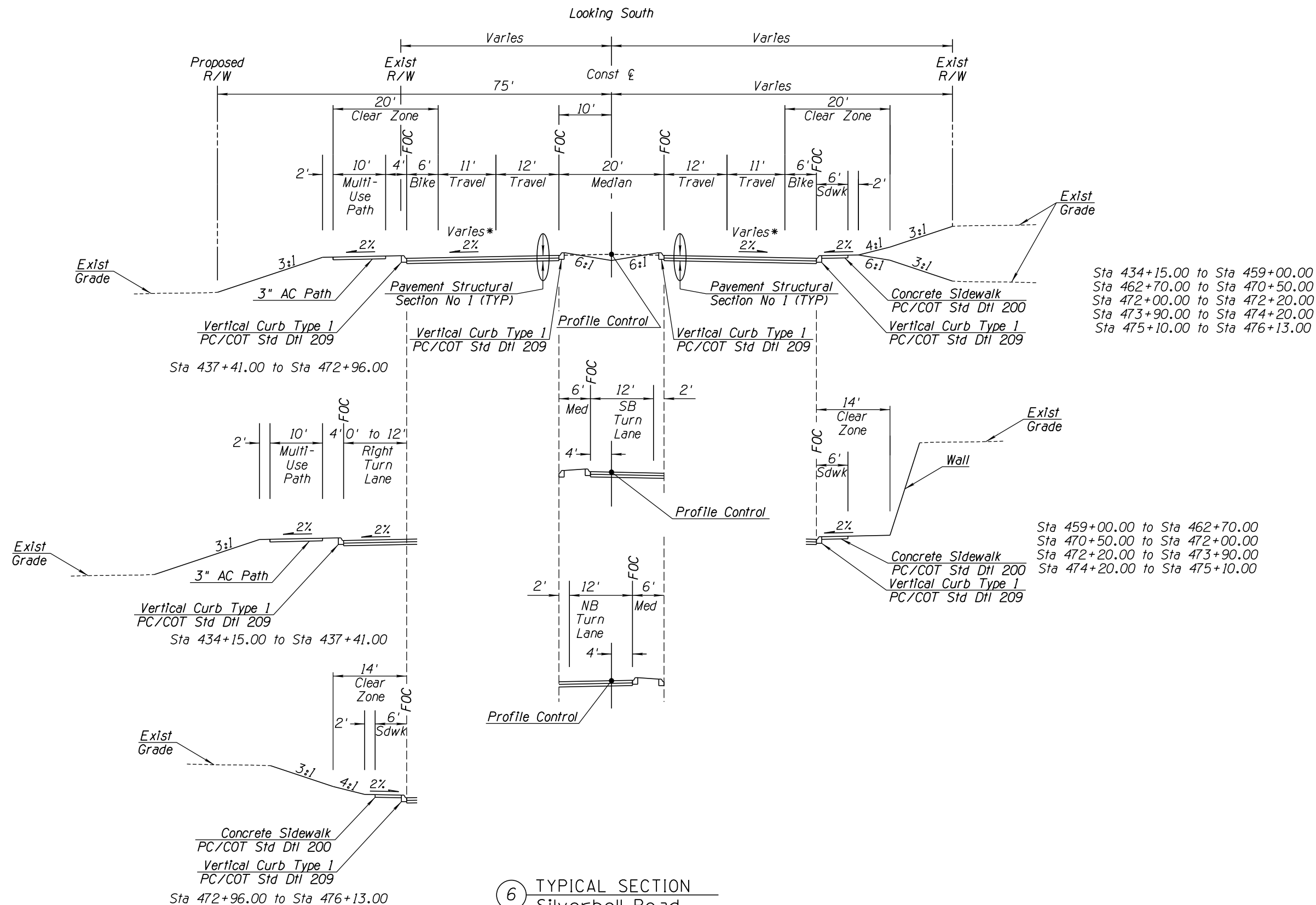
7/5/2011
H:\profile\9589 - Silverbell Road DCR\30%-South\03 Typicals\svb-typ04.dgn

K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.
-----	------	----------	----	-------	-------

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

TYPICAL SECTIONS					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					7
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD					TYP04 OF TYP10 138
 CITY OF TUCSON	DRWN. BY	LAS/TMR	6/11	REF.	SCALE:
	DSGN. BY	MDA/YSM	6/11		
	CHKD. BY	JAS	6/11	PLAN NO.	I-2010-005

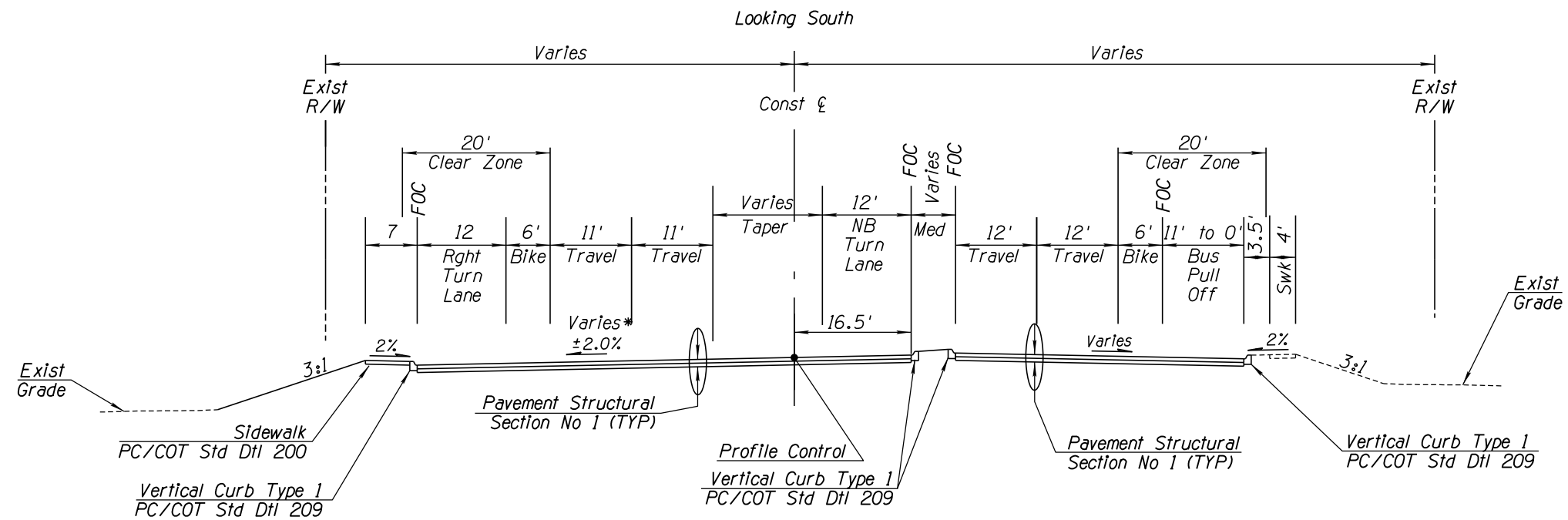


6 TYPICAL SECTION Silverbell Road NTS

Goret Road to Silver Sun Drive
Sta 434+00 to Sta 476+00

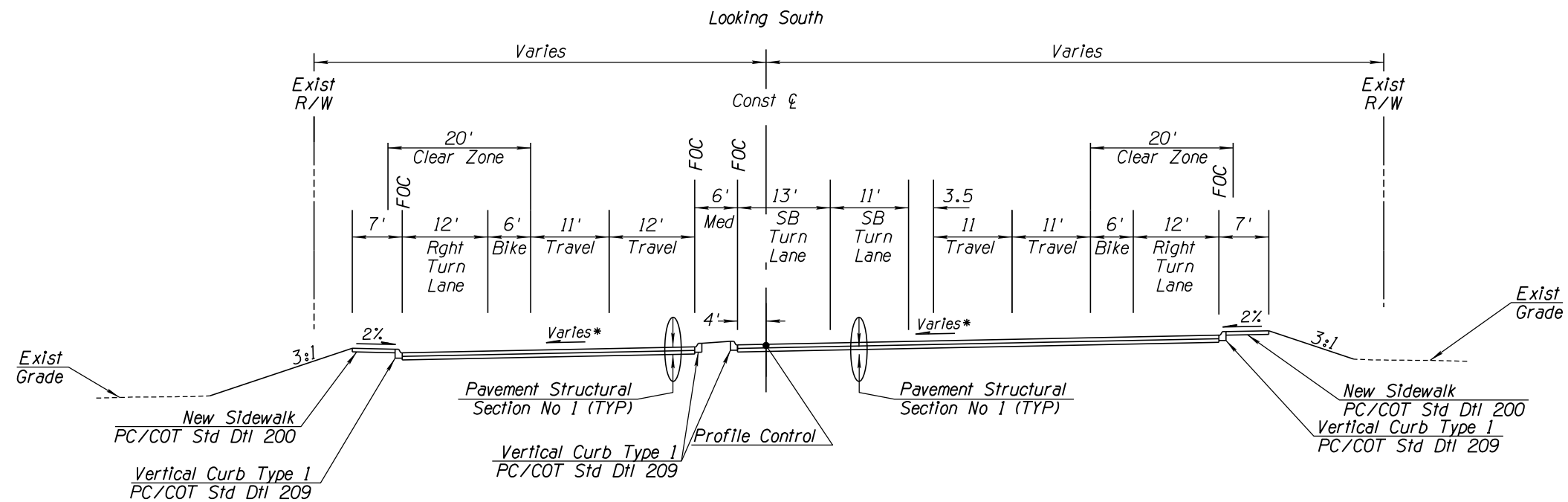
*See superelevation diagram on
plan and profile for cross slope variations





7 TYPICAL SECTION
Silverbell Road
NTS
Sta 476+50 to Sta 481+00

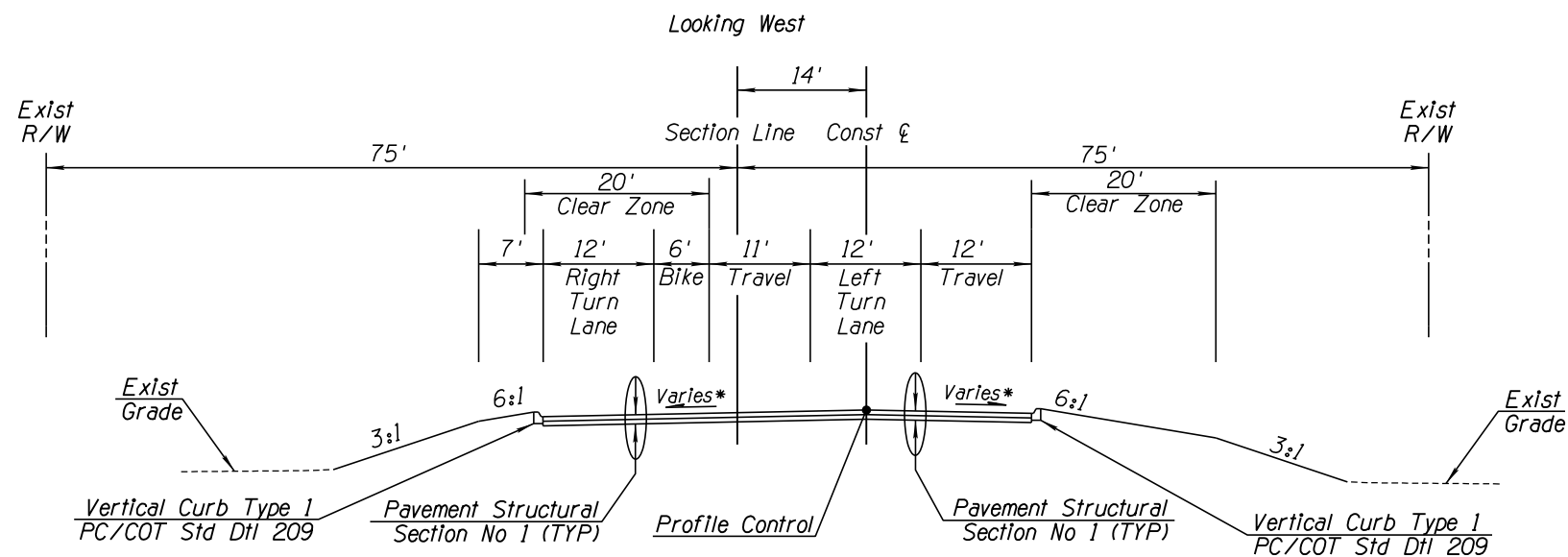
*See superelevation diagram on
plan and profile for cross slope variations



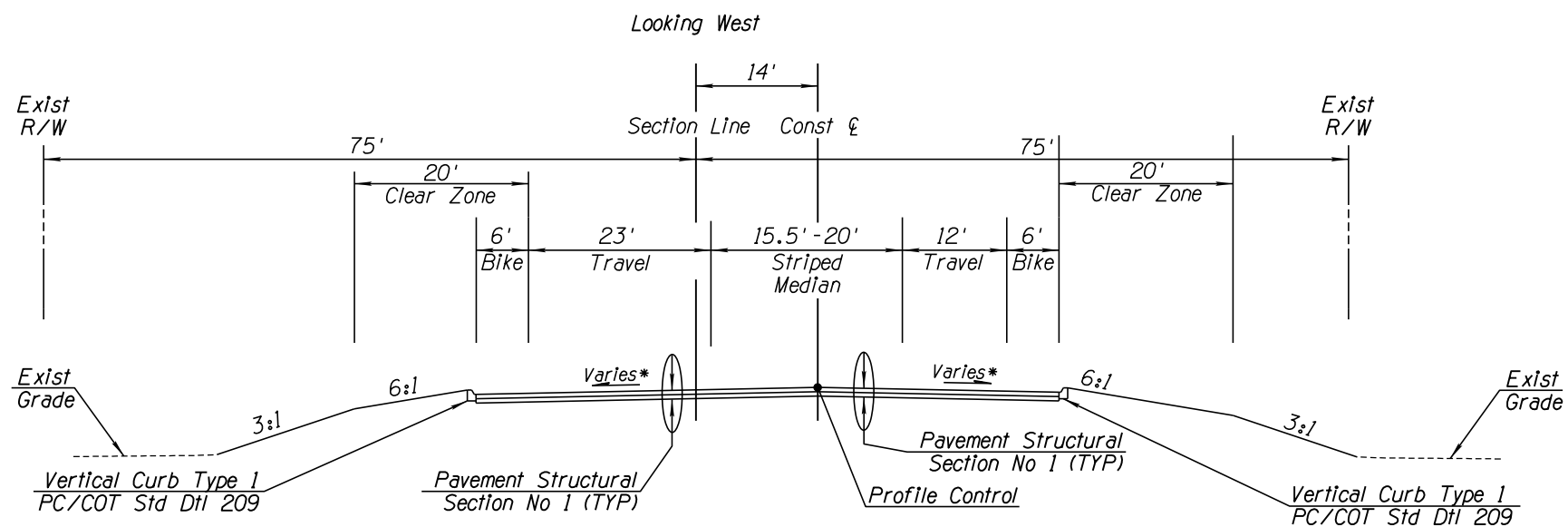
8 TYPICAL SECTION
Silverbell Road
NTS
Sta 481+00 to Sta 483+50

*See superelevation diagram on
plan and profile for cross slope variations



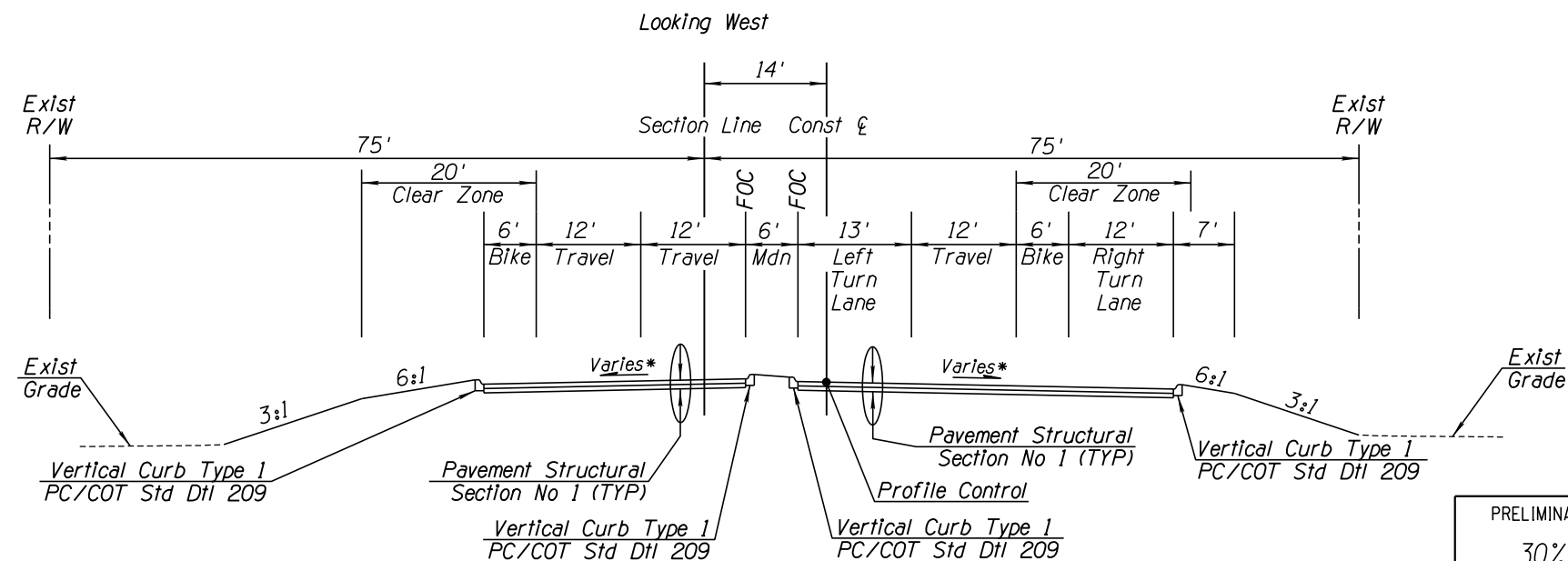


9 TYPICAL SECTION
El Camino Del Cerro
NTS
Sta 40+50 to Sta 43+00



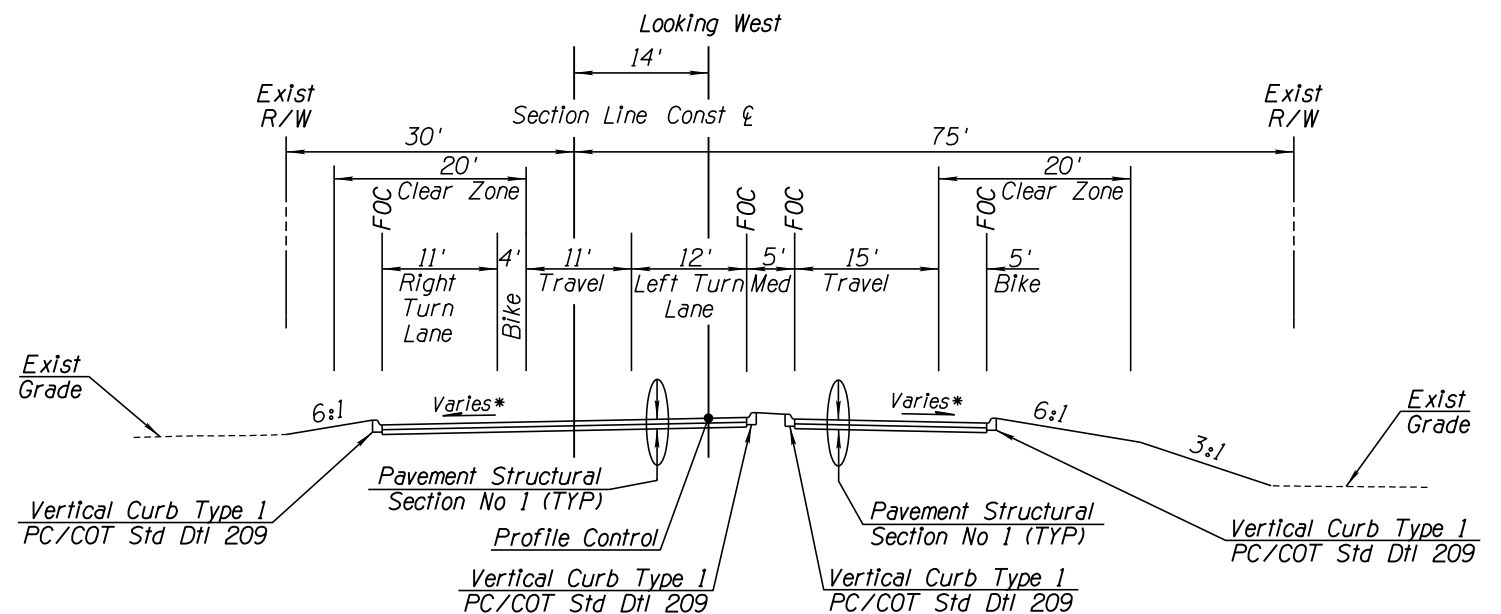
10 TYPICAL SECTION
El Camino Del Cerro
NTS
Sta 43+00 to Sta 45+19

*See superelevation diagram on plan and profile for cross slope variations

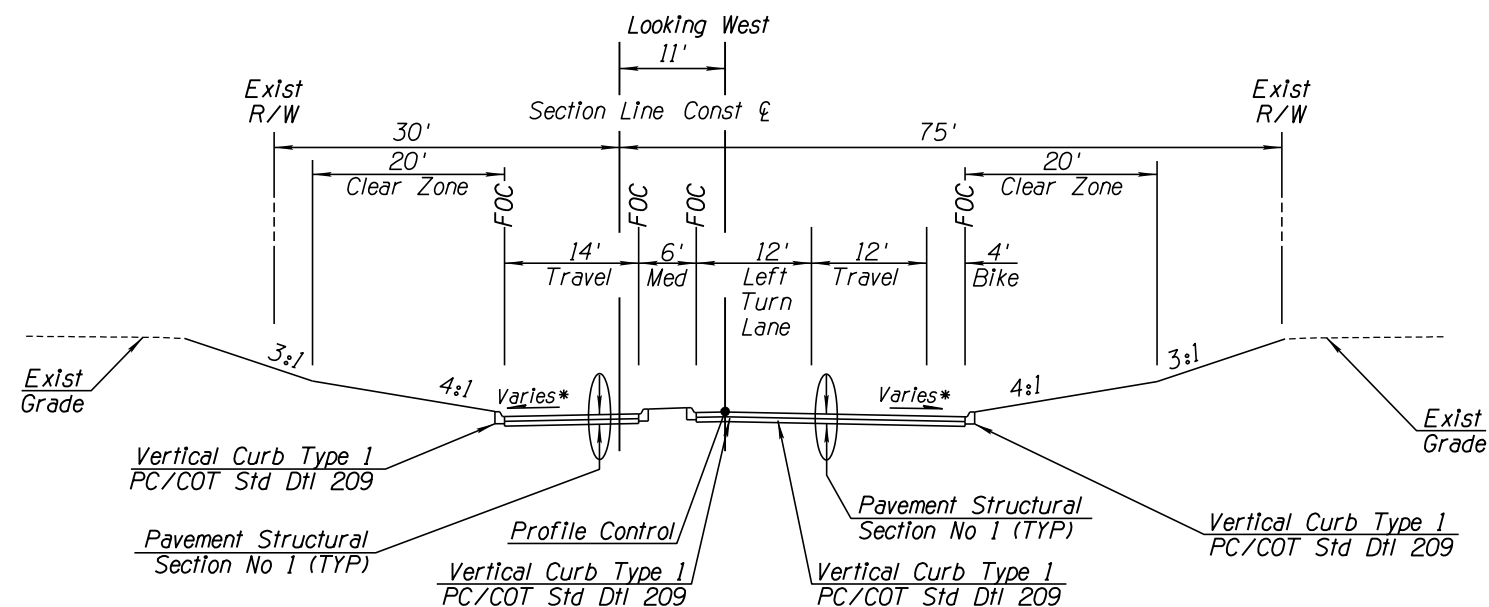


11 TYPICAL SECTION
El Camino Del Cerro
NTS
Sta 45+19 to Sta 50+00



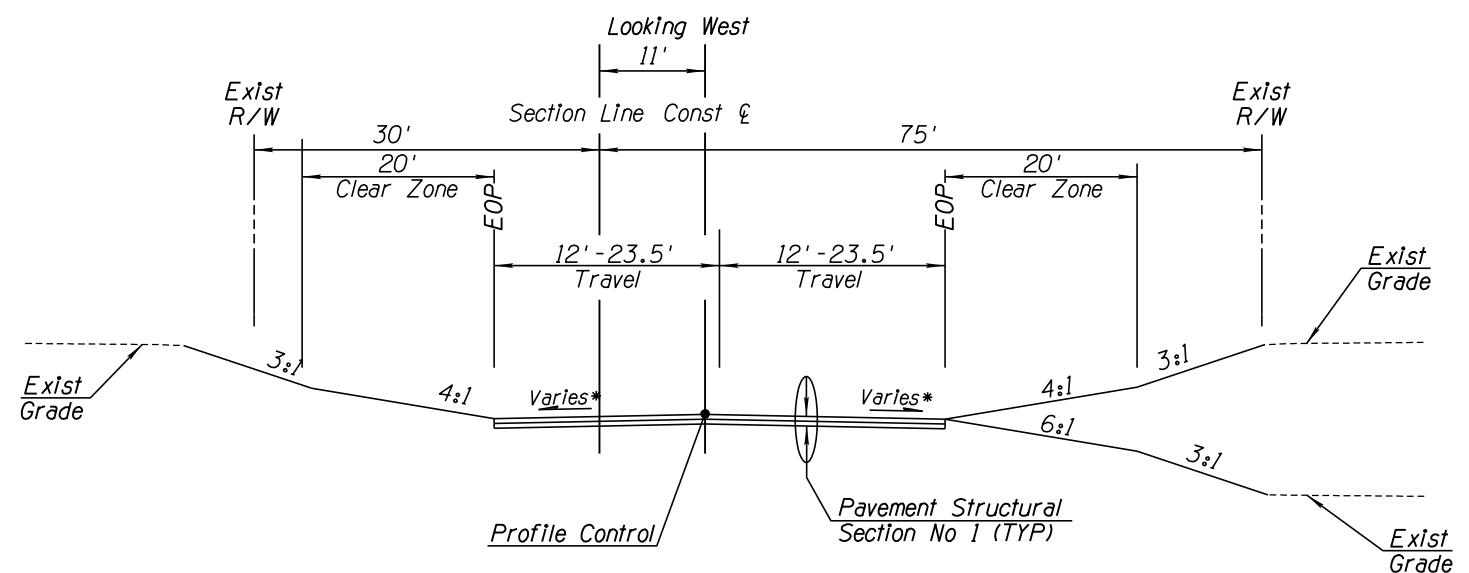


12 TYPICAL SECTION
El Camino del Cerro
NTS
Sta 50+00 to Sta 52+50



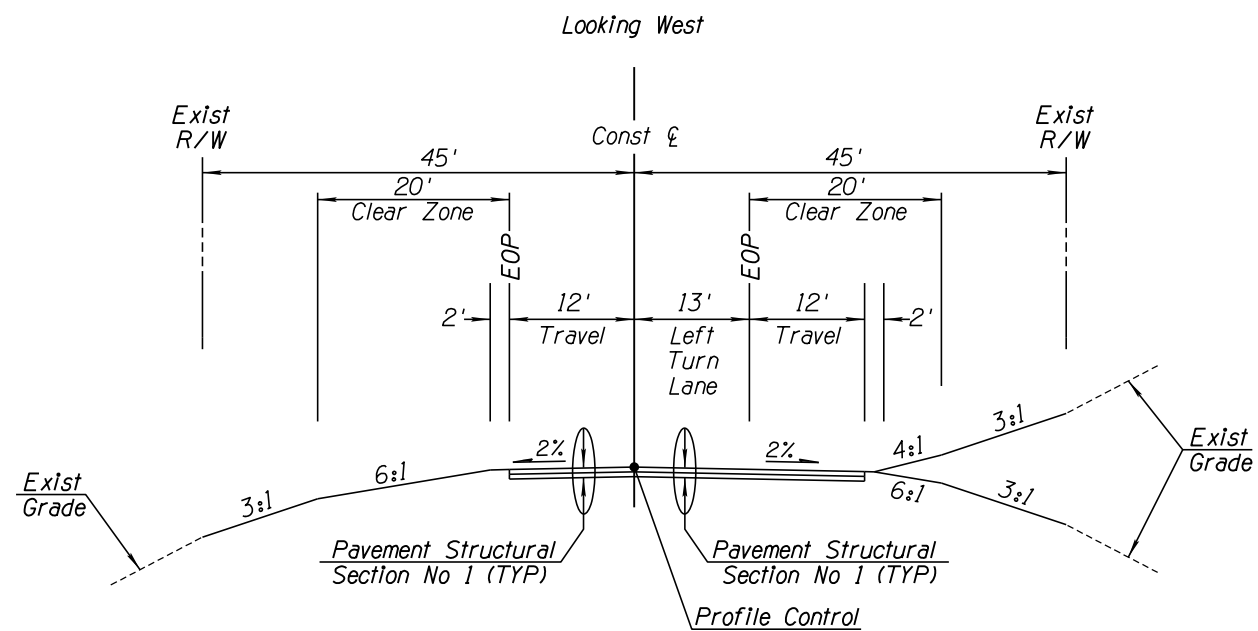
13 TYPICAL SECTION
El Camino del Cerro
NTS
Sta 52+50 to Sta 54+00

*See superelevation diagram on plan and profile for cross slope variations

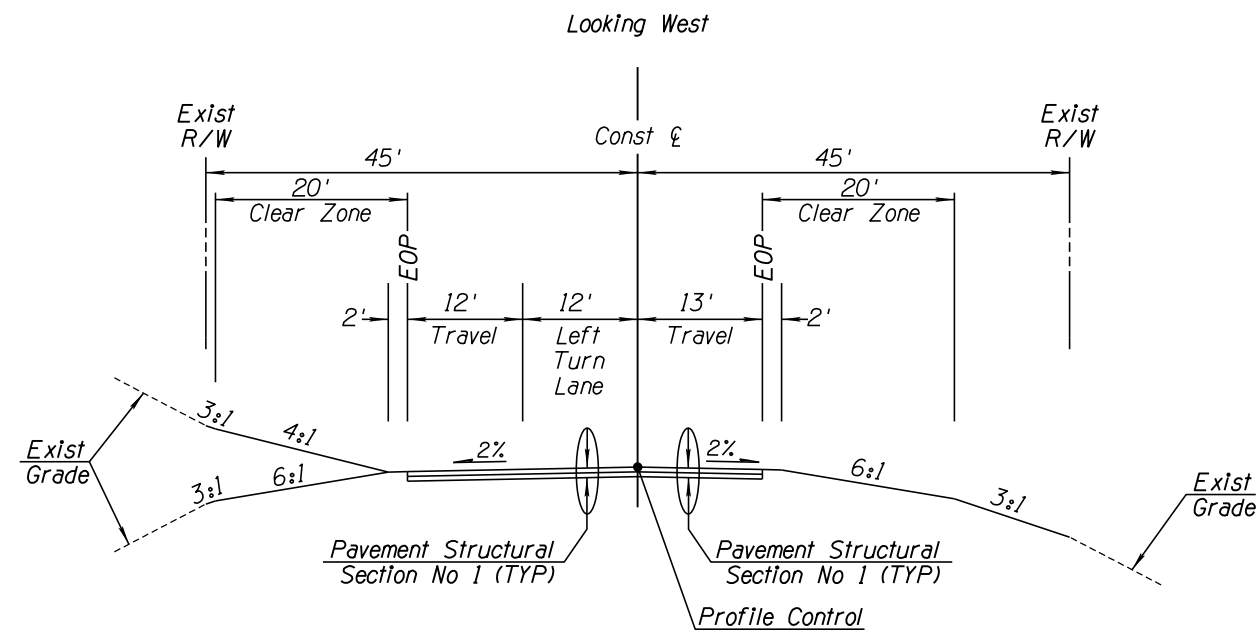


14 TYPICAL SECTION
El Camino del Cerro
NTS
Sta 54+00 to Sta 64+50

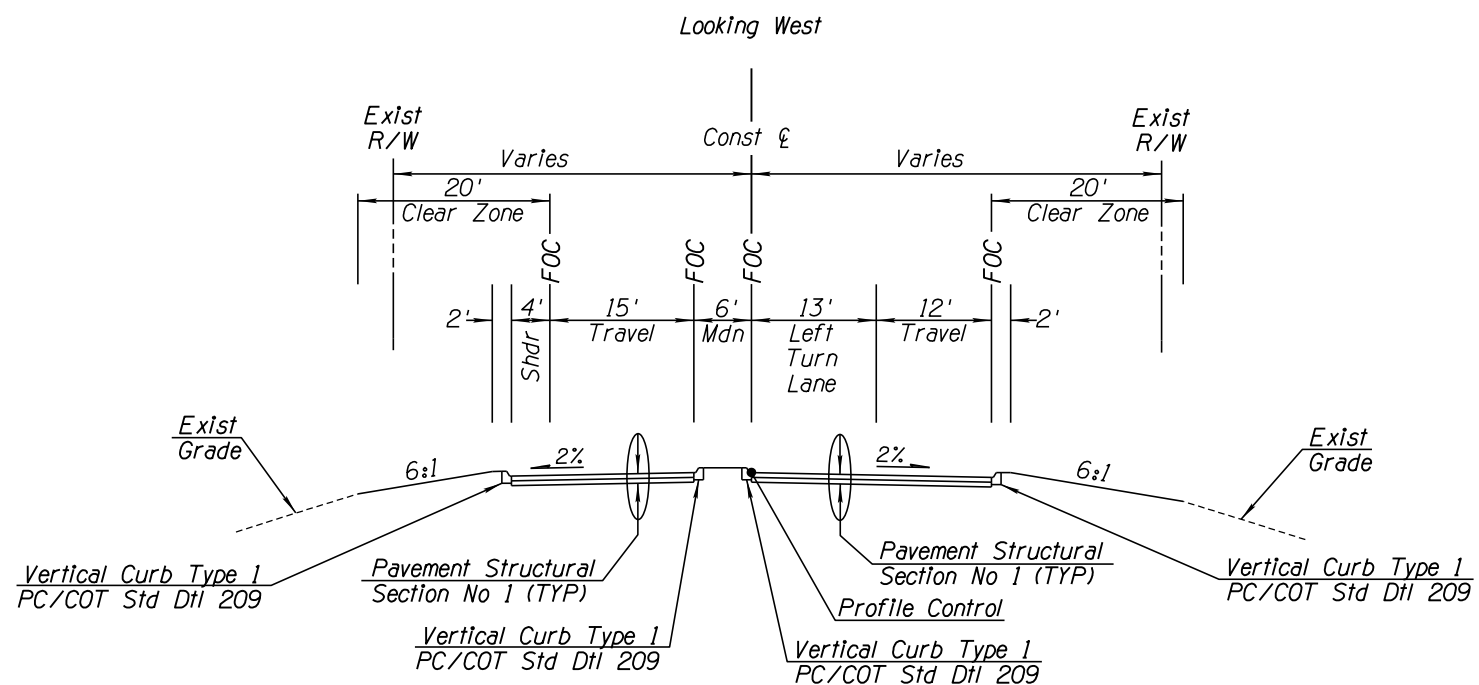




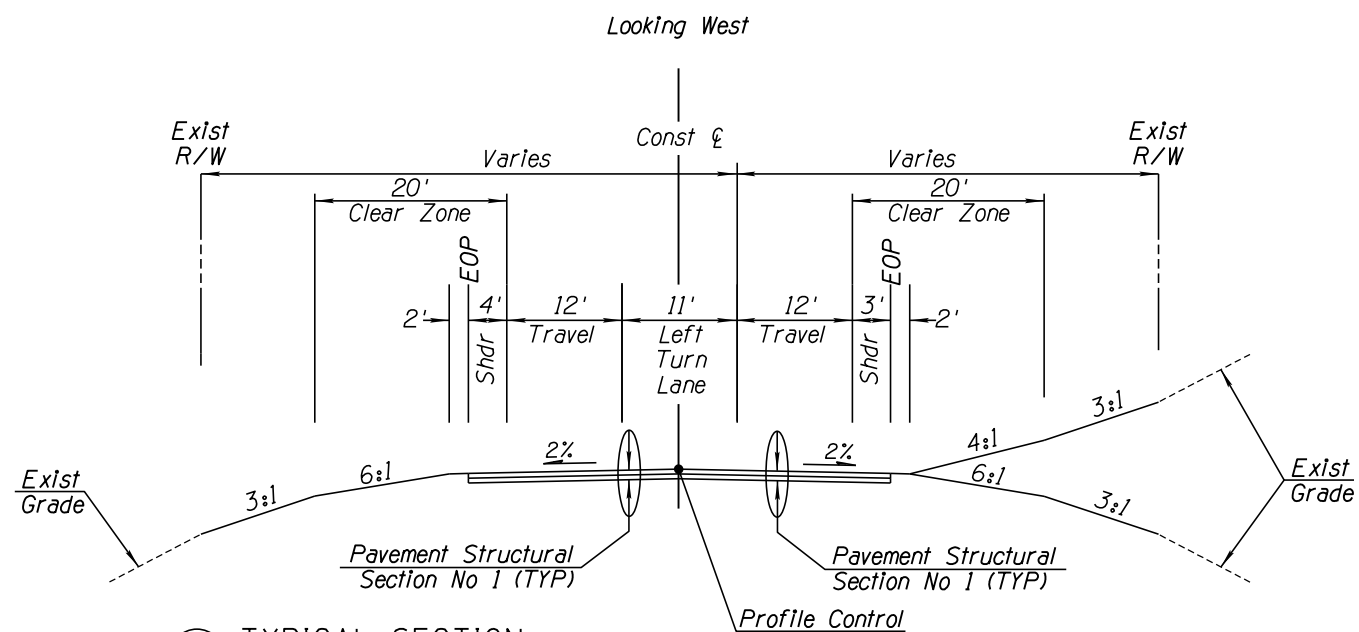
15 TYPICAL SECTION
Sweetwater Drive
NTS
East of Silverbell Road



16 TYPICAL SECTION
Sweetwater Drive
NTS
West of Silverbell Road



17 TYPICAL SECTION
Goret Road
NTS
East of Silverbell Road



18 TYPICAL SECTION
Goret Road
NTS
West of Silverbell Road



7/5/2011
H:\profile\9589 - Silverbell Road DCR\30%-South\03 Typicals\svb-typ-09.dgn

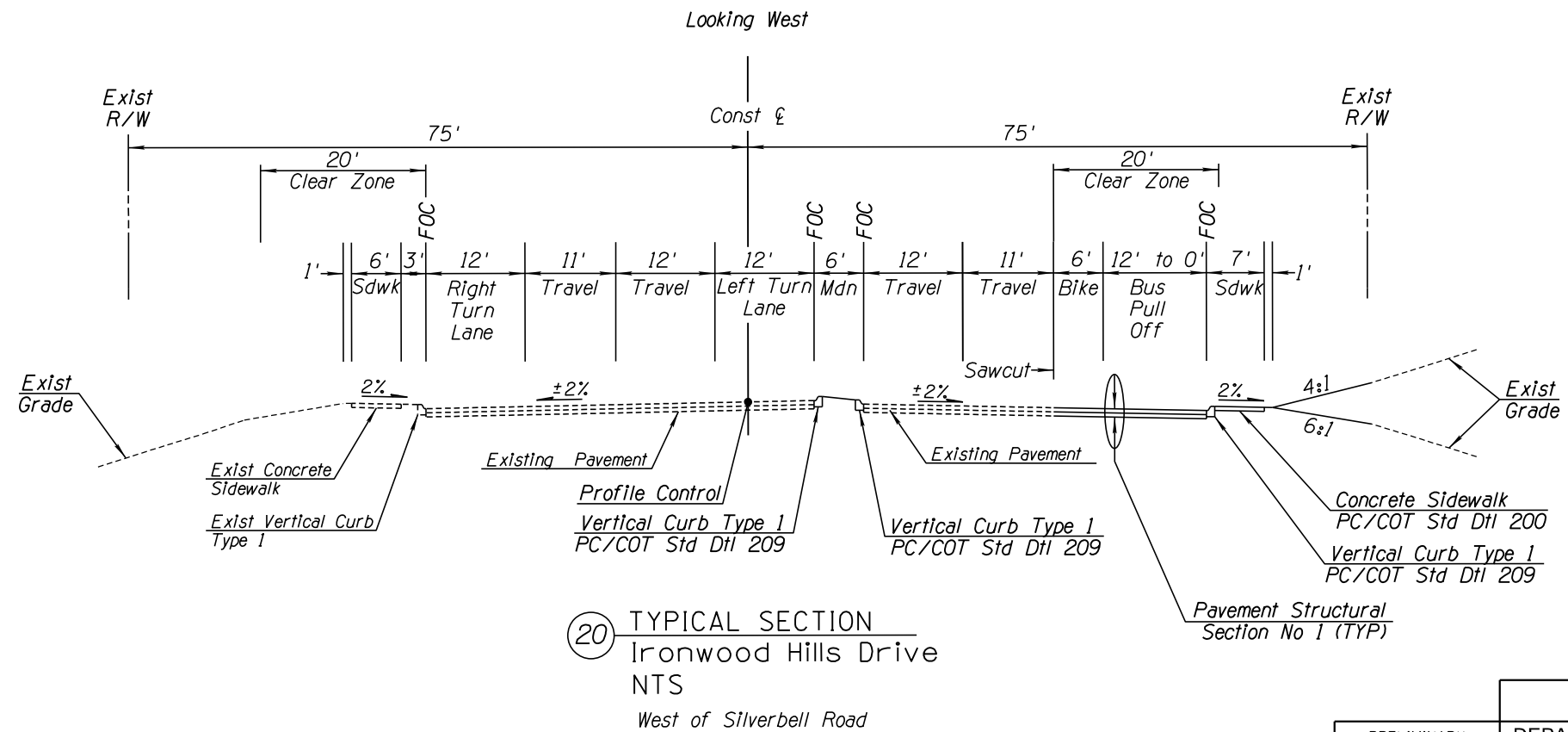
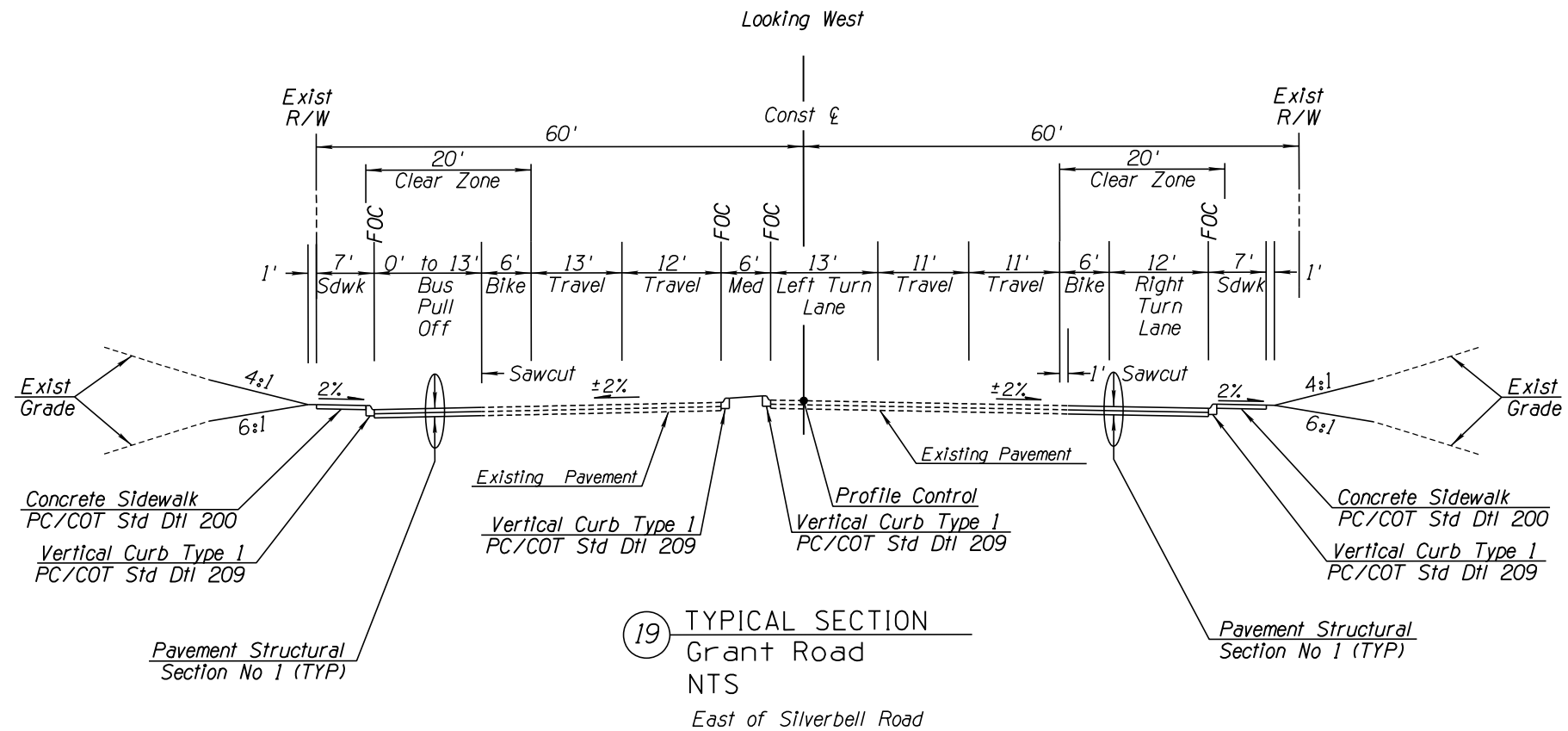
K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO. DATE REVISION BY CHKD. APPR.

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

TYPICAL SECTIONS			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			12
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			TYP09 OF TYP10 138
DRWN. BY	LAS/TMR	6/11	REF. _____
DSGN. BY	MDA/YSM	6/11	SCALE: 1" = 10'
CHKD. BY	JAS	6/11	PLAN NO. I-2010-005





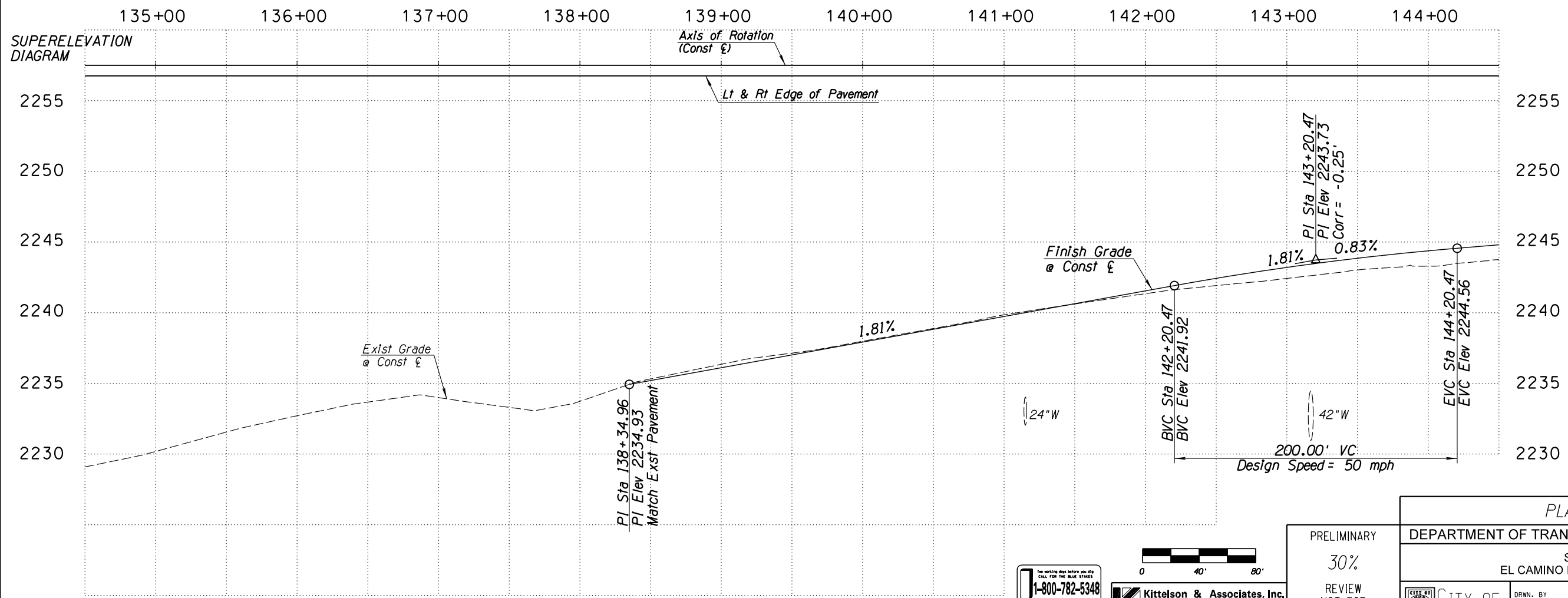
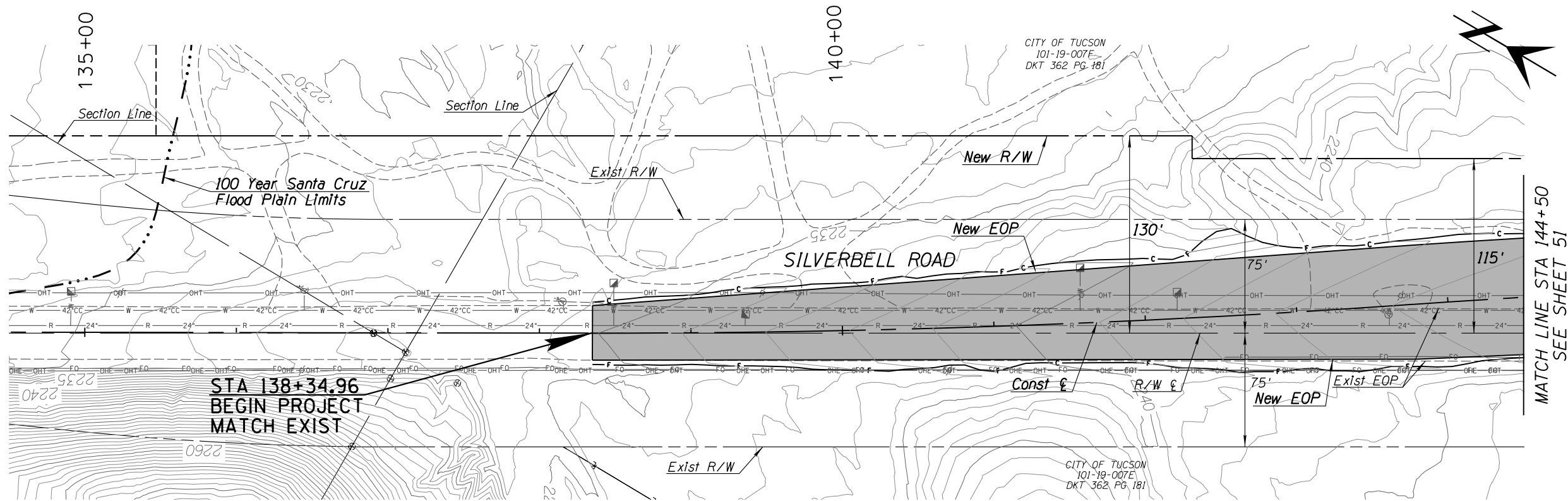
7/5/2011
H:\profile\9589 - Silverbell Road DCR\30%-South\03 Typicals\svb-typ-10.dgn

K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

TYPICAL SECTIONS			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			13
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			TYP10 OF TYP10 138
DRWN. BY	LAS/TMR	6/11	REF. _____ SCALE: 1" = 10'
DSGN. BY	MDA/YSM	6/11	
CHKD. BY	JAS	6/11	
CITY OF TUCSON			PLAN NO. I-2010-005



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701
(520) 544-4067

1-800-782-5348
Blue Stone Center
CALL COLLECT

0 40' 80'

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

NO. DATE REVISION BY CHKD. APPR.

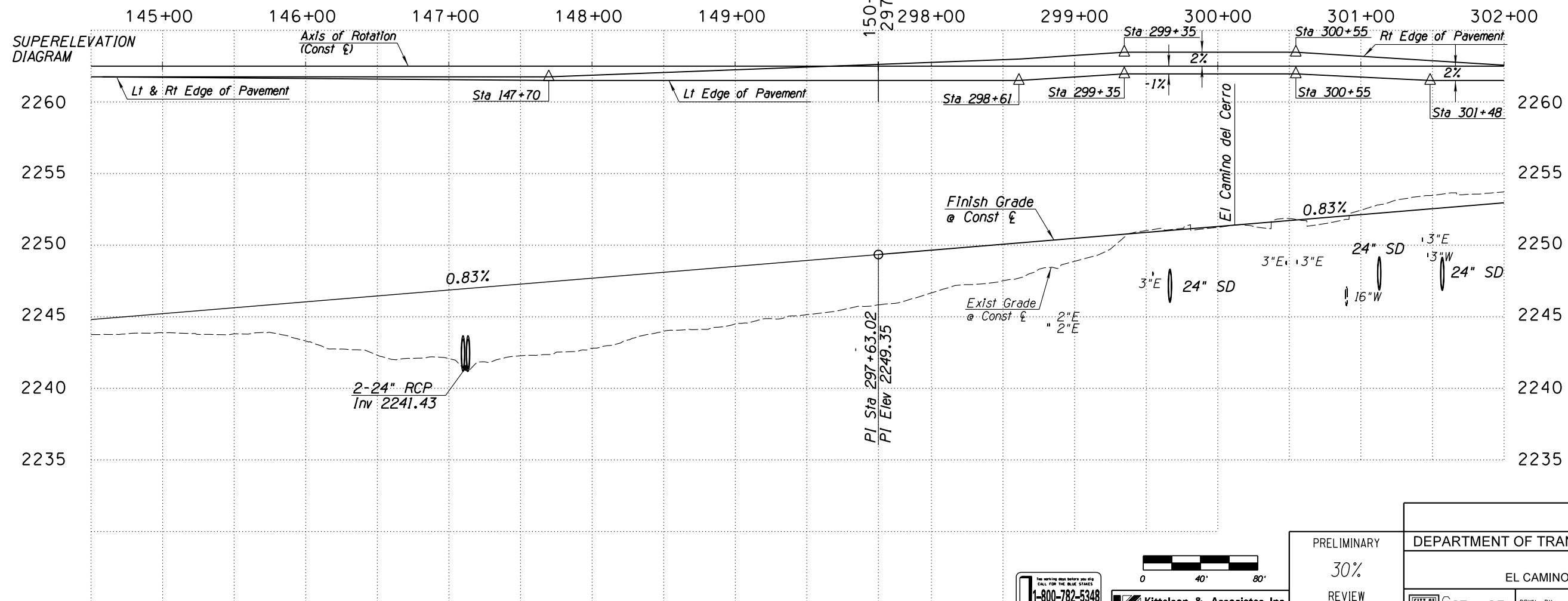
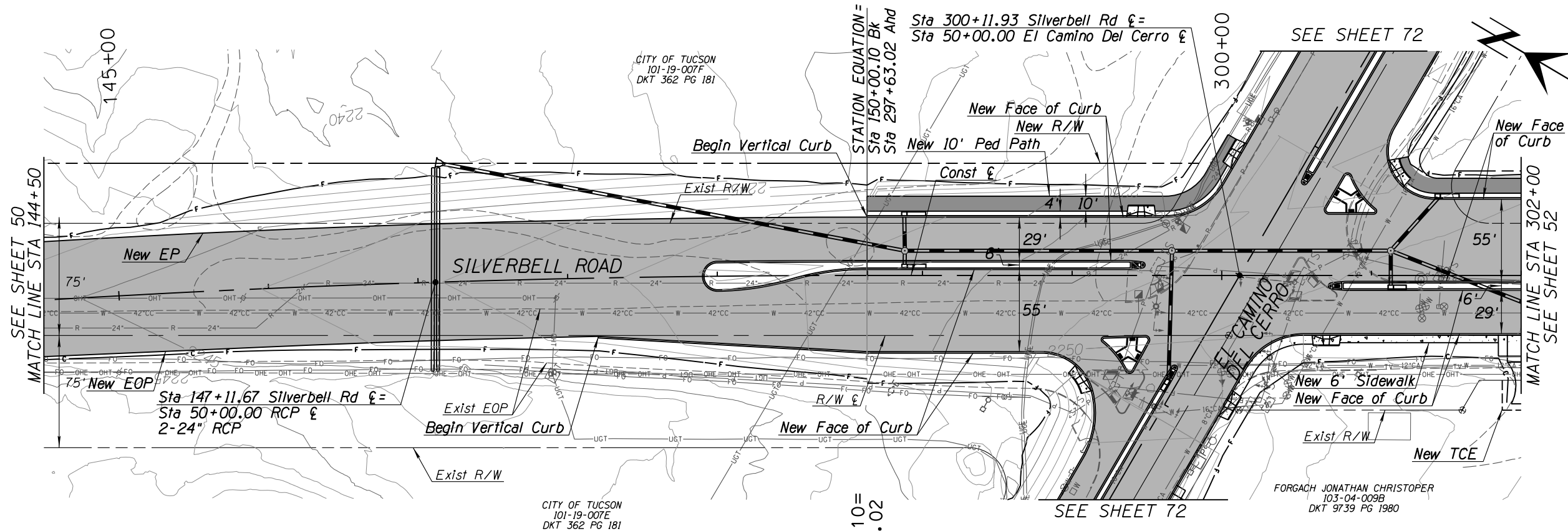
PLAN & PROFILE
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION
SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD

CITY OF TUCSON

DRWN. BY LAS/TMR 9/10
DSGN. BY MDA/YSM 9/10
CHKD. BY JAS 9/10

REF. SCALE: 1" = 40'
1" = 4'

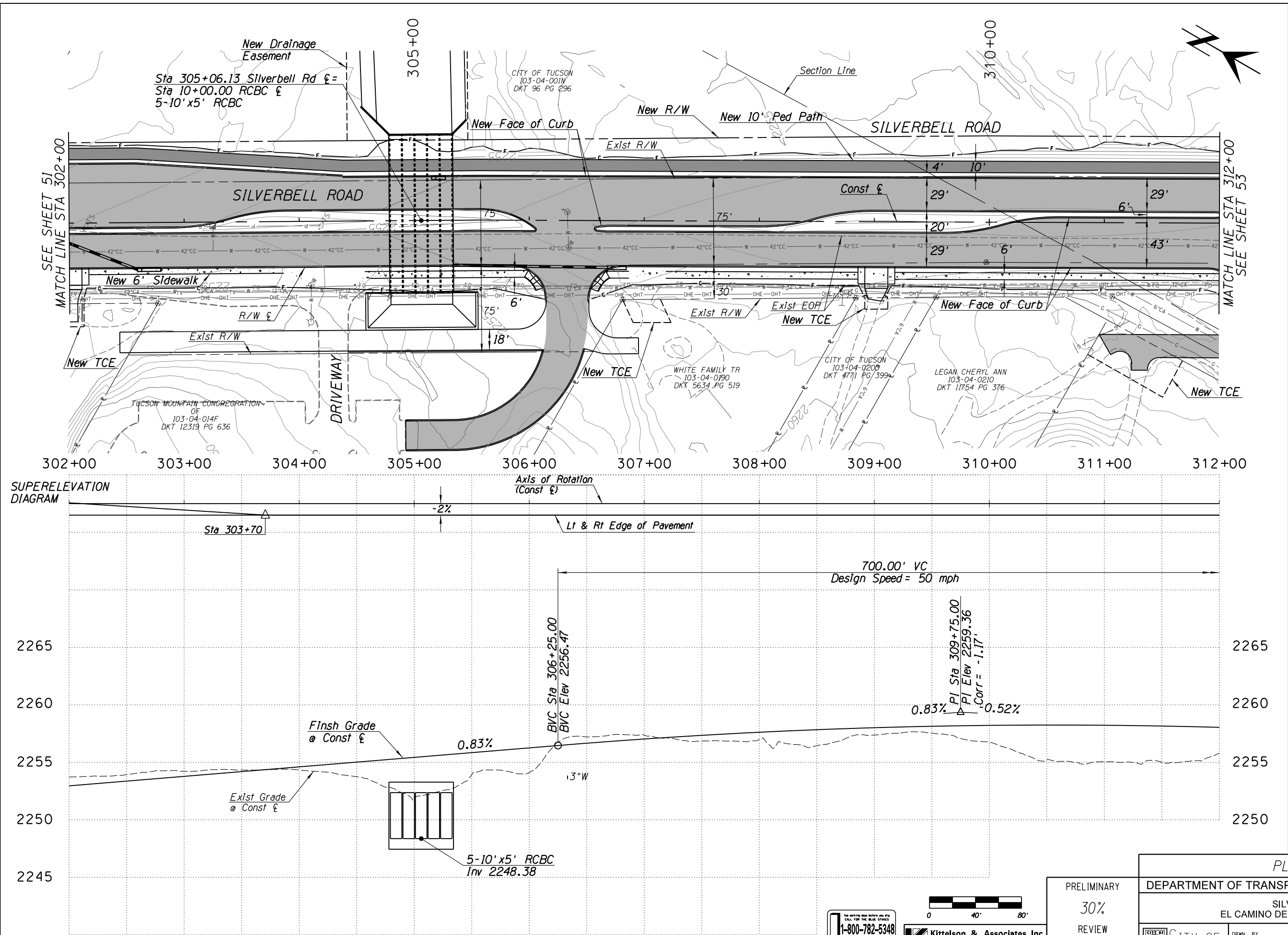
PP1 OF PP36
50 OF 138
PLAN NO. I-2010-005



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

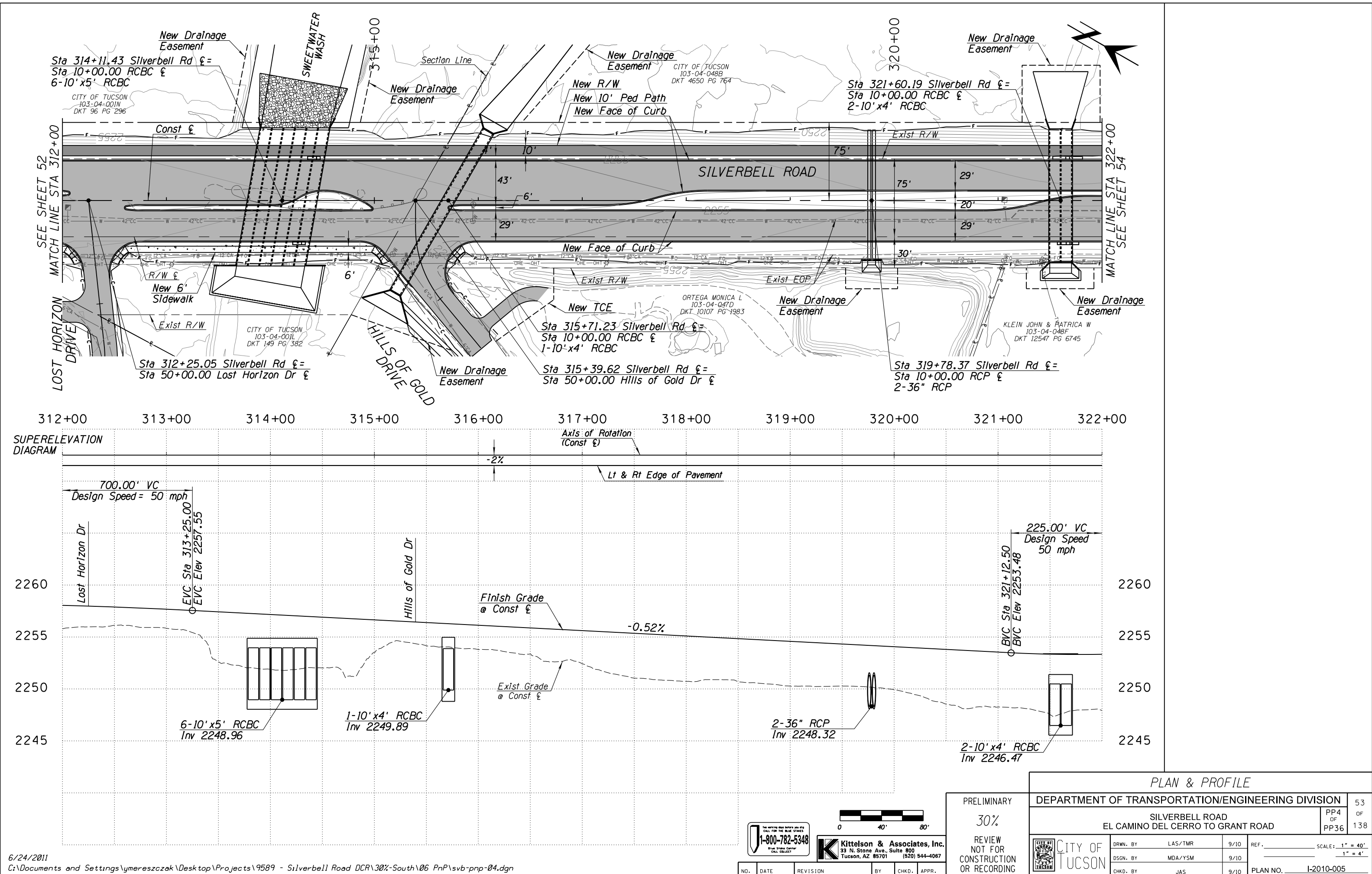
PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			51 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP2 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005

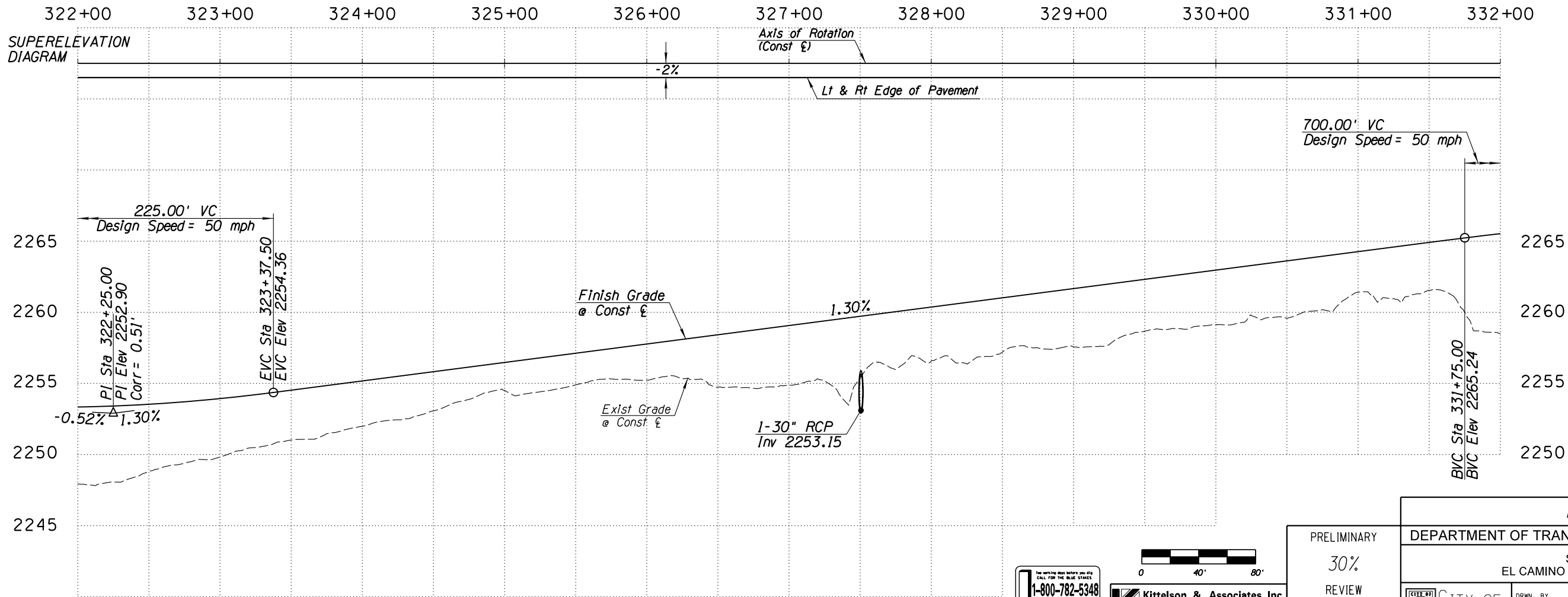
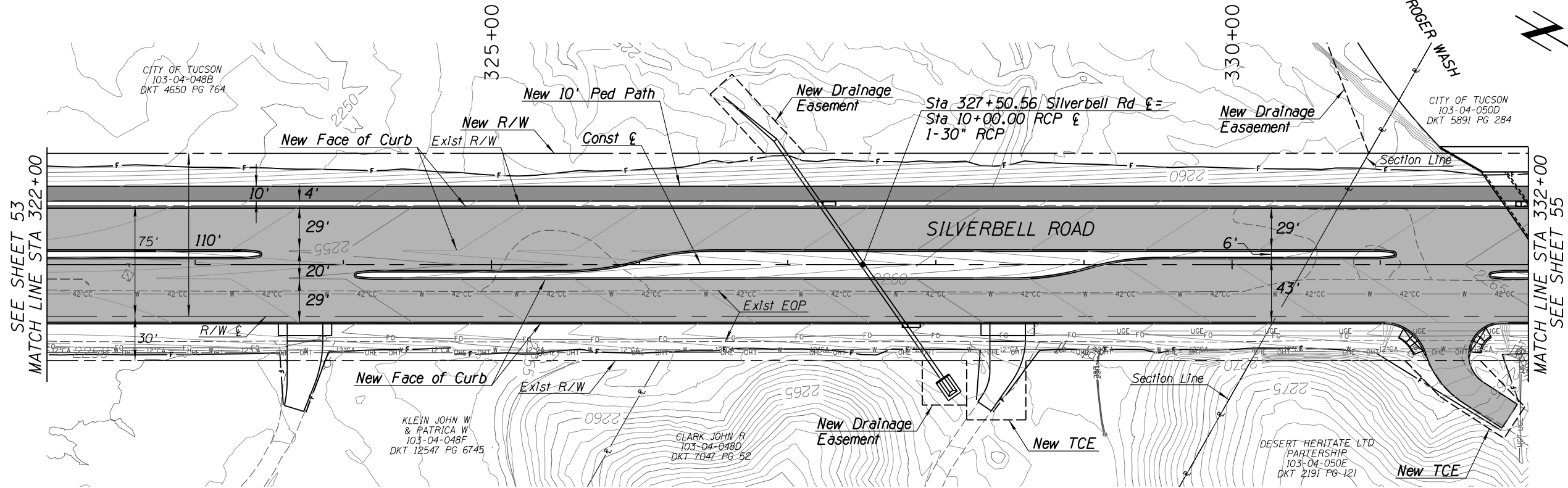


Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

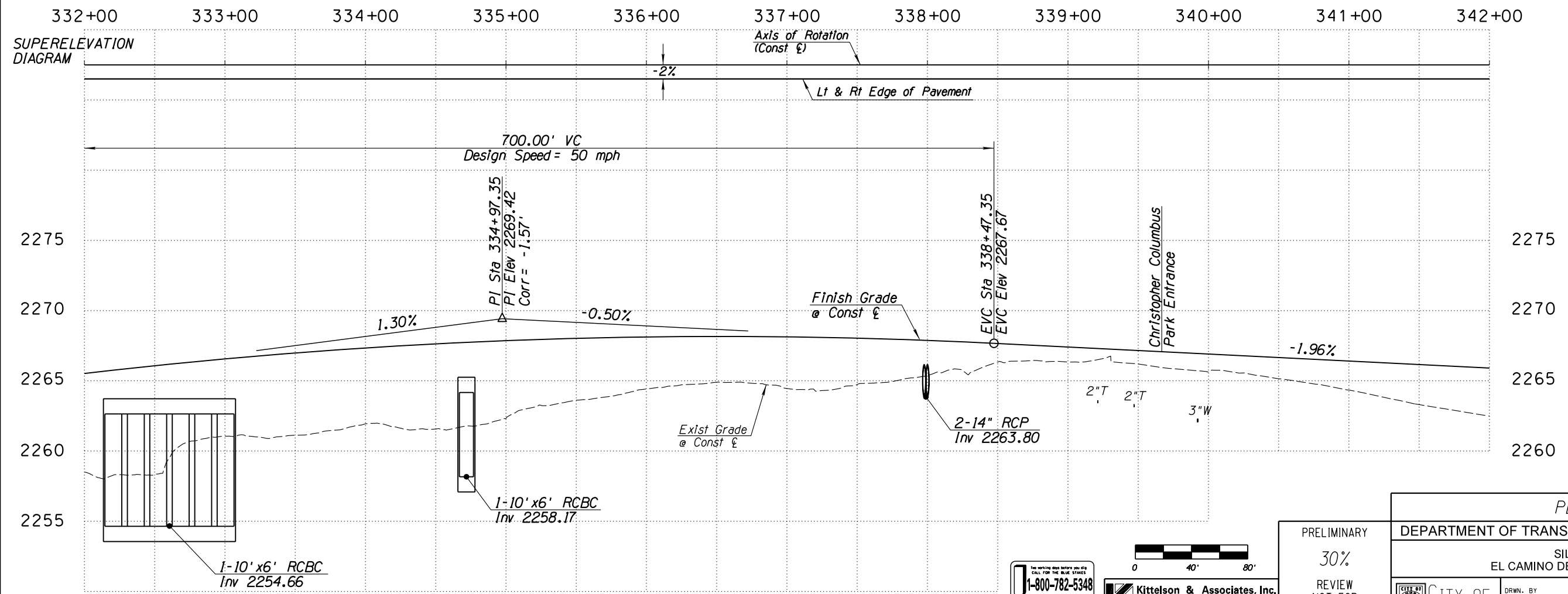
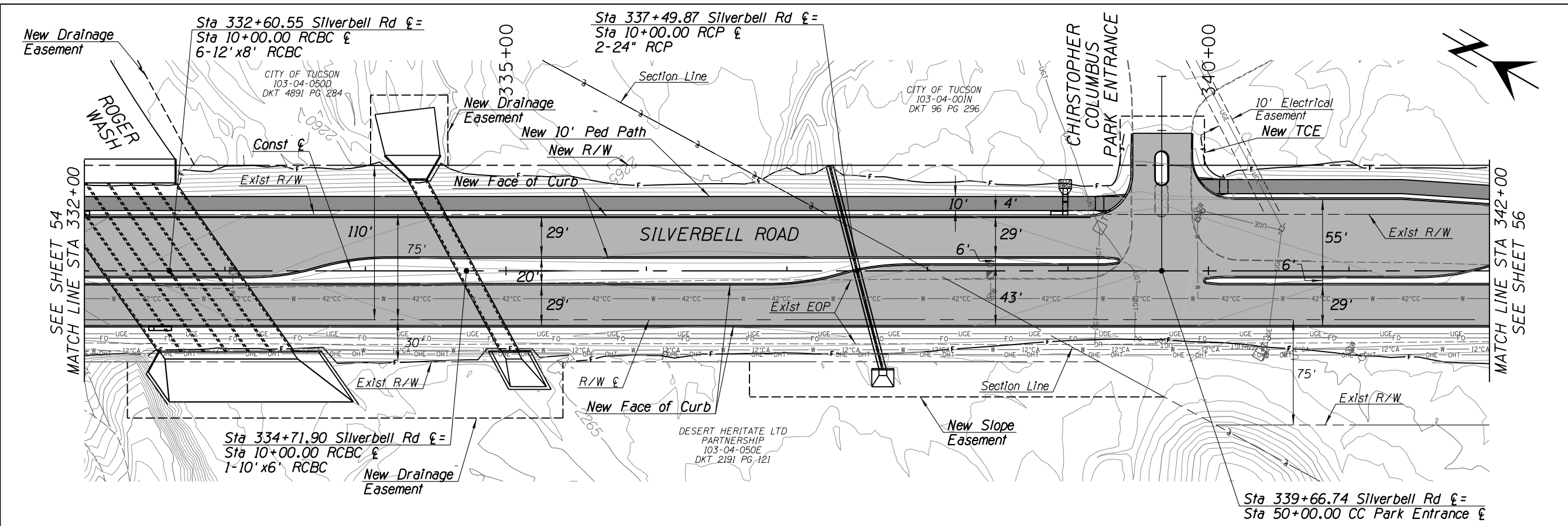
PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	MDA/YSM	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON			PP3 OF PP36
PLAN NO.			I-2010-005





PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			54 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP5 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. _____ SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005

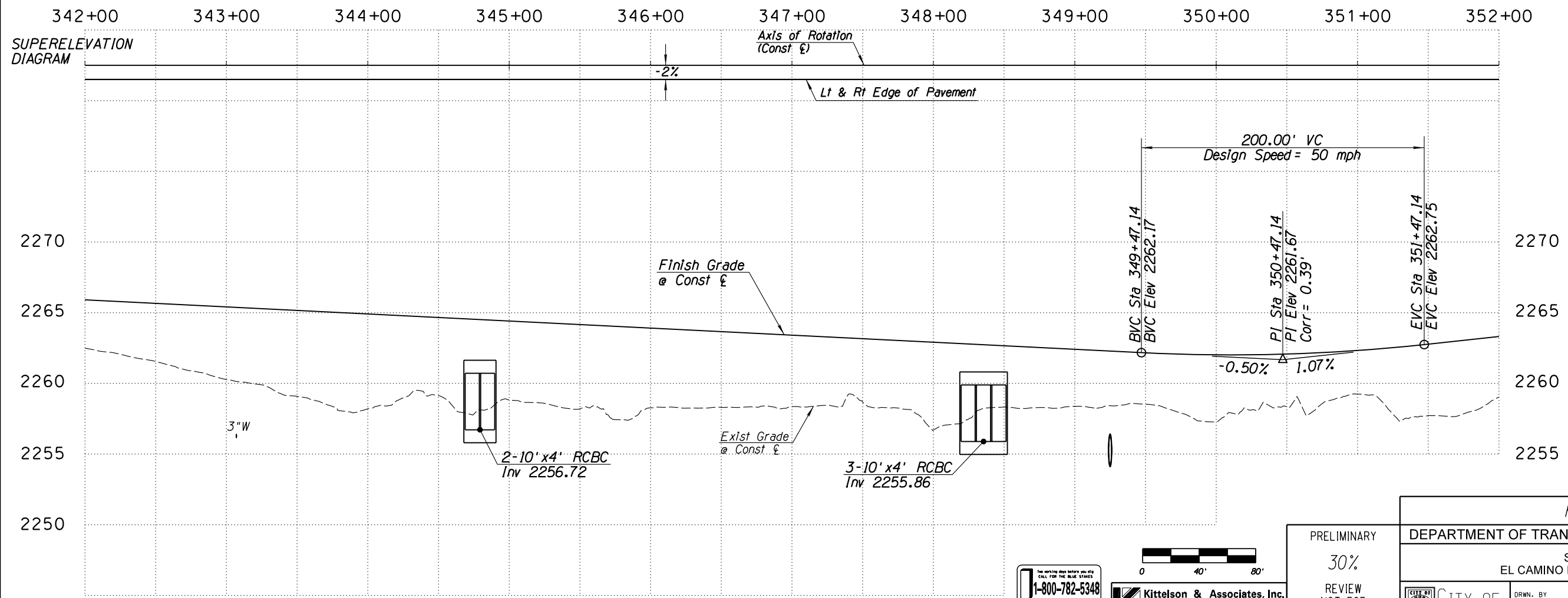
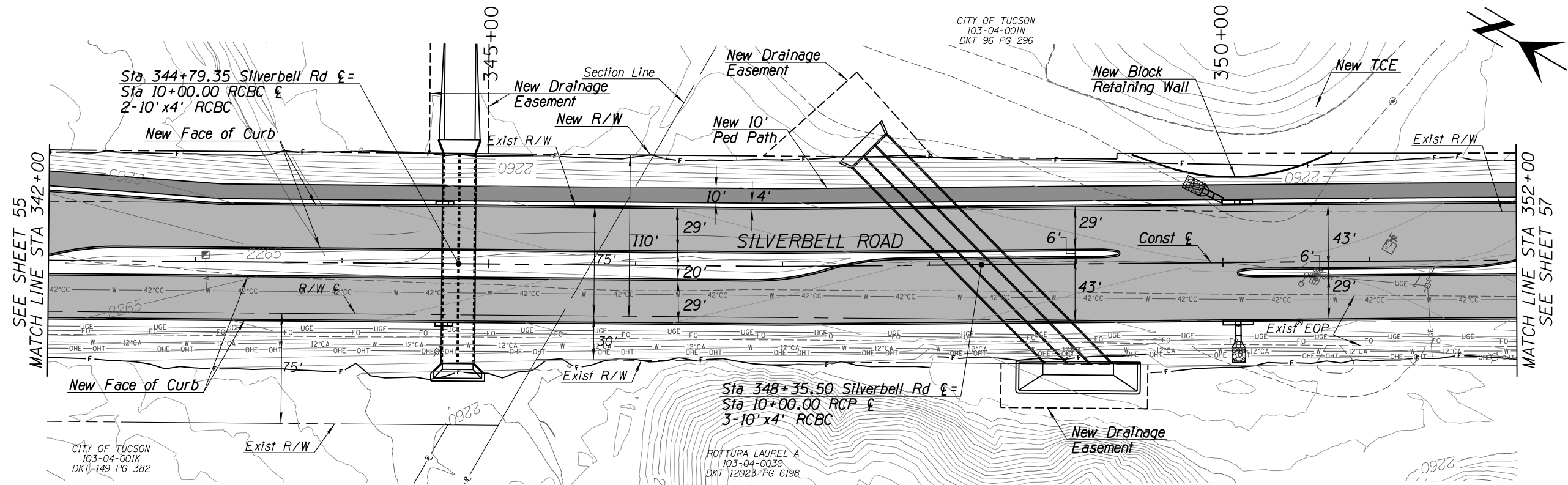


1-800-782-5348
Blue Stone Center
CALL COLLECT

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701
(520) 544-4067

0 40' 80'

PRELIMINARY		30%		REVIEW NOT FOR CONSTRUCTION OR RECORDING	
PLAN & PROFILE					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD					
DRWN. BY LAS/TMR		9/10		PP6 OF PP36	
DSGN. BY MDA/YSM		9/10		SCALE: 1" = 40'	
CHKD. BY JAS		9/10		1" = 4'	
CITY OF TUCSON		PLAN NO. I-2010-005			



1-800-782-5348
 Blue Stone Center
 CALL COLLECT

K Kittelson & Associates, Inc.
 33 N. Stone Ave., Suite 800
 Tucson, AZ 85701 (520) 544-4067

0 40' 80'

PRELIMINARY
 30%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PLAN & PROFILE

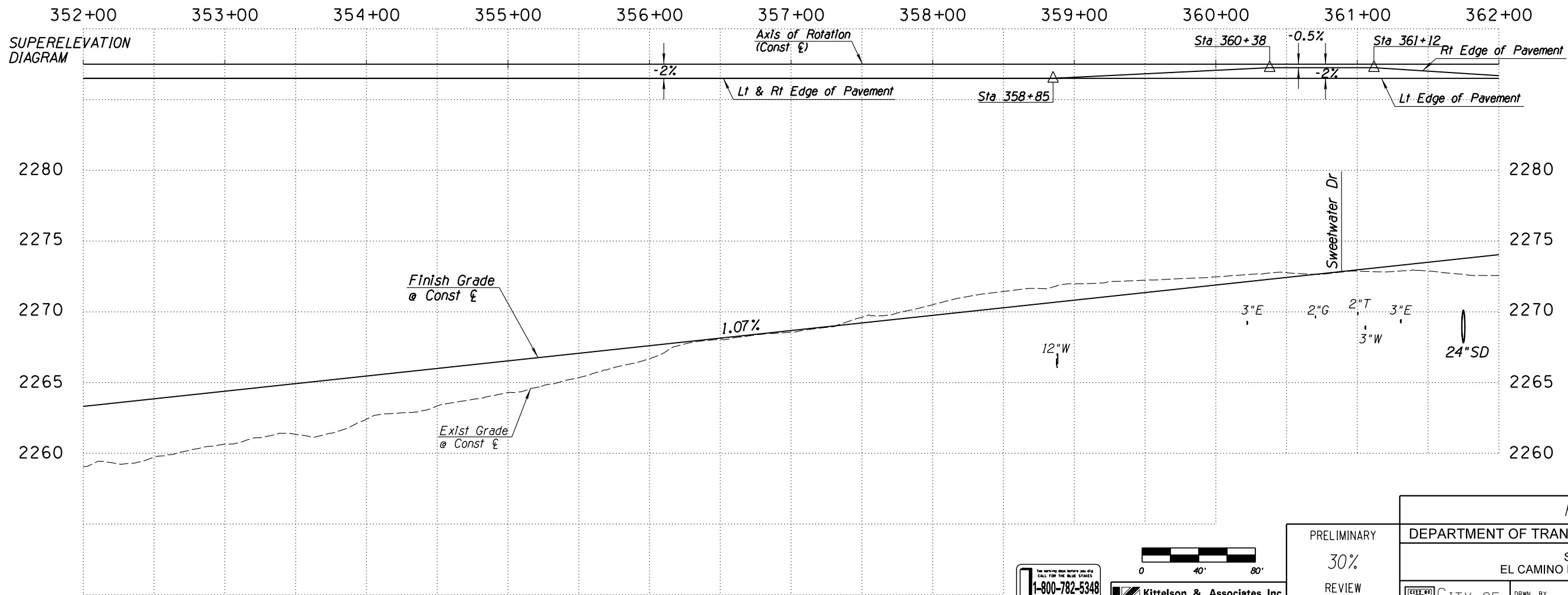
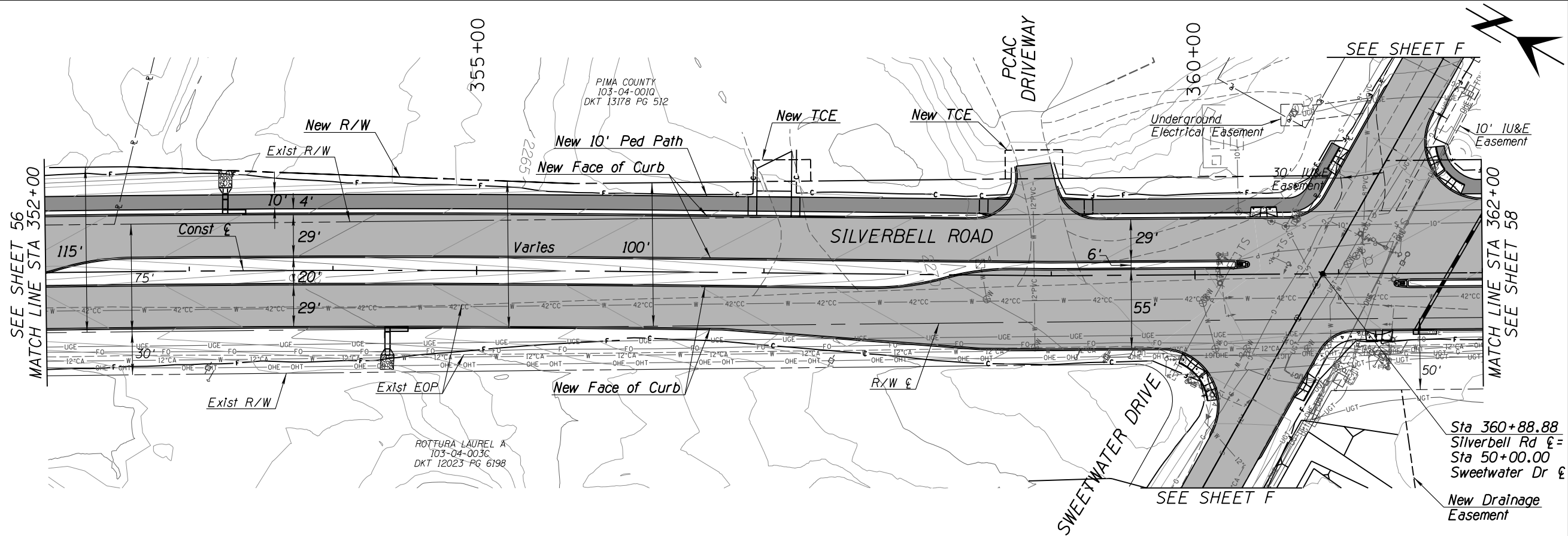
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
 EL CAMINO DEL CERRO TO GRANT ROAD

DRWN. BY LAS/TMR	9/10	REF. _____
DSGN. BY MDA/YSM	9/10	SCALE: 1" = 40'
CHKD. BY JAS	9/10	1" = 4'

PLAN NO. I-2010-005

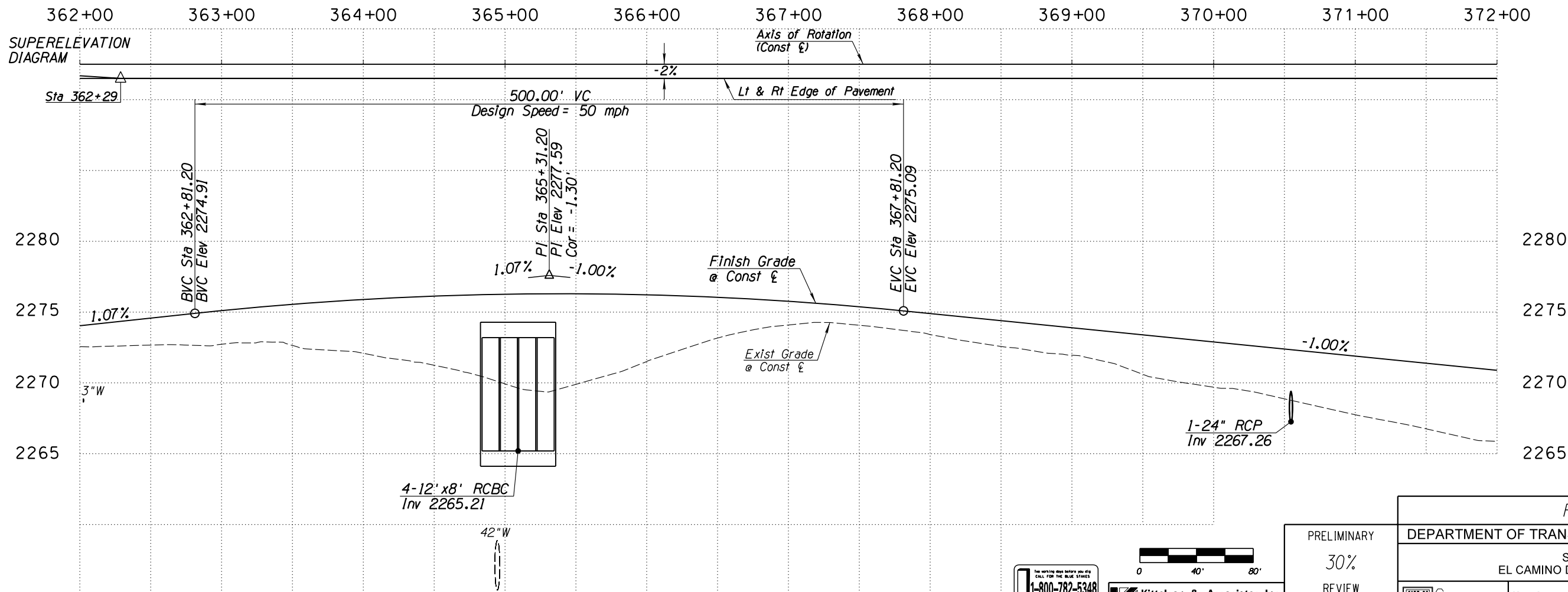
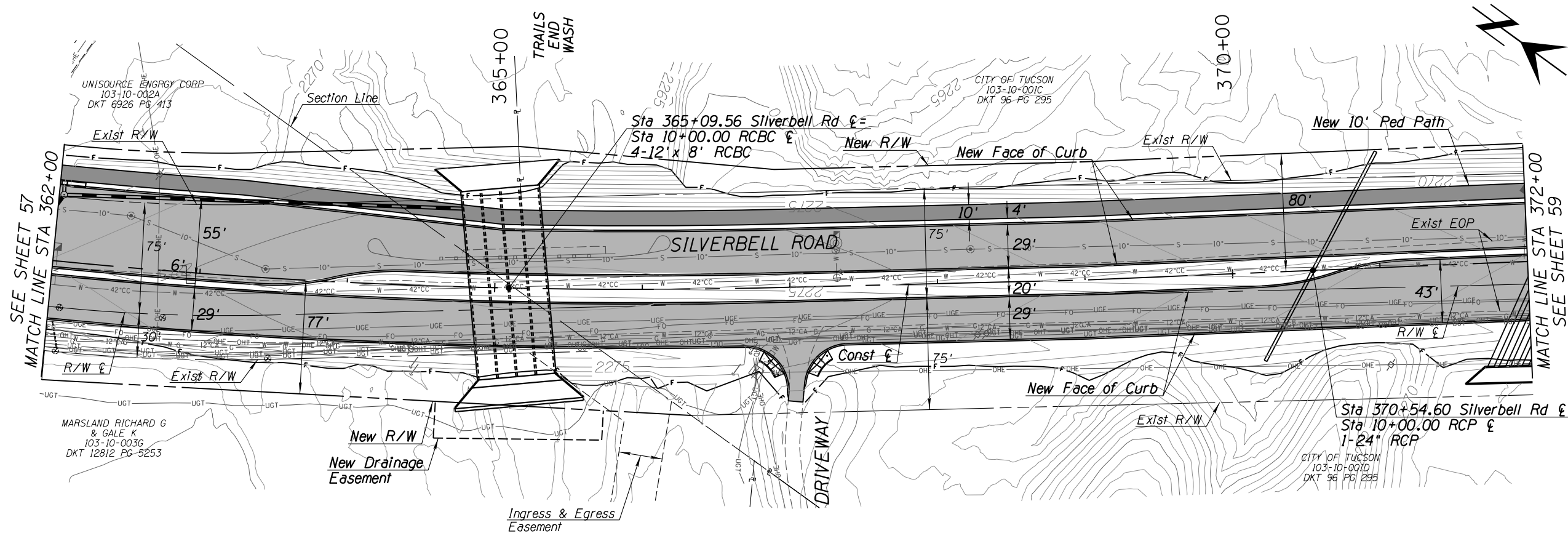
56
 OF
 138



NO.	DATE	REVISION	BY	CHKD.	APPR.

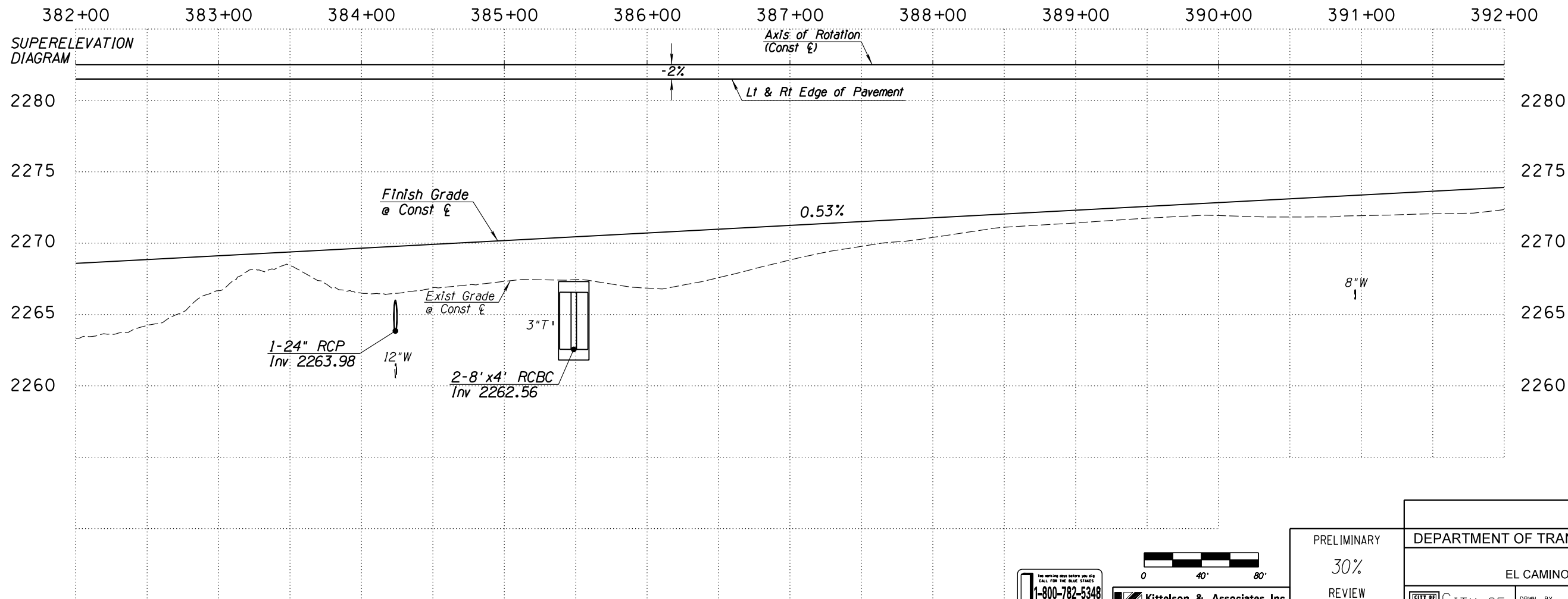
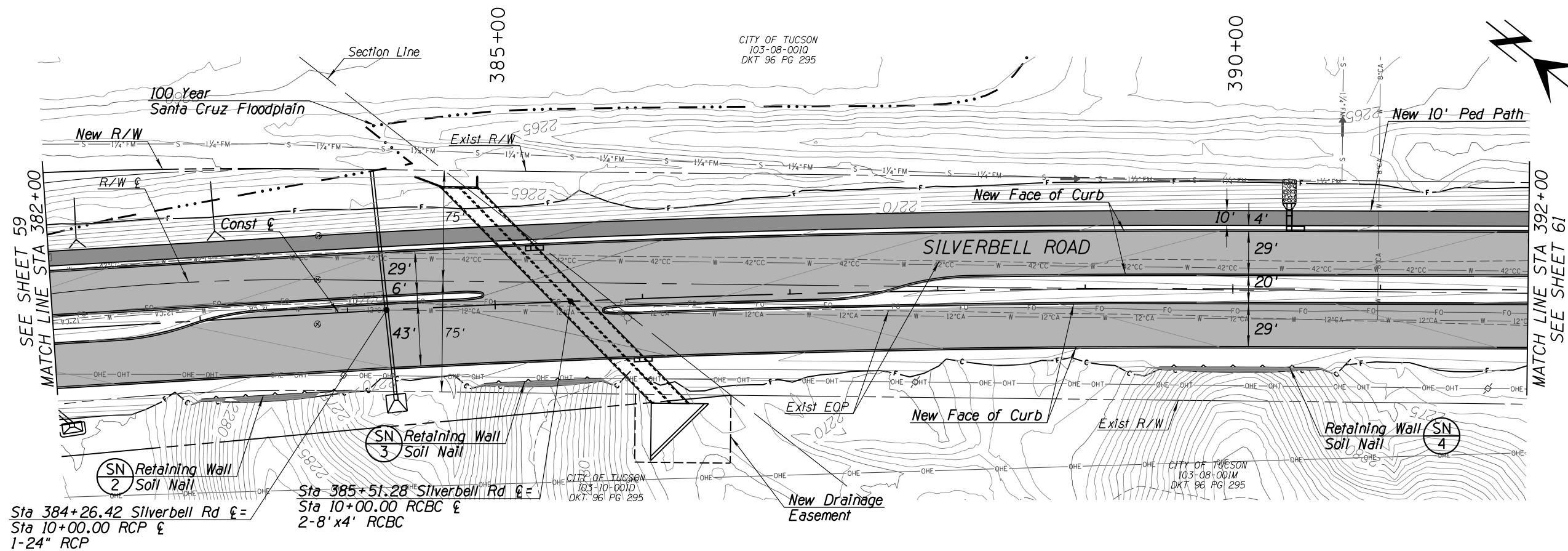
PRELIMINARY
 30%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	MDA/YSM	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON			PP8 OF PP36
PLAN NO.			I-2010-005



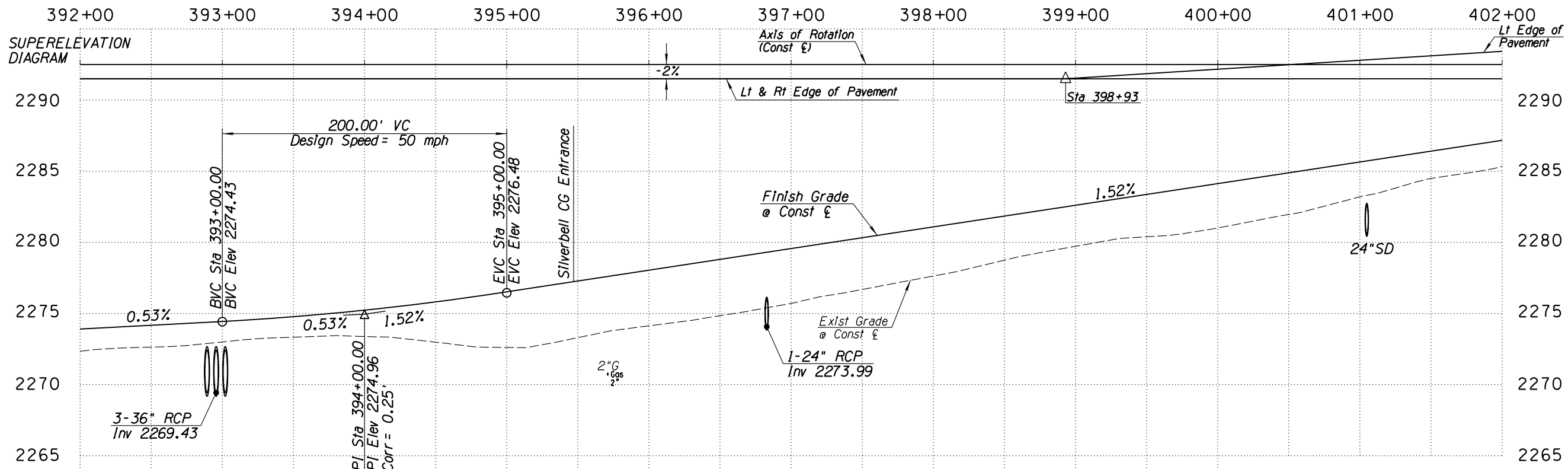
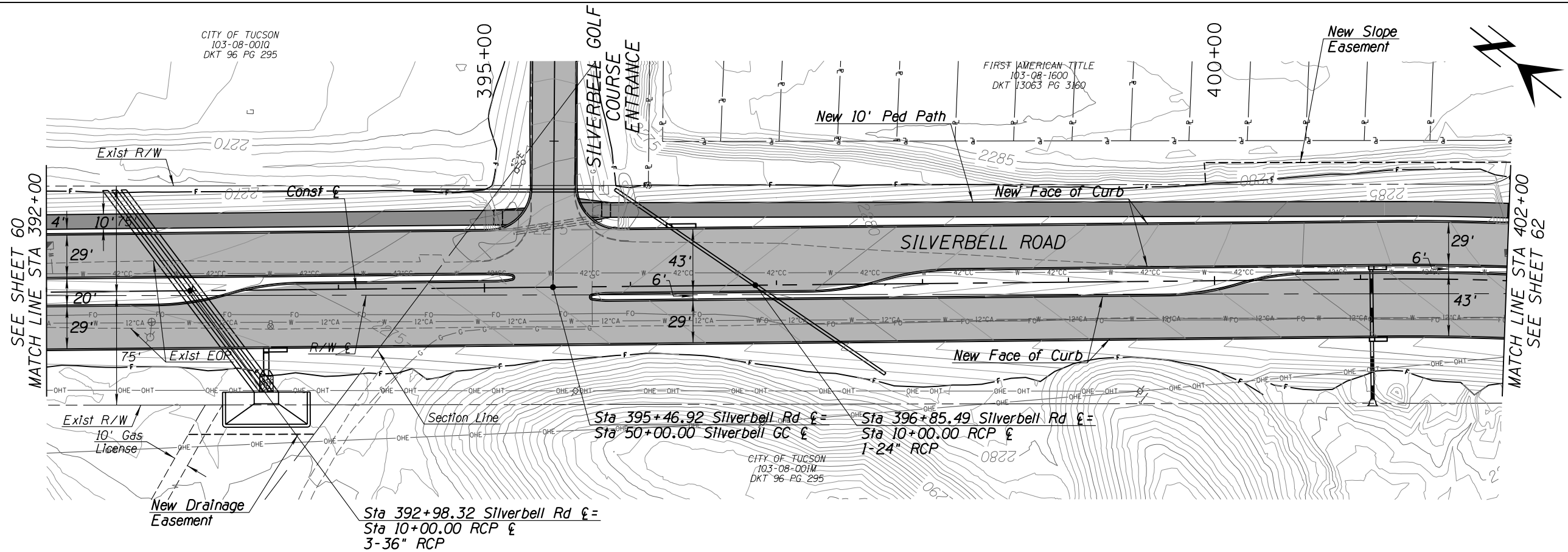
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			58 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP9 OF PP36
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	MDA/YSM	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON			PLAN NO. I-2010-005



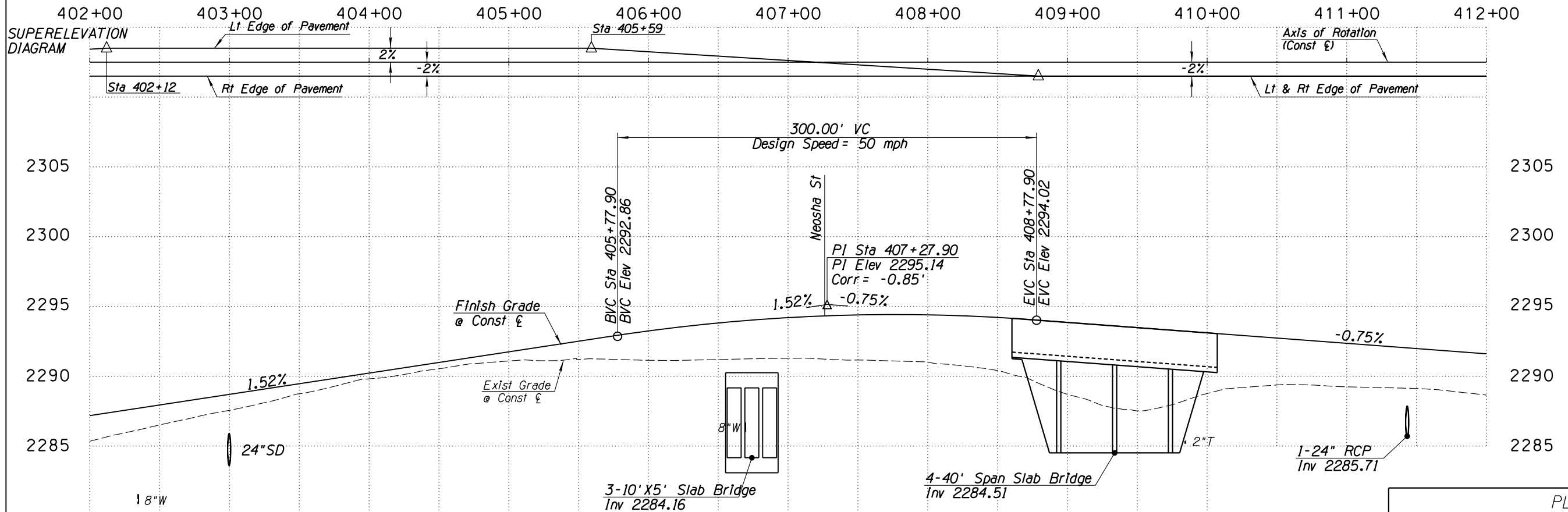
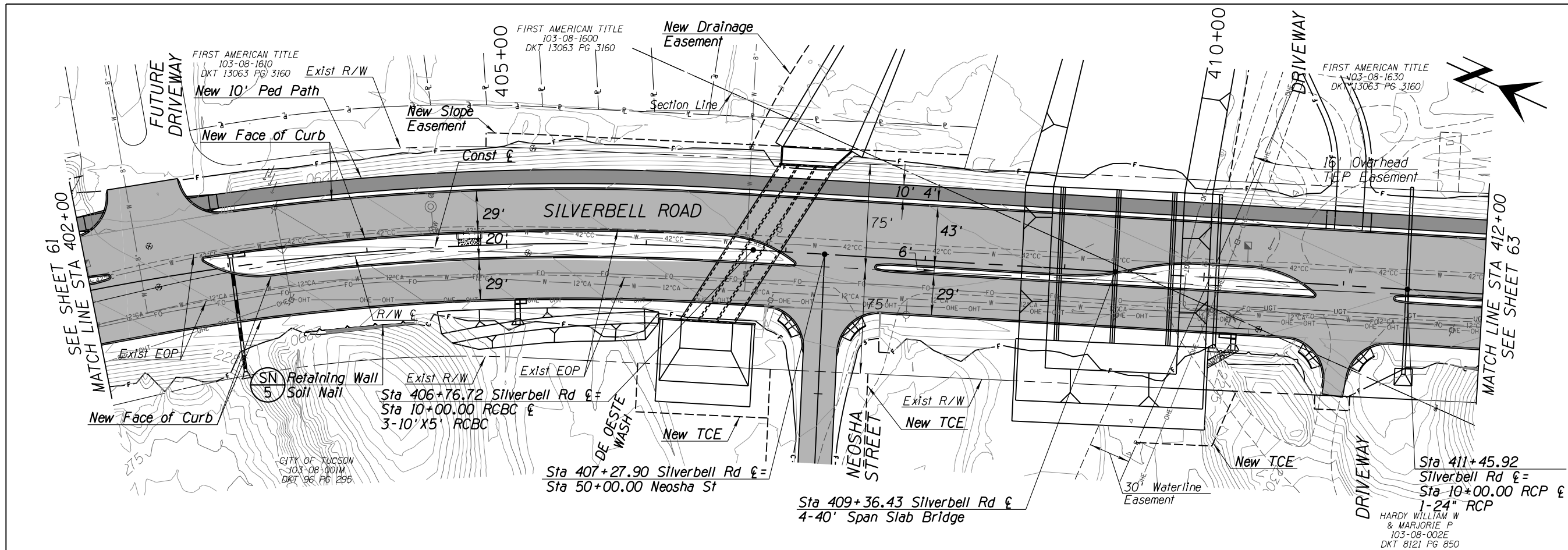
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			60 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP11 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005



PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	MDA/YSM	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON			PP12 OF PP36
PLAN NO.			I-2010-005



6/24/2011
C:\Documents and Settings\ymereszczak\Desktop\Projects\9589 - Silverbell Road DCR\30%-South\06 PnP\svb-pnp-13.dgn

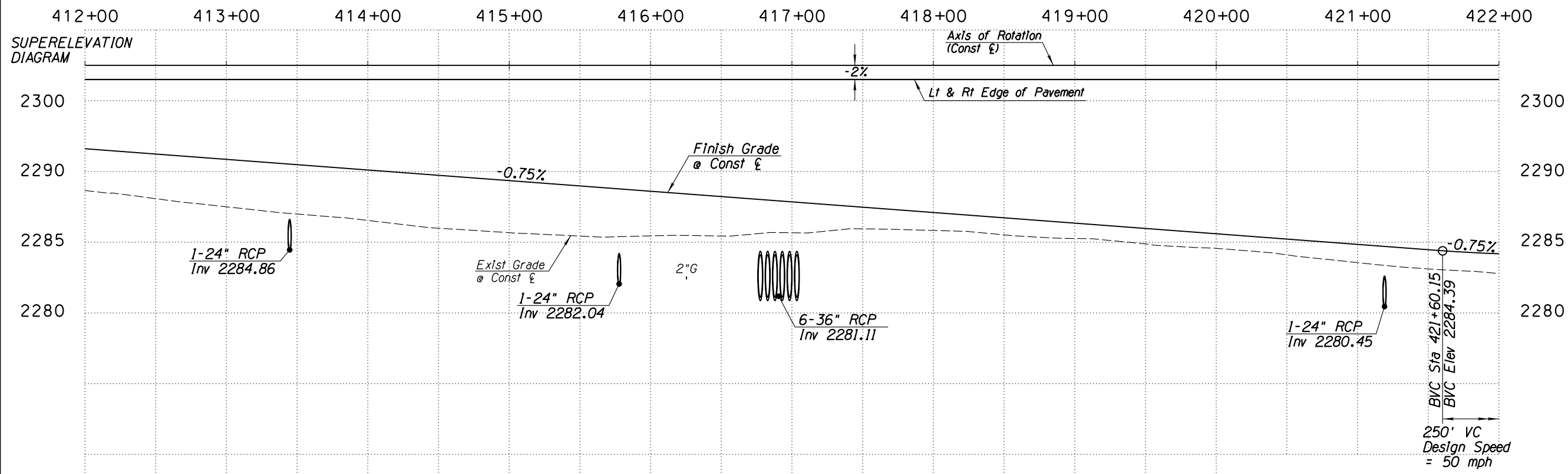
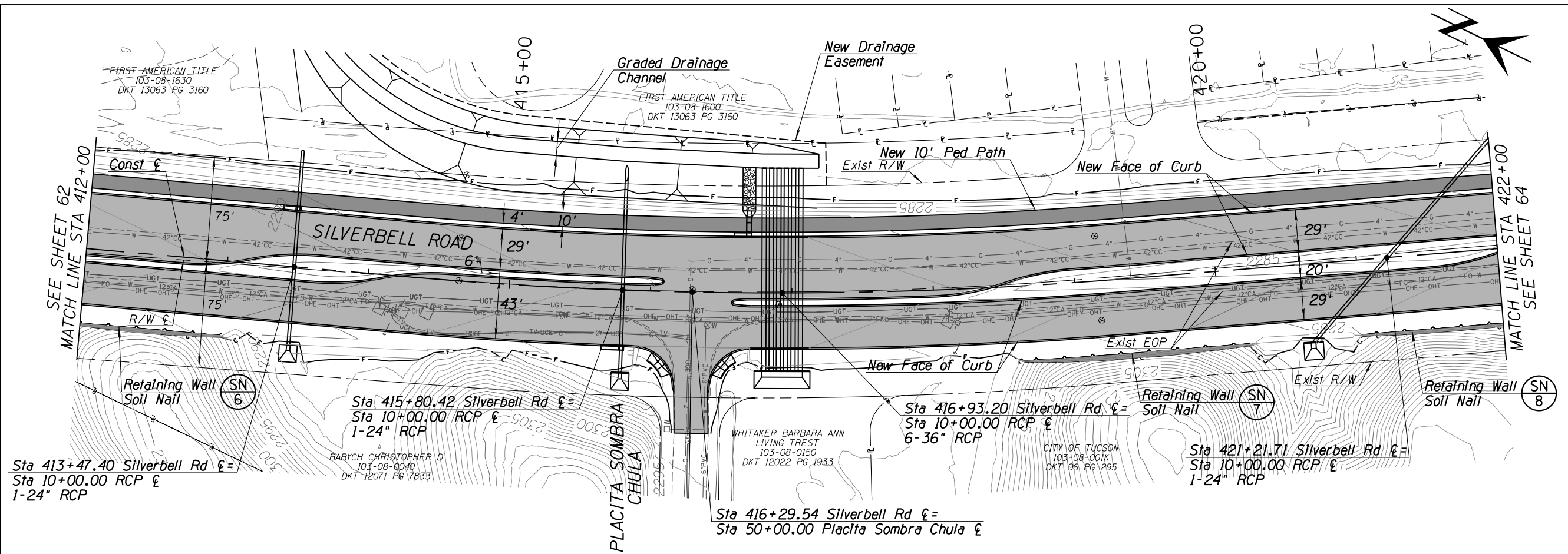
PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION		62 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD		PP13 OF PP36
DRWN. BY	LAS/TMR	9/10
DSGN. BY	MDA/YSM	9/10
CHKD. BY	JAS	9/10
CITY OF TUCSON		REF. _____ SCALE: 1" = 40'
PRELIMINARY		1" = 4'
30%		
REVIEW NOT FOR CONSTRUCTION OR RECORDING		
NO.	DATE	REVISION
BY	CHKD.	APPR.

1-800-782-5348

Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

0 40' 80'



PRELIMINARY

30%

REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

NO.

DATE

REVISION

BY

CHKD.

APPR.

1-800-782-5348

K Kittelson & Associates, Inc.

33 N. Stone Ave., Suite 800
Tucson, AZ 85701
(520) 544-4067

PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD

DRWN. BY

LAS/TMR

9/10

REF.

SCALE: 1" = 40'

1" = 4'

DSGN. BY

MDA/YSM

9/10

CITY OF
TUCSON

CHKD. BY

JAS

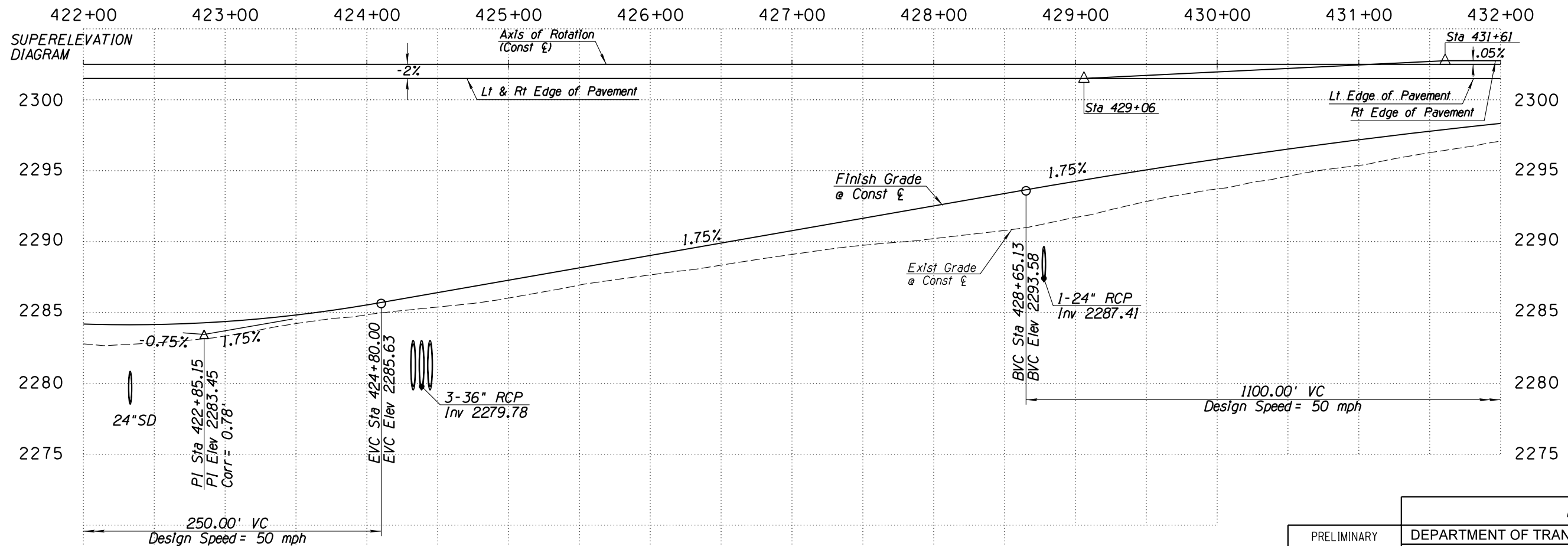
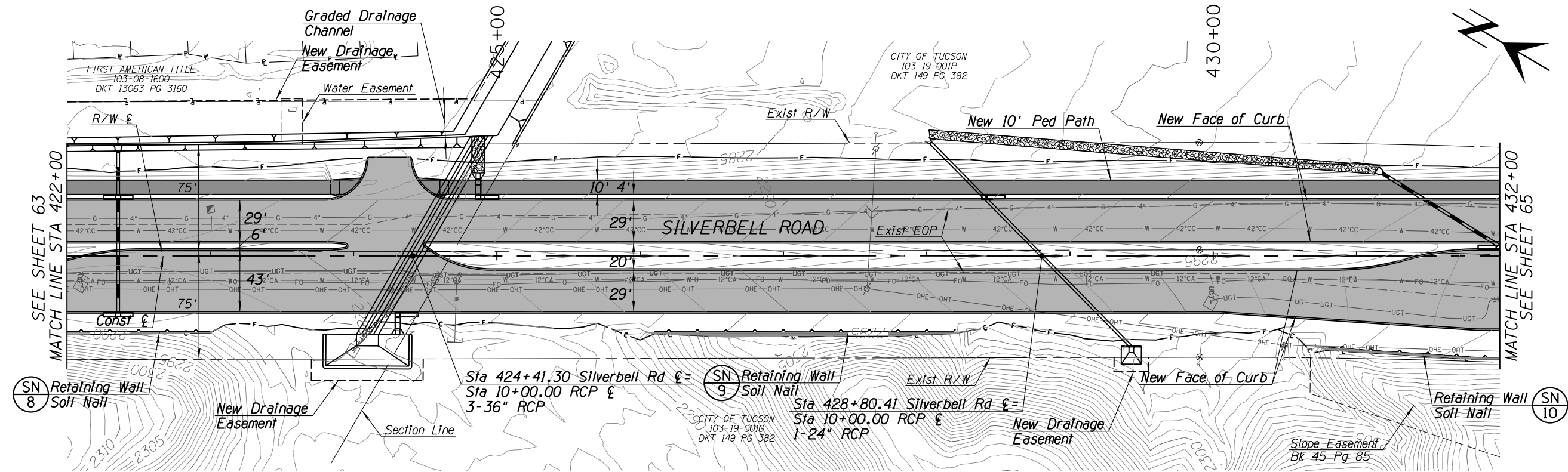
9/10

PLAN NO.

I-2010-005

63
OF
138

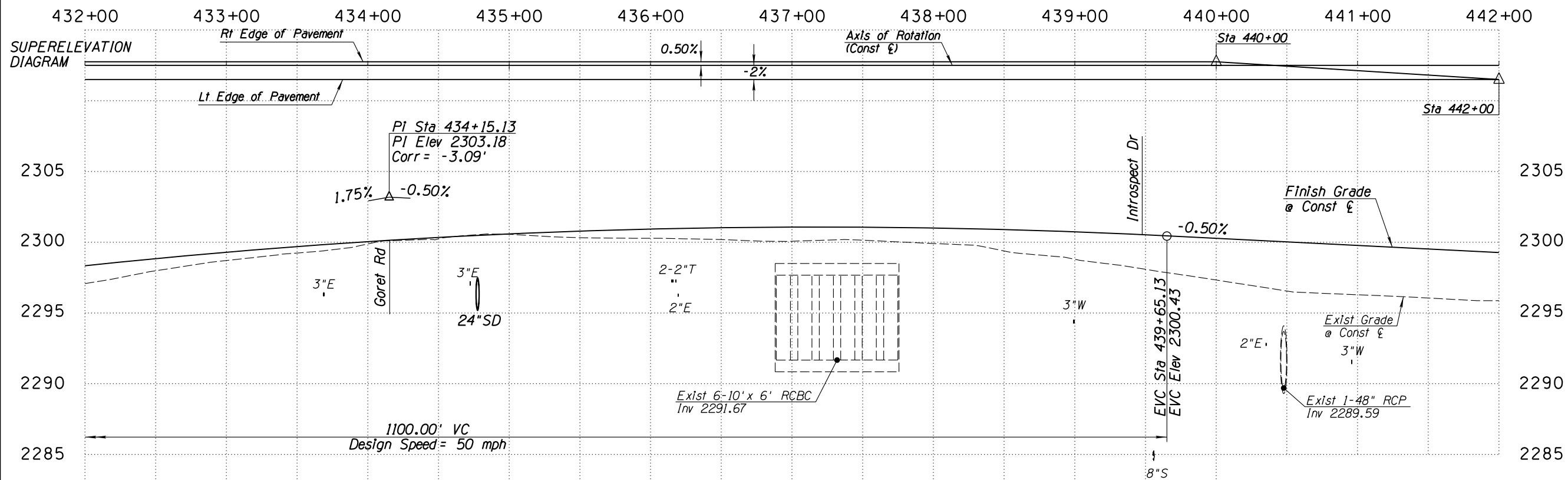
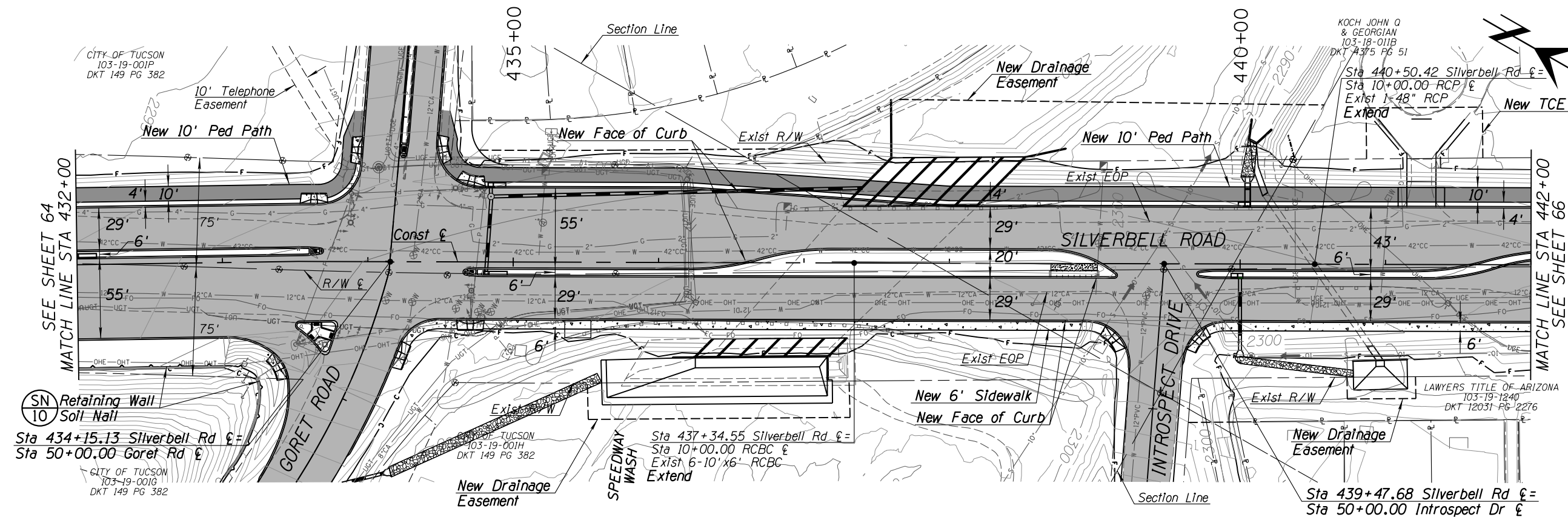
PP14
OF
PP36



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

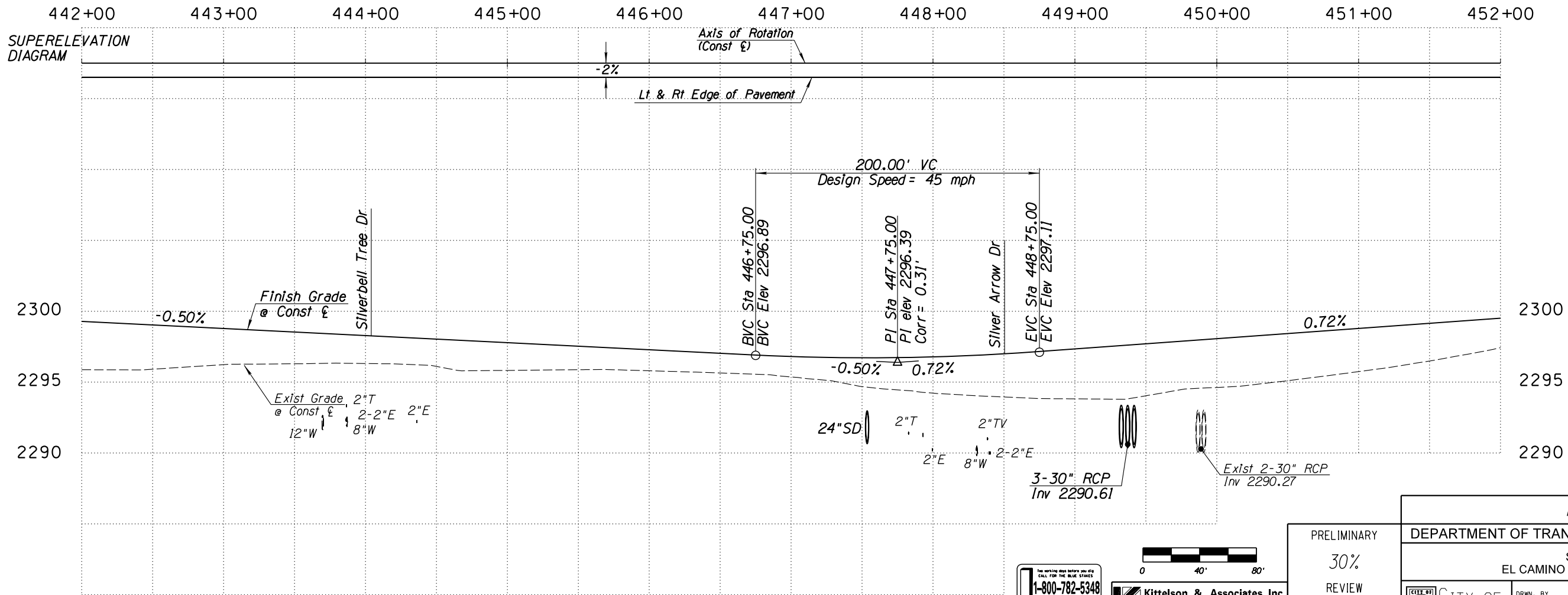
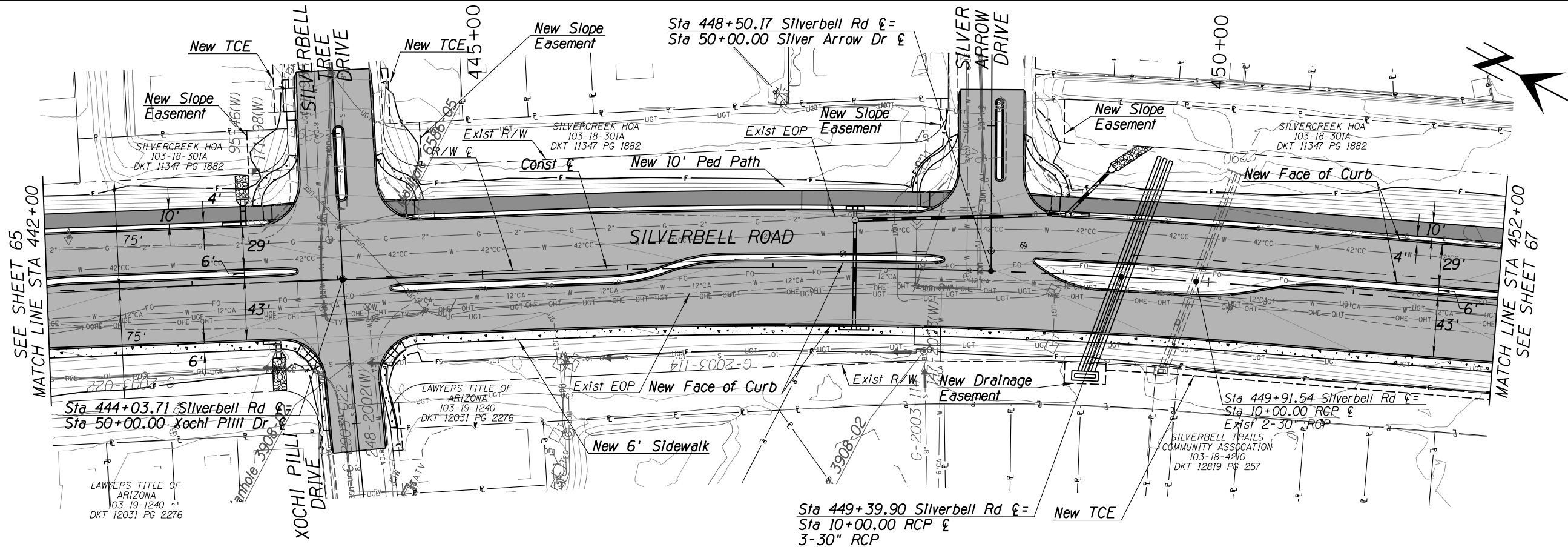
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			64 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP15 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005



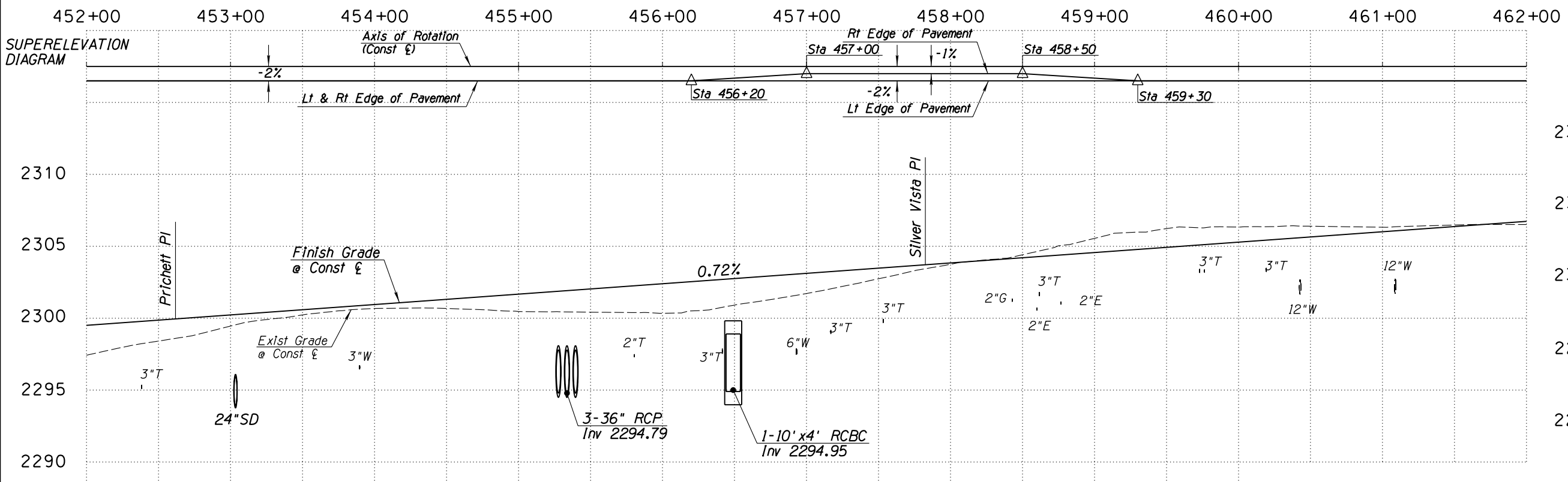
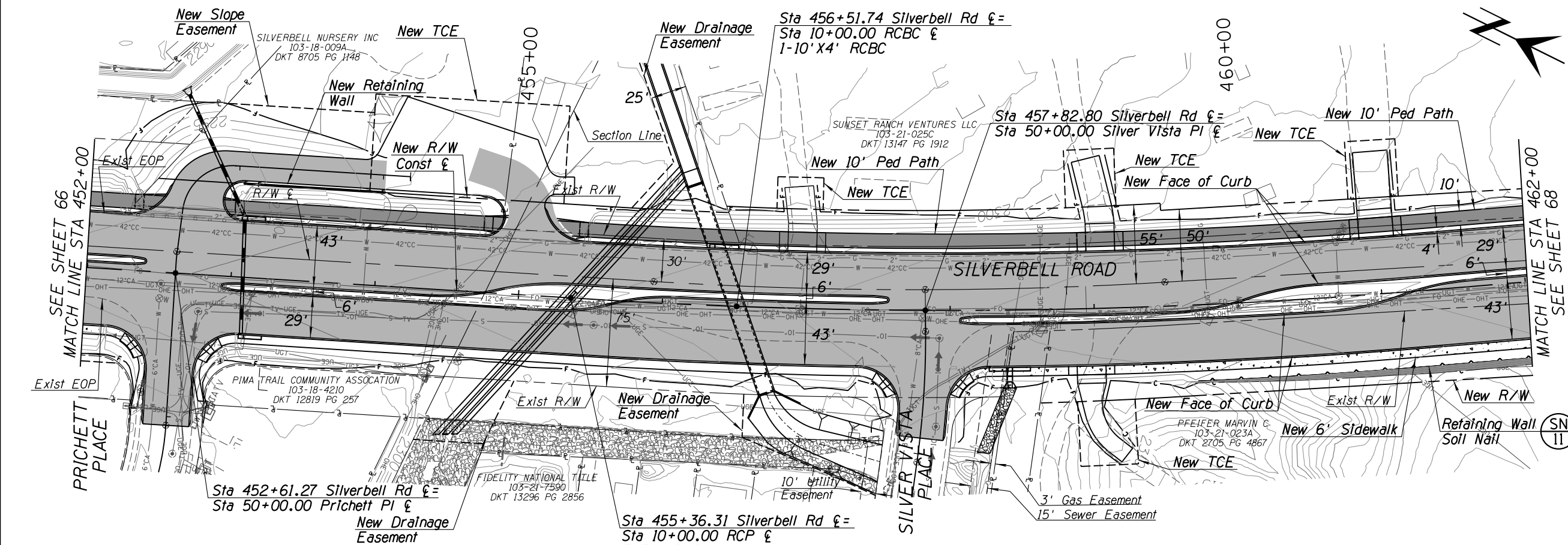
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			65
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP16 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005



PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			66 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP17 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005



1-800-782-5348
Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

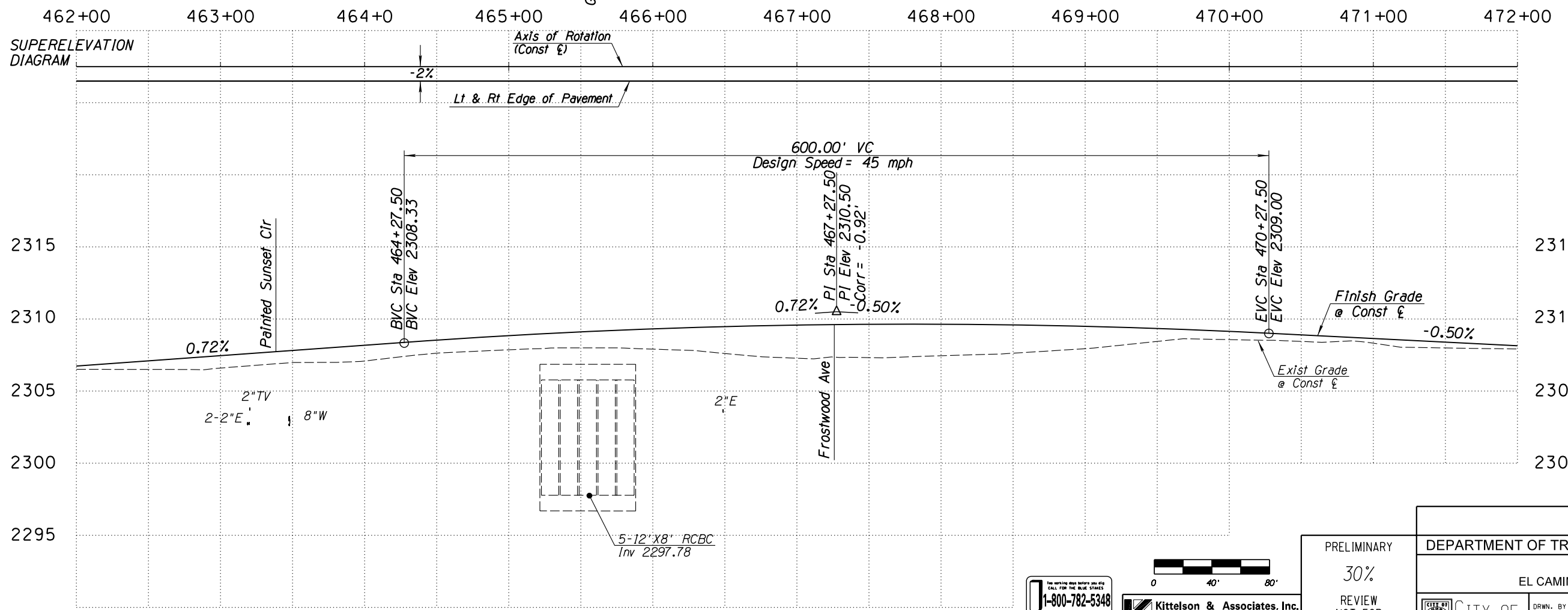
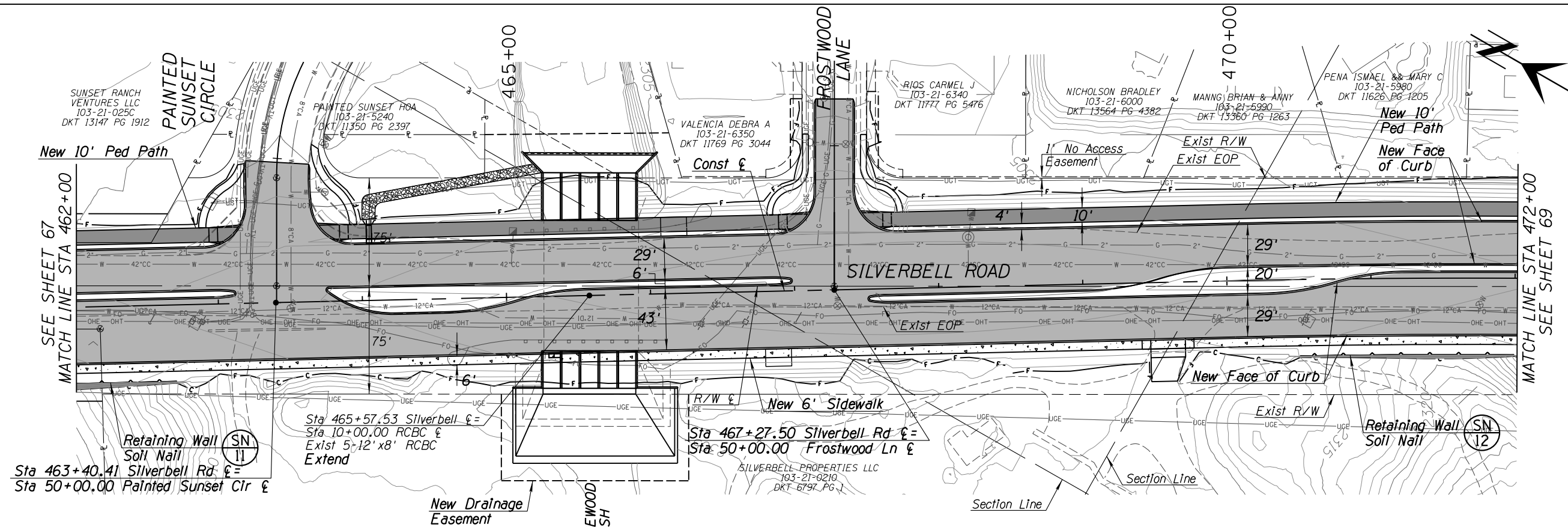
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION
SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD

67 OF 138
PP18 OF PP36

CITY OF TUCSON

DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10		1" = 4'
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

1-800-782-5348
Blue Stone Center
CALL COLLECT

0 40' 80'

PRELIMINARY

30%

REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD

DRWN. BY	LAS/TMR	9/10
DSGN. BY	MDA/YSM	9/10
CHKD. BY	JAS	9/10

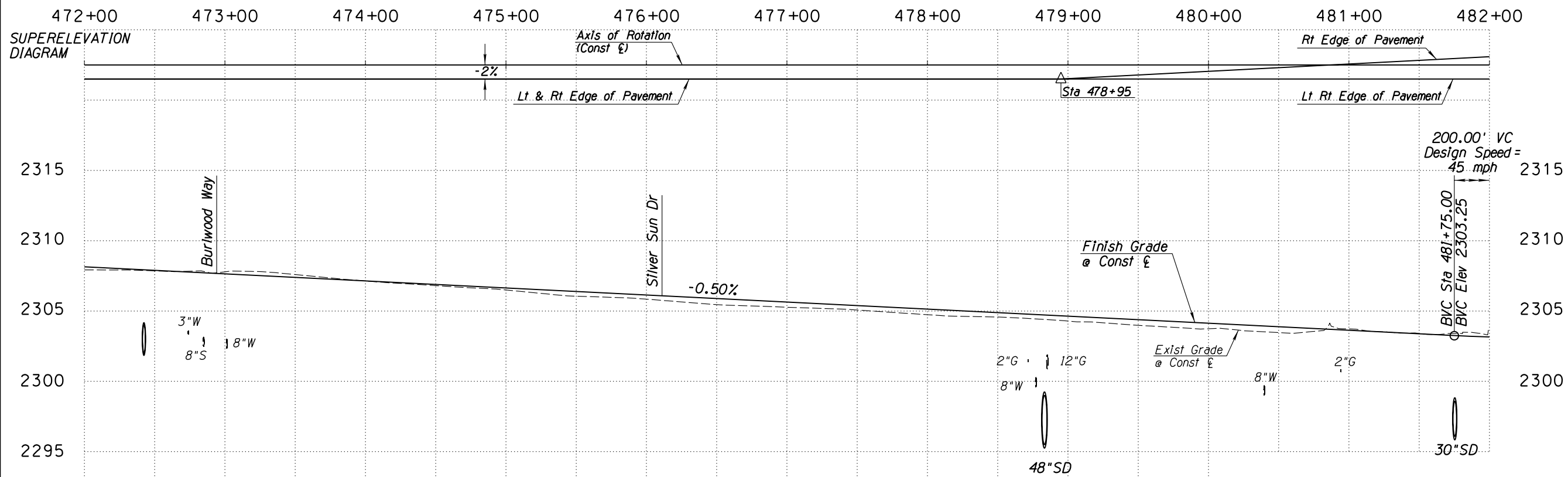
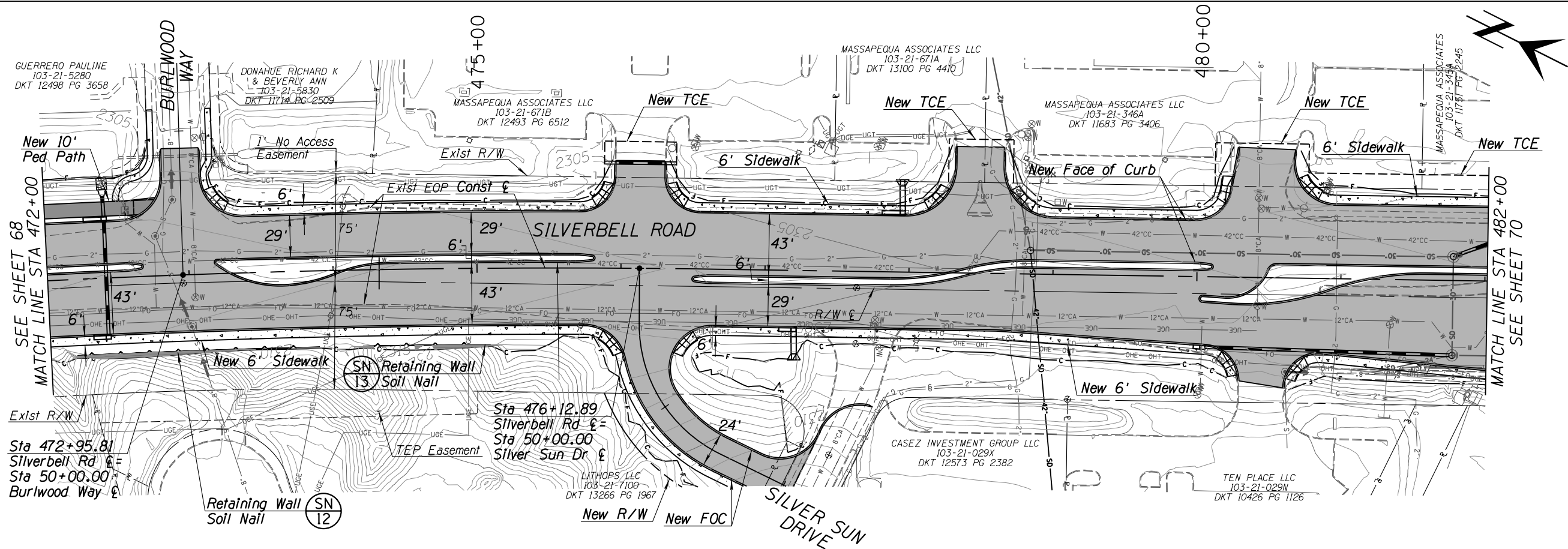
REF. _____ SCALE: 1" = 40'

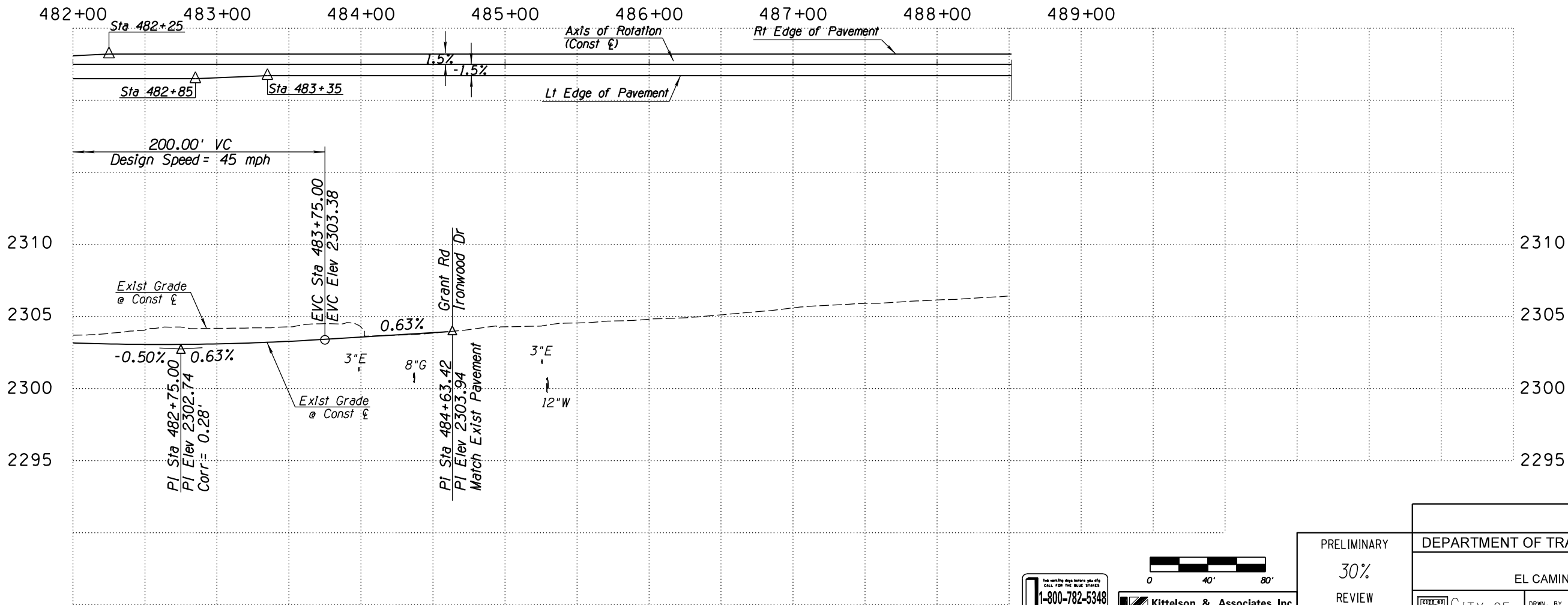
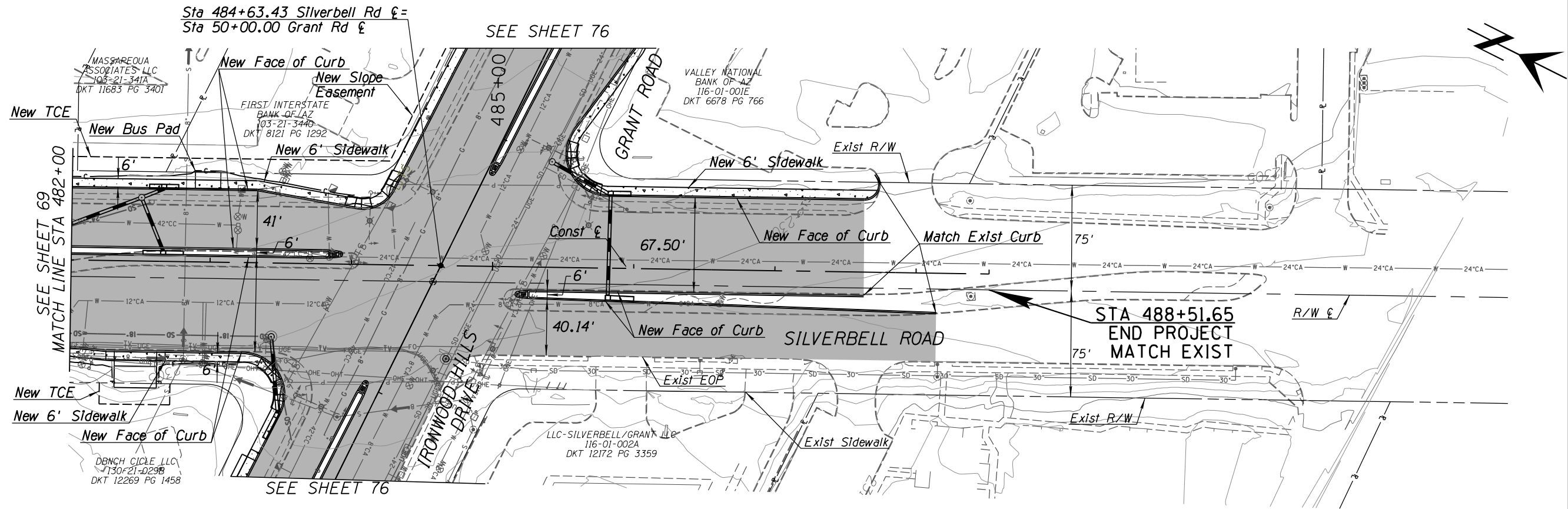
PP19 OF PP36

CITY OF TUCSON

PLAN NO. I-2010-005

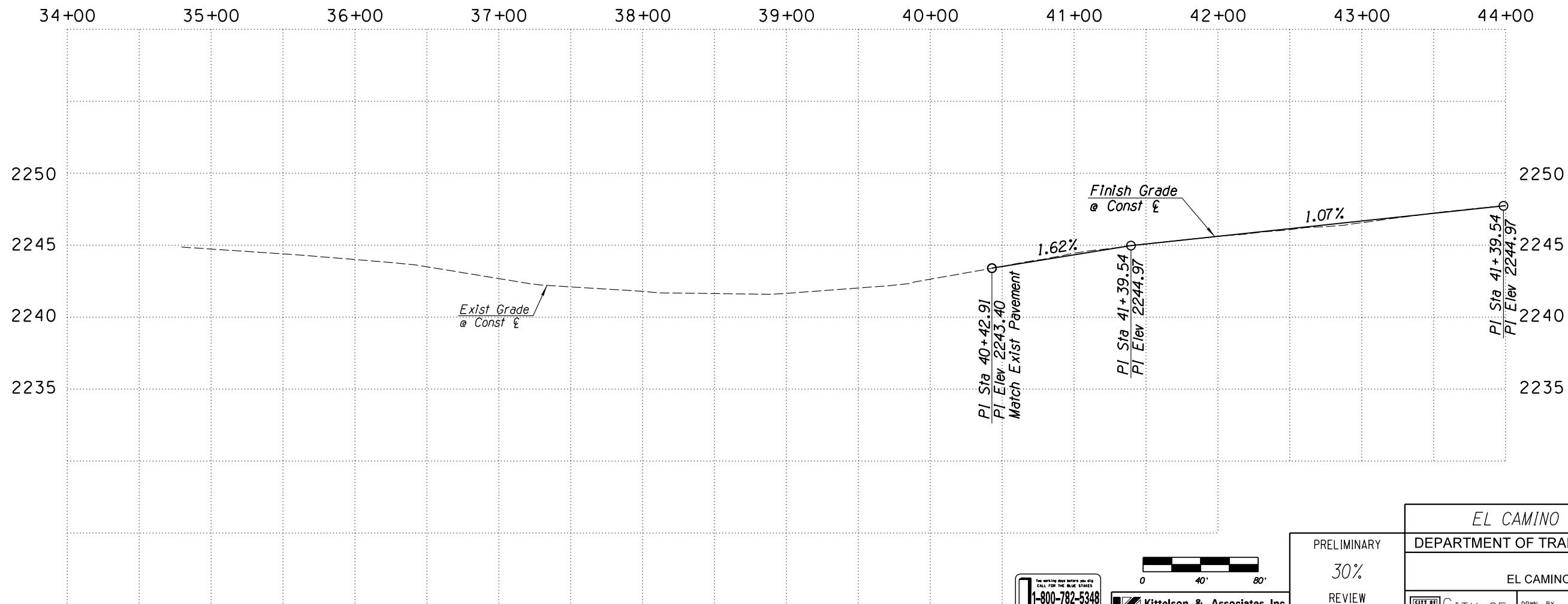
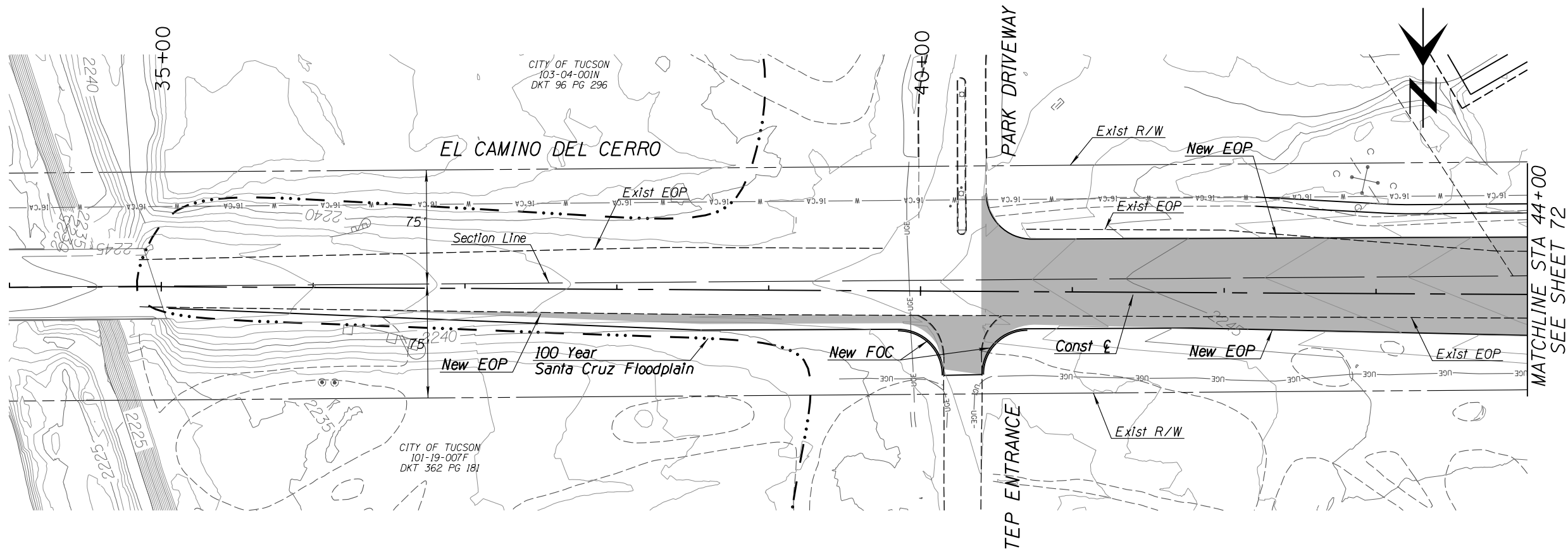
68 OF 138





PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			70 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP21 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005

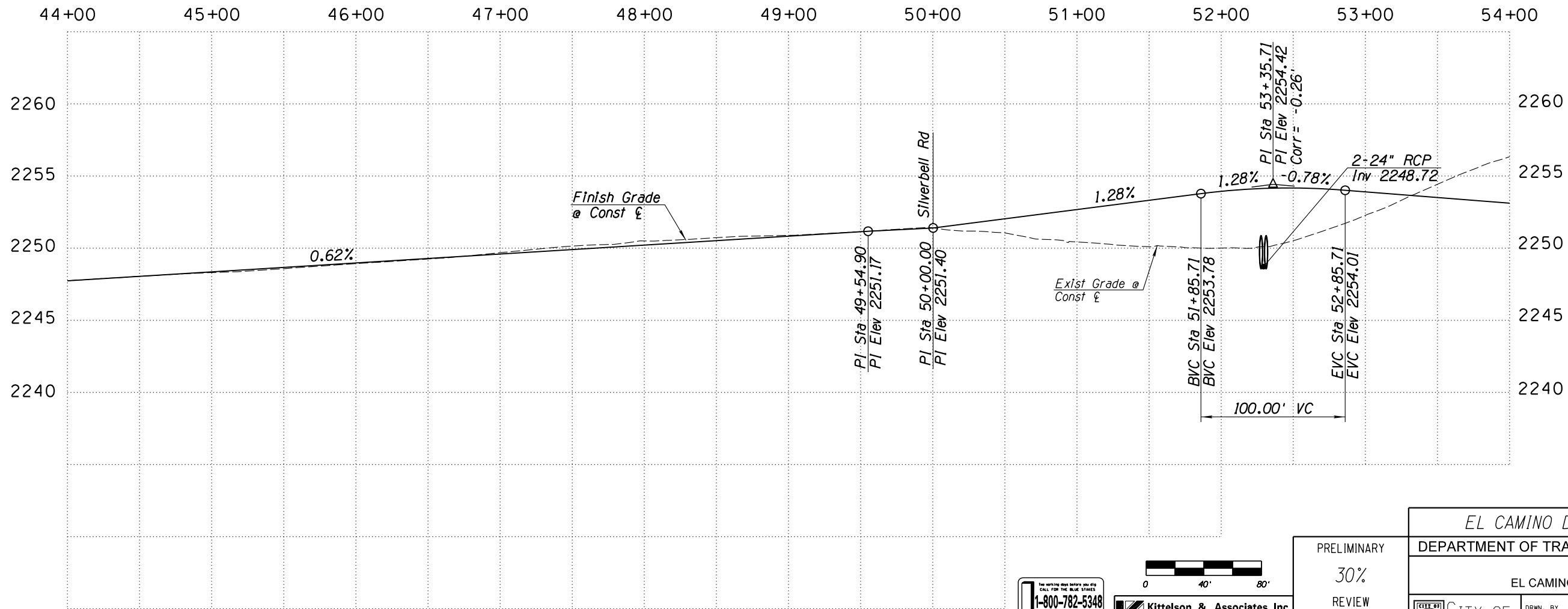
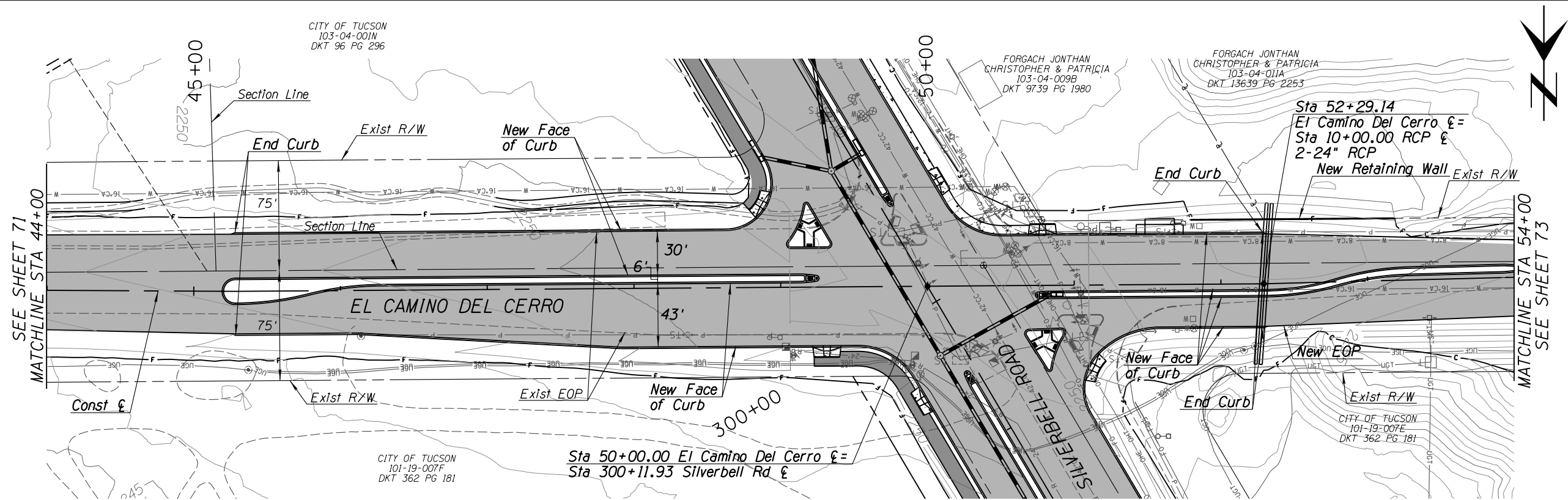


Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067



PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

EL CAMINO DEL CERRO PLAN & PROFILE					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				71	OF
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD				PP22	OF
CITY OF TUCSON				PP36	138
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'	
DSGN. BY	MDA/YSM	9/10		1" = 4'	
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005	



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067



PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

NO.	DATE	REVISION	BY	CHKD.	APPR.

EL CAMINO DEL CERRO PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD

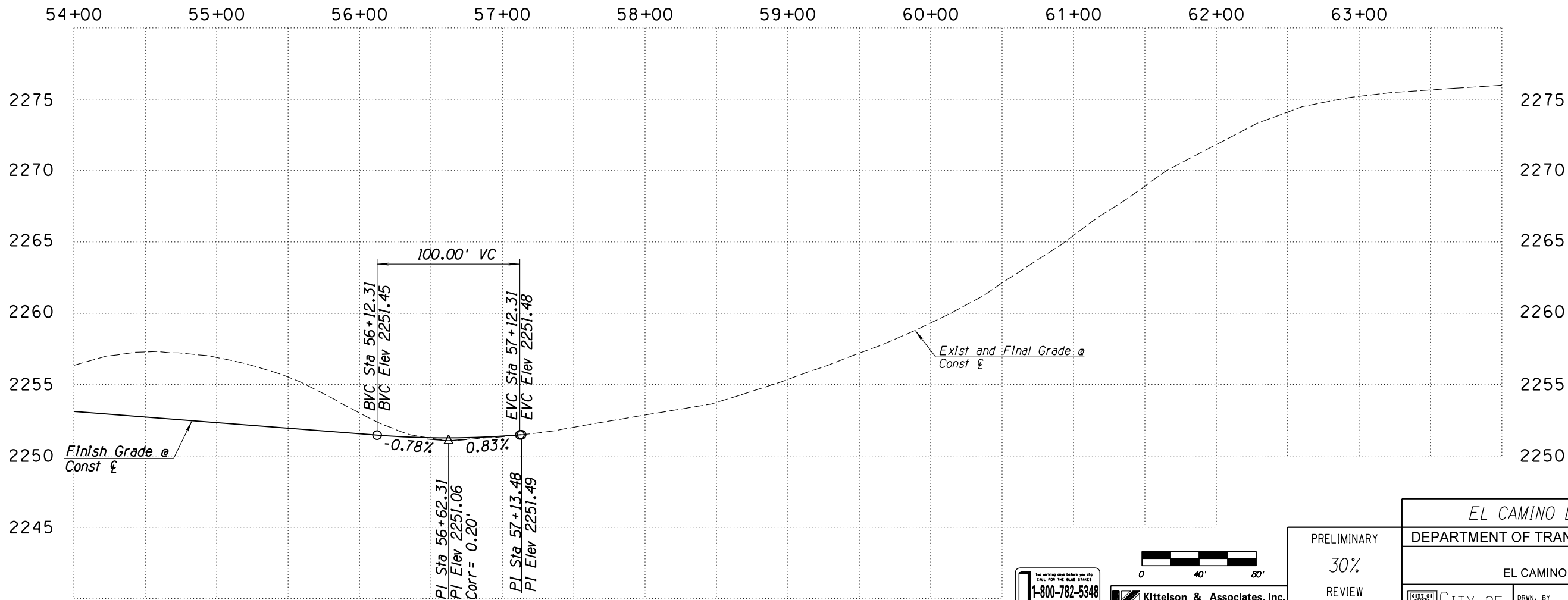
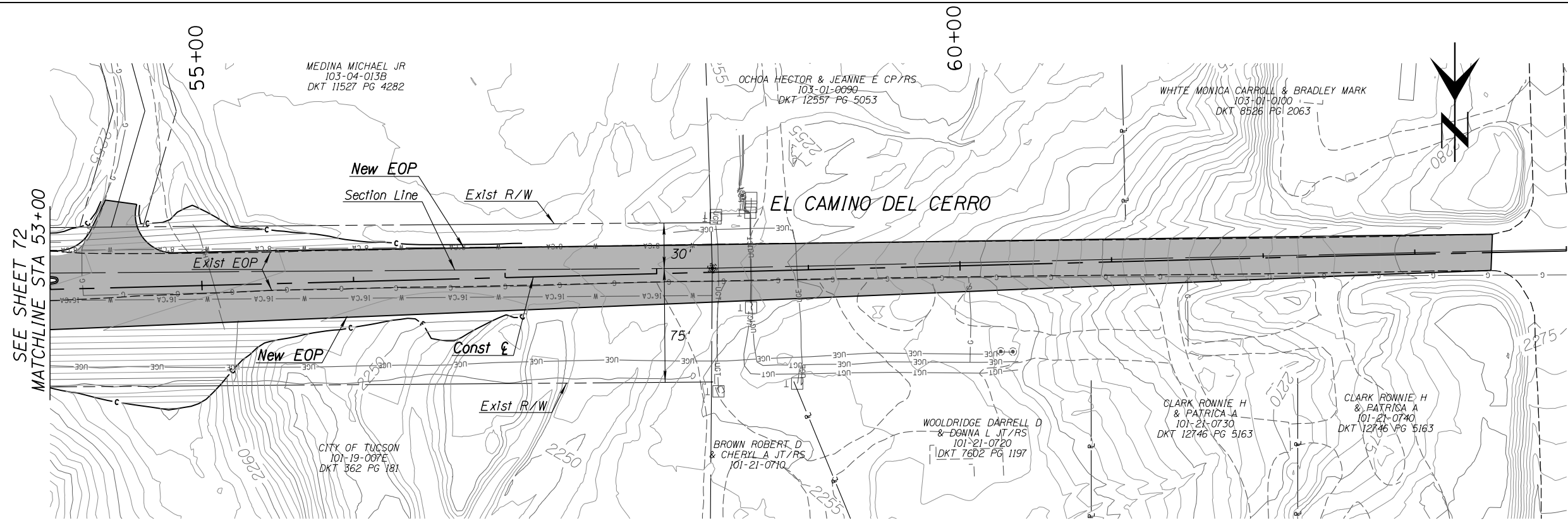


DRWN. BY LAS/TMR
DSGN. BY MDA/YSM
CHKD. BY JAS

9/10
9/10
9/10
PLAN NO. I-2010-005

72
OF
138

SCALE: 1" = 40'
1" = 4'

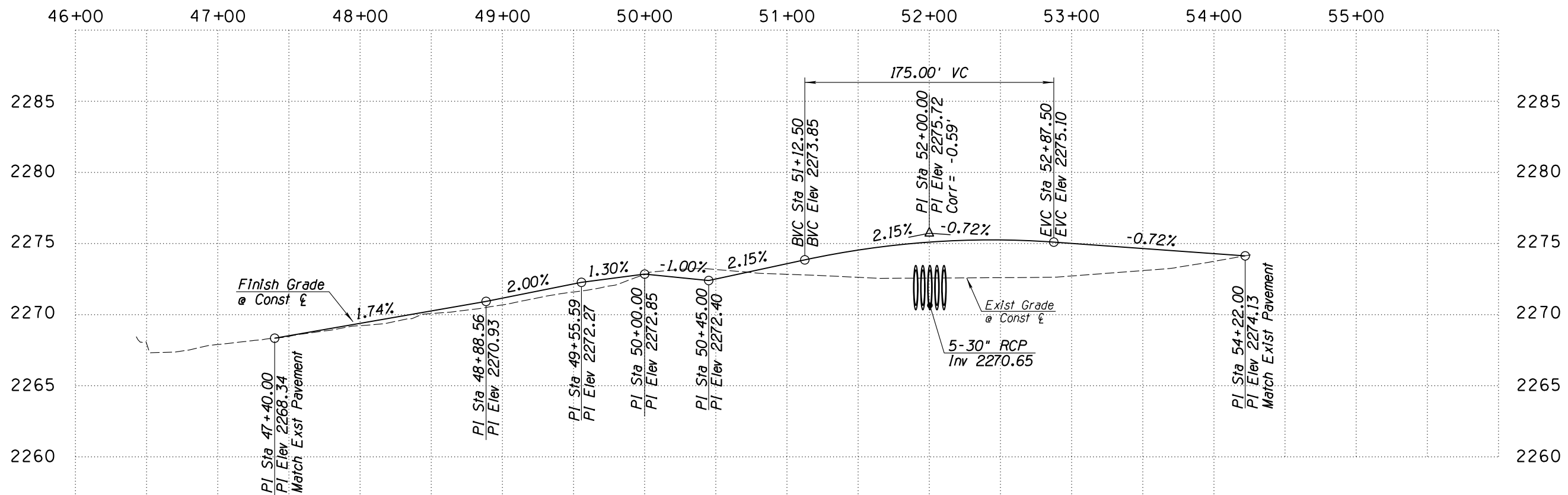
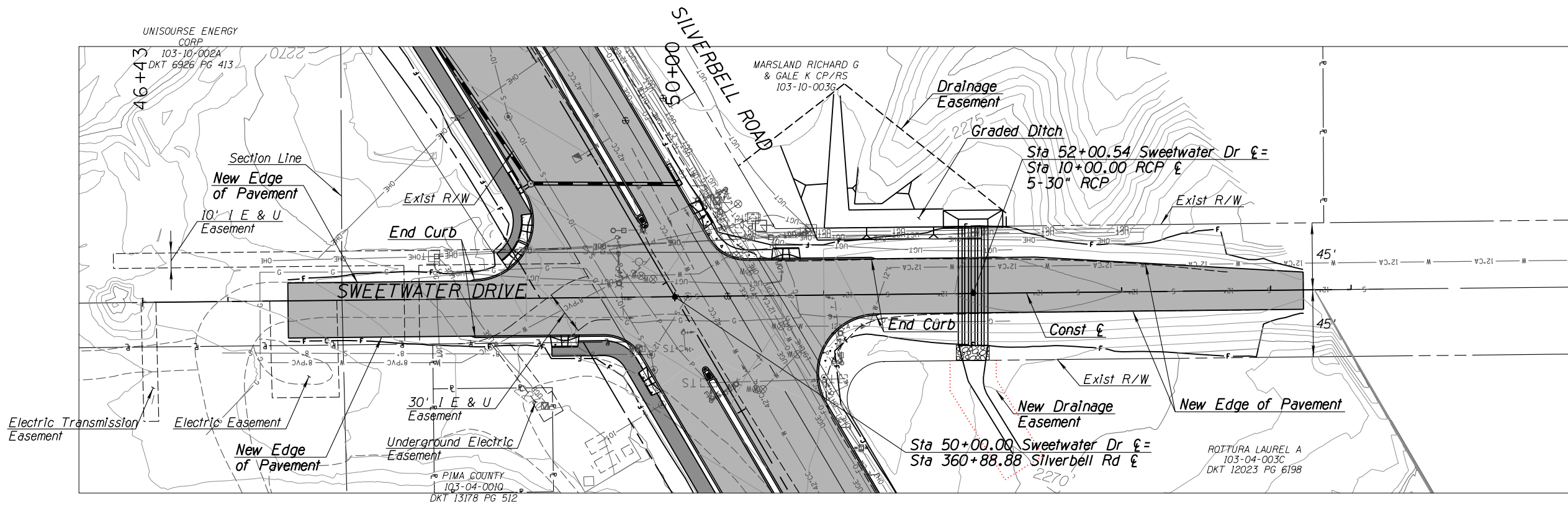


Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.
-----	------	----------	----	-------	-------

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

EL CAMINO DEL CERRO PLAN & PROFILE					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				PP24	73
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD				OF	OF
CITY OF TUCSON				PP36	138
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'	
DSGN. BY	MDA/YSM	9/10		1" = 4'	
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005	



For working days before you die
CALL FOR THE BLUE STICKS

1-800-782-5348

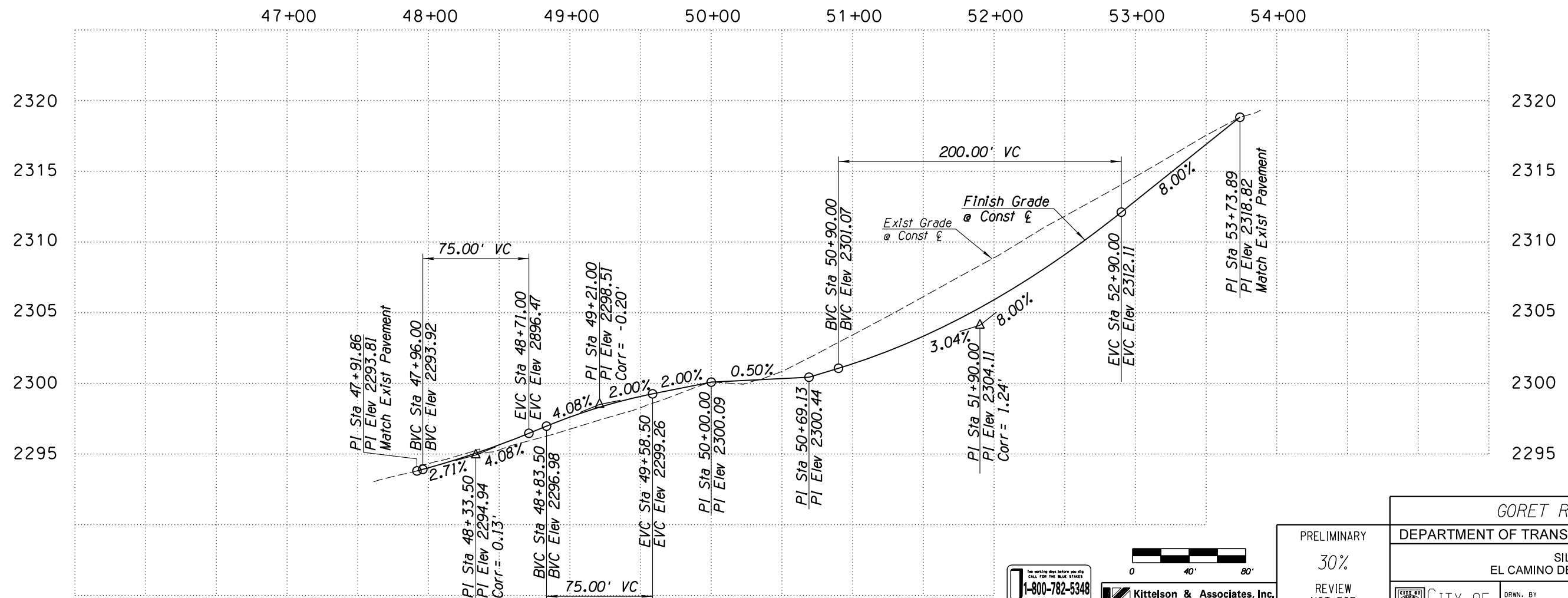
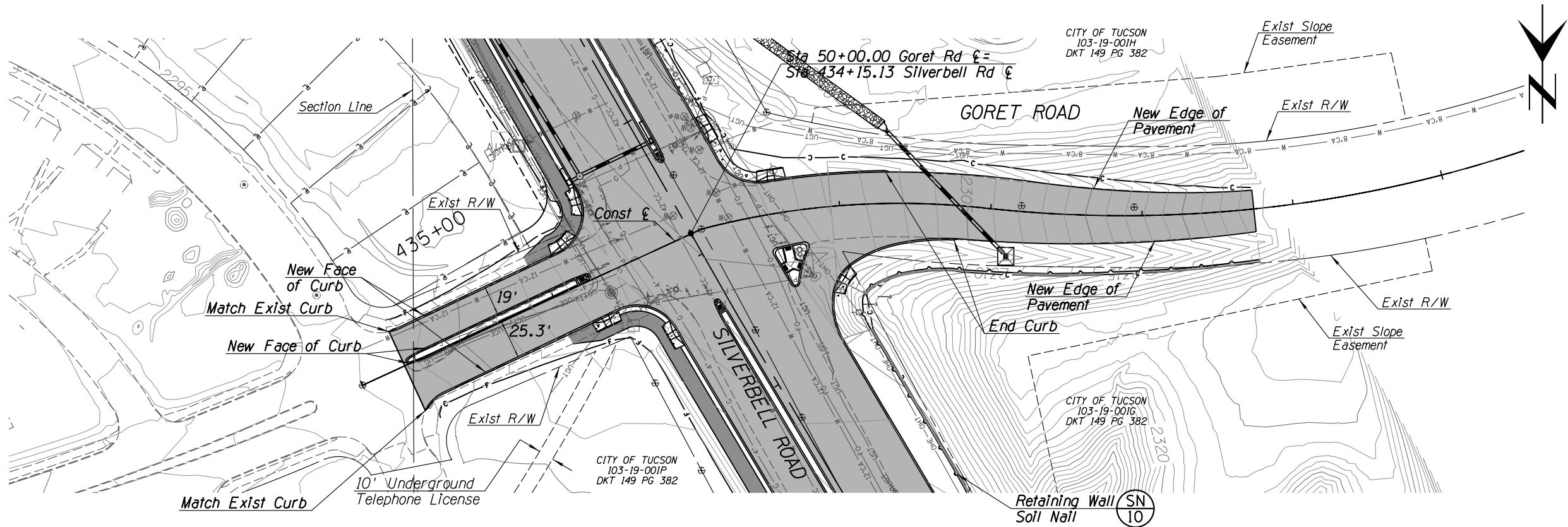
Blue Stick Center
CALL COLLECT

0 40' 80'

K Kittelson & Associates, Inc.

33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

<p style="margin: 0;">PRELIMINARY</p> <p style="margin: 0; font-size: 1.2em;">30%</p> <p style="margin: 0; font-size: 0.8em;">REVIEW NOT FOR CONSTRUCTION OR RECORDING</p>				<p style="margin: 0; font-size: 0.8em;">DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION</p> <p style="margin: 0; font-size: 0.8em;">SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD</p>		<p style="margin: 0; font-size: 0.8em;">74 OF 138</p>
<p style="margin: 0; font-size: 0.8em;">CITY OF TUCSON</p>		<p style="margin: 0; font-size: 0.8em;">DRWN. BY LAS/TMR 9/10</p> <p style="margin: 0; font-size: 0.8em;">DSGN. BY MDA/YSM 9/10</p> <p style="margin: 0; font-size: 0.8em;">CHKD. BY JAS 9/10</p>	<p style="margin: 0; font-size: 0.8em;">REF. _____</p> <p style="margin: 0; font-size: 0.8em;">SCALE: 1" = 40'</p> <p style="margin: 0; font-size: 0.8em;">1" = 4'</p>	<p style="margin: 0; font-size: 0.8em;">PLAN NO. I-2010-005</p>		



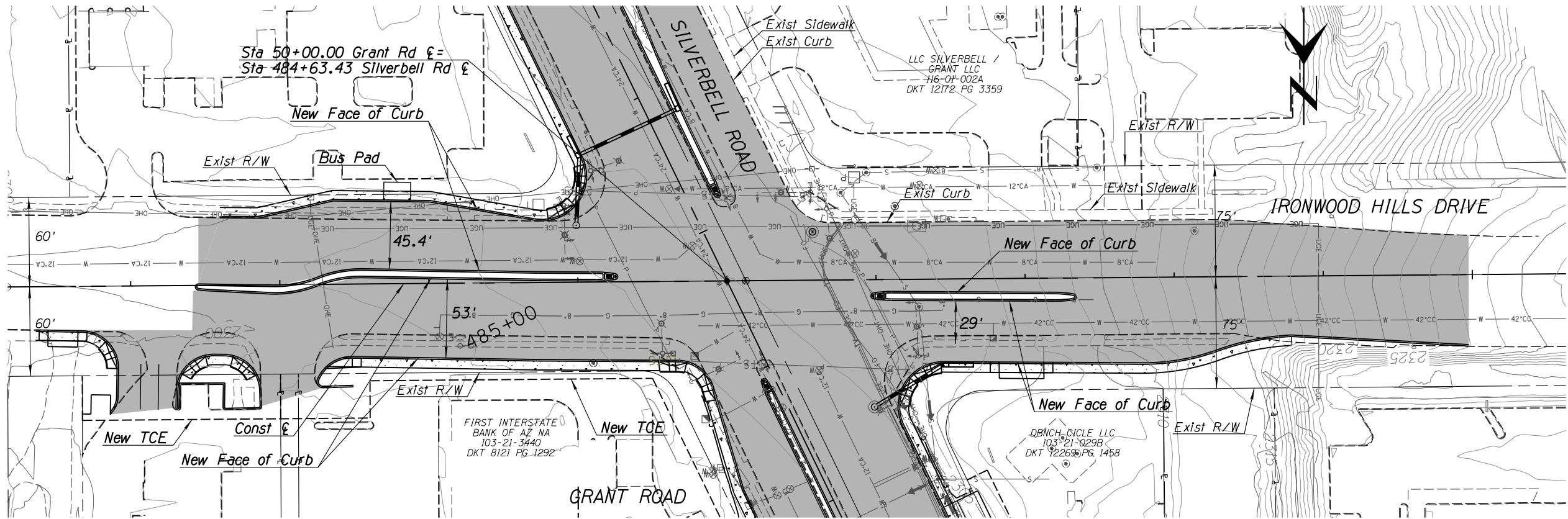
Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

1-800-782-5348
Blue Stone Center
CALL COLLECT

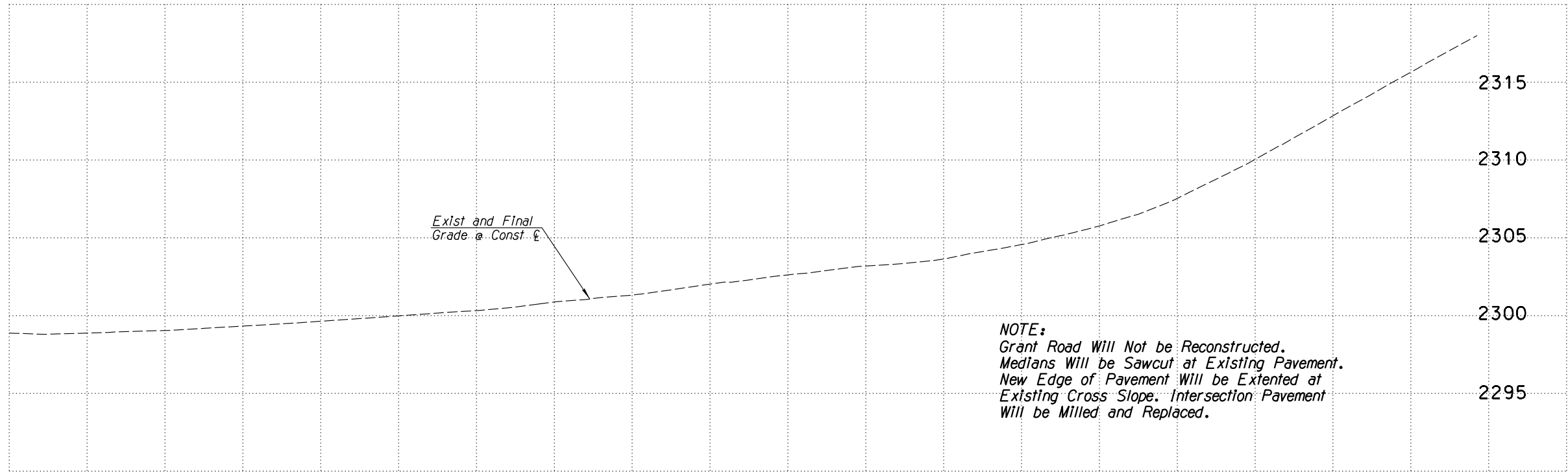
0 40' 80'

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

GORET RD PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			75 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP26 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005



45+00 46+00 47+00 48+00 49+00 50+00 51+00 52+00 53+00 54+00



NOTE:
Grant Road Will Not be Reconstructed.
Medians Will be Sawcut at Existing Pavement.
New Edge of Pavement Will be Extended at
Existing Cross Slope. Intersection Pavement
Will be Milled and Replaced.



Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067



PRELIMINARY

30%

REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

NO.	DATE	REVISION	BY	CHKD.	APPR.

GRANT RD/IRONWOOD HILL DR PLAN & PROFILE

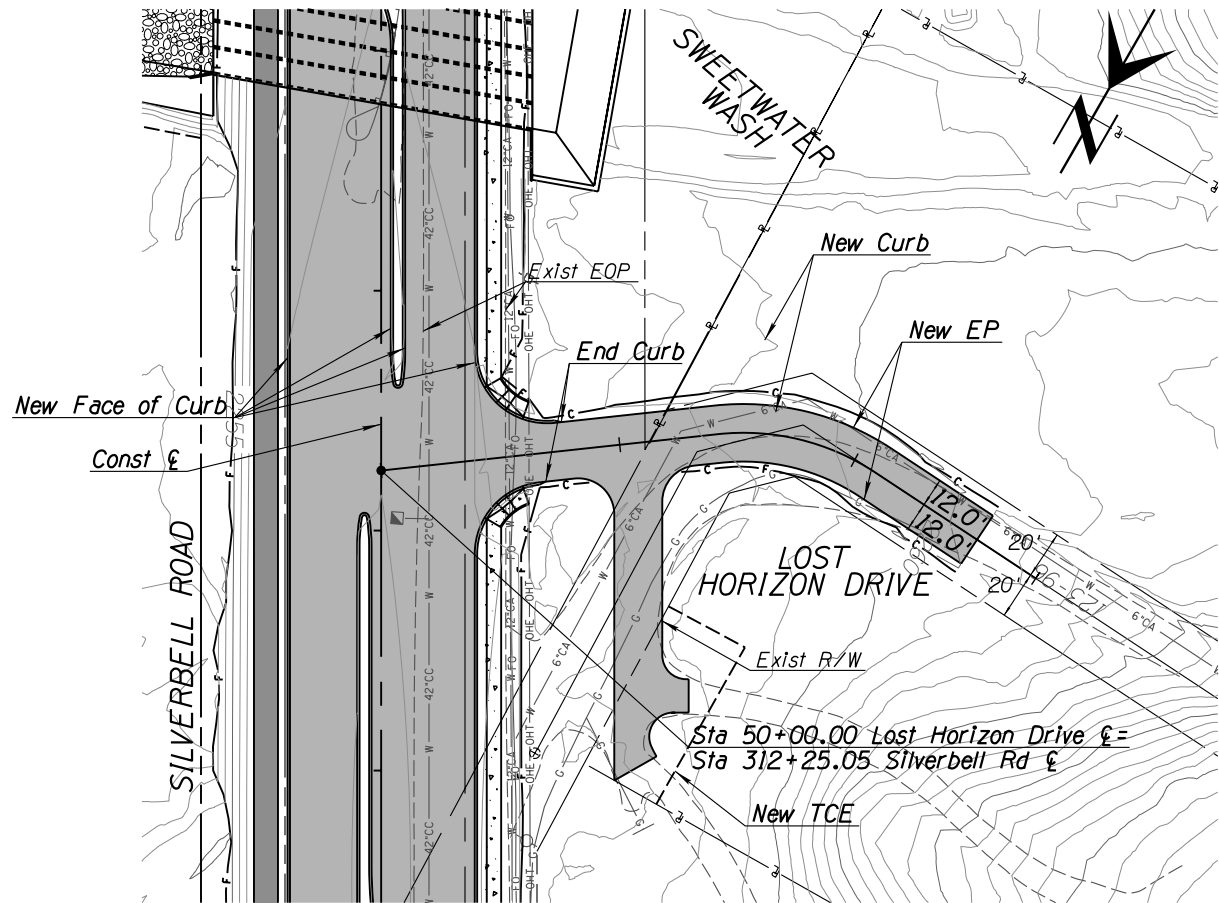
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD

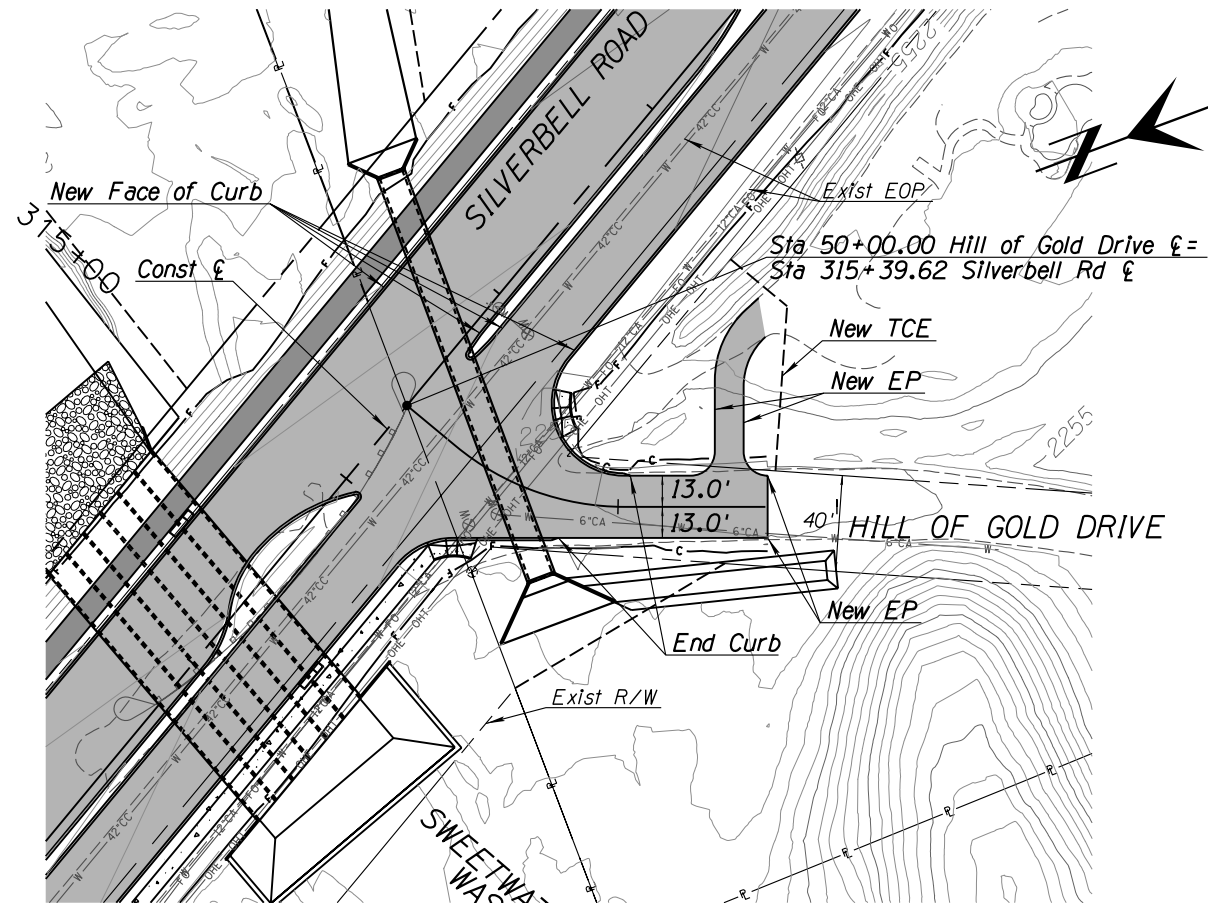


DRWN. BY	LAS/TMR	9/10
DSGN. BY	MDA/YSM	9/10
CHKD. BY	JAS	9/10

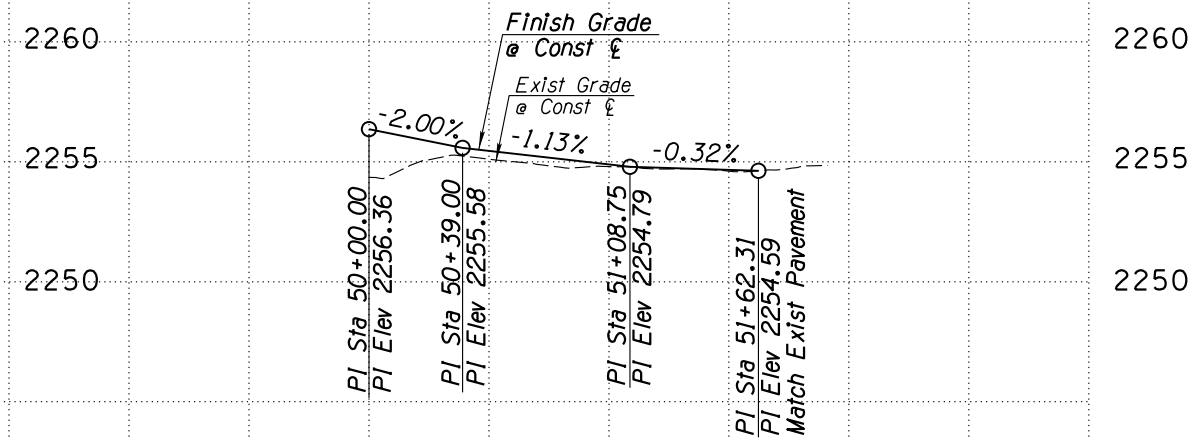
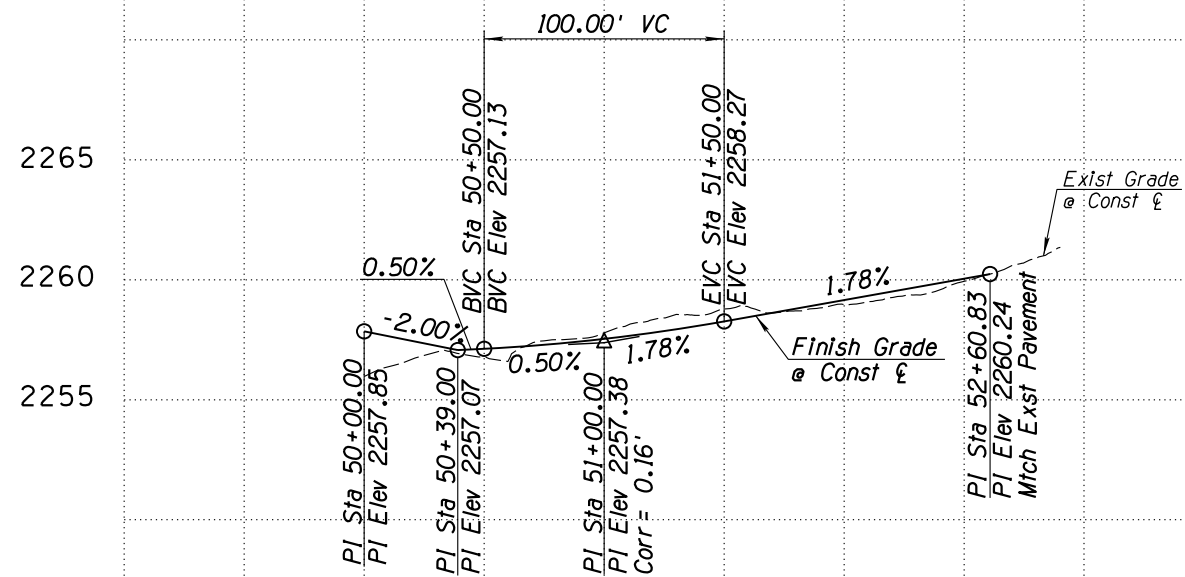
REF.	SCALE: 1" = 40'	76 OF 138
PLAN NO.	I-2010-005	PP27 OF PP36



50+00 51+00 52+00 53+00



50+00 51+00 52+00

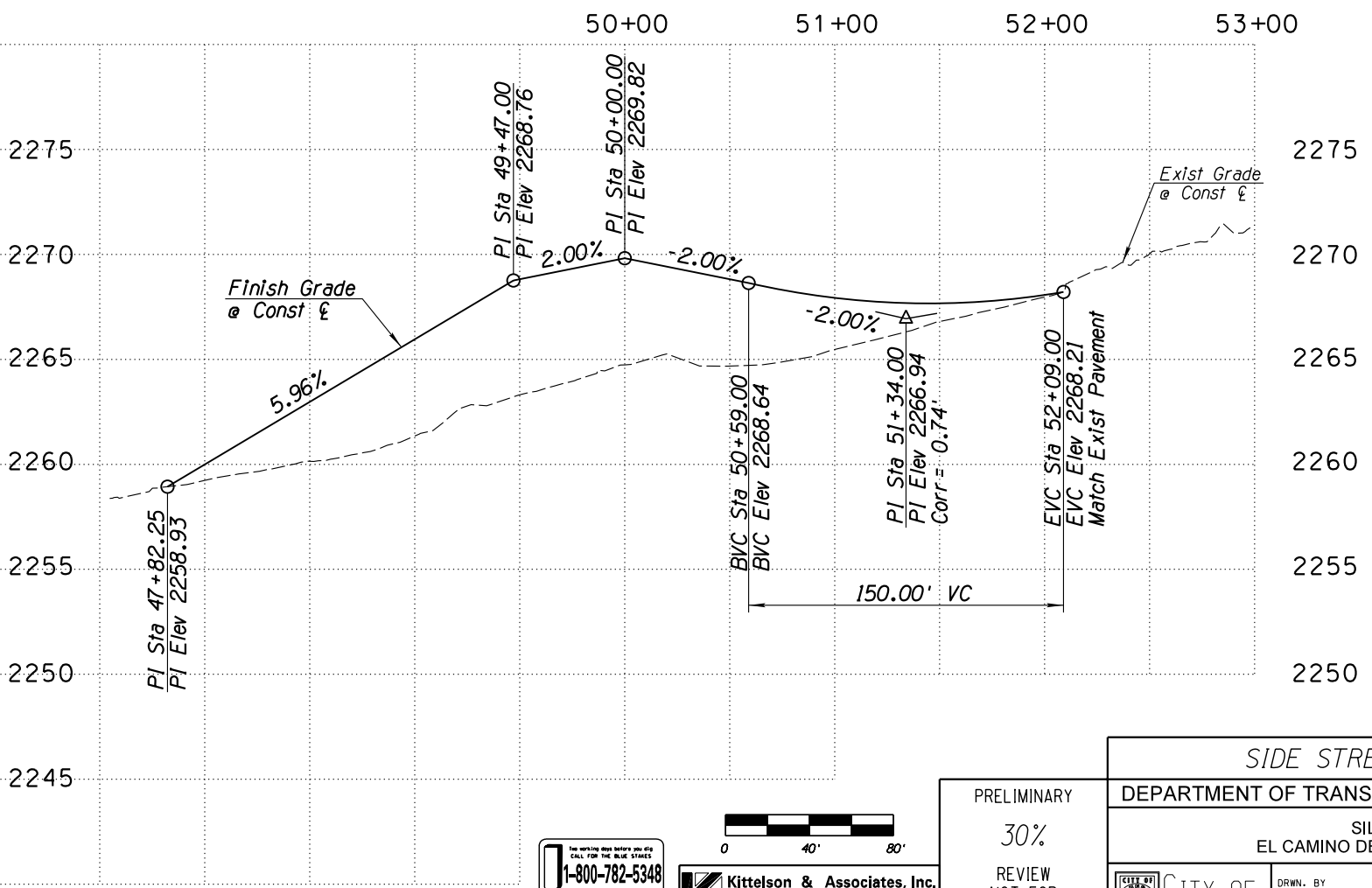
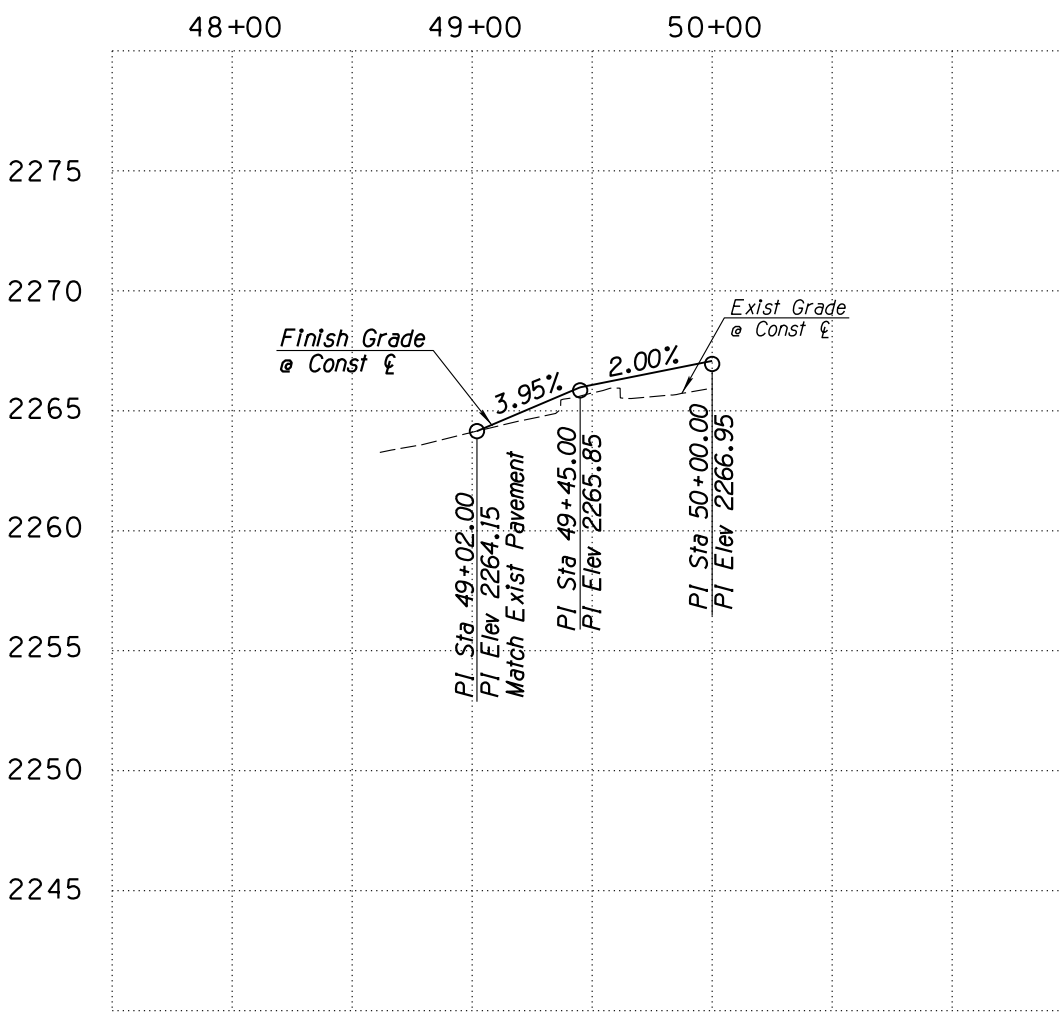
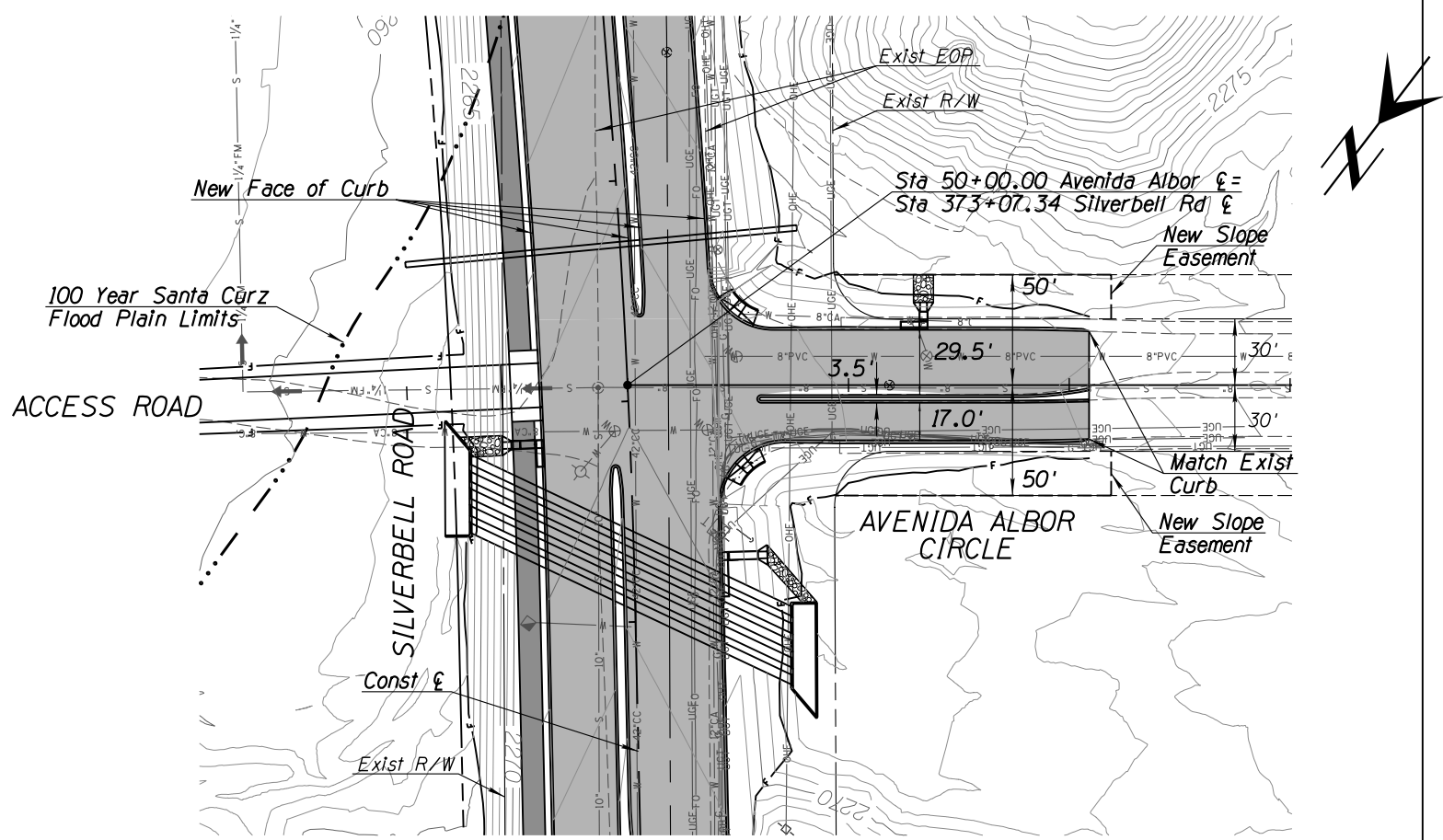
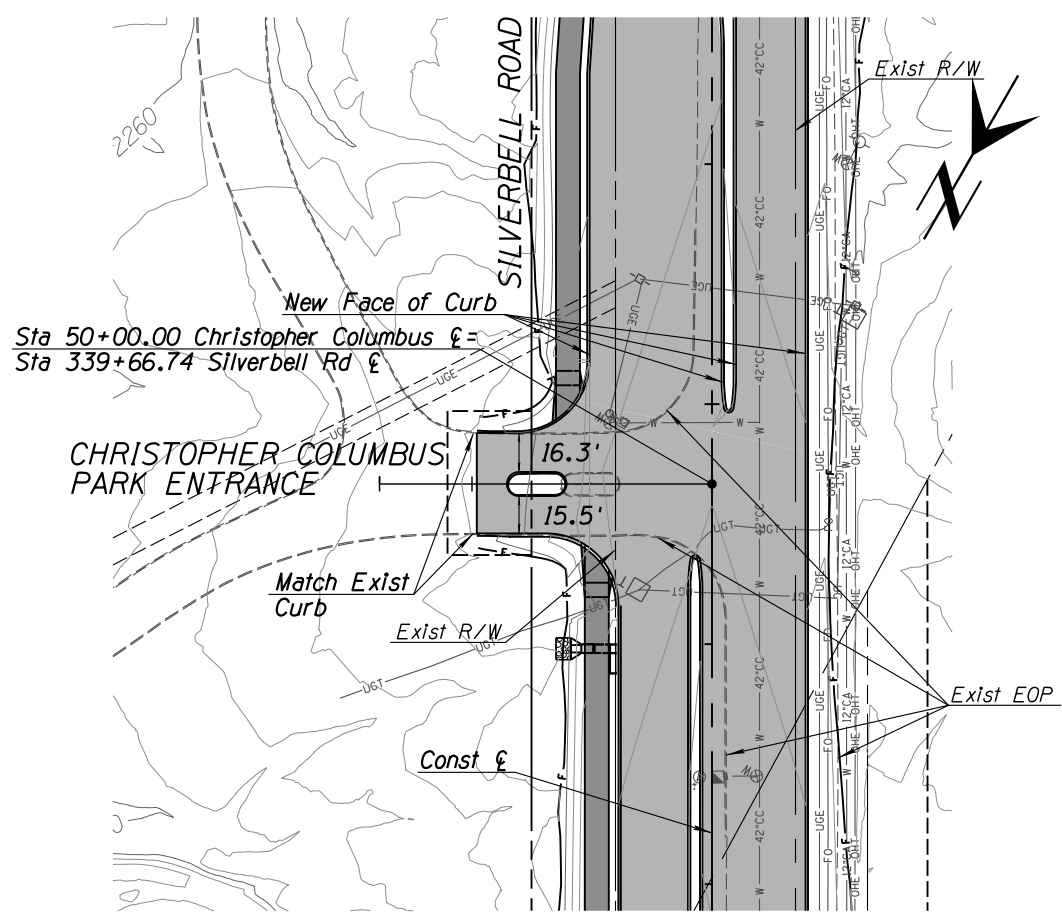


Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.

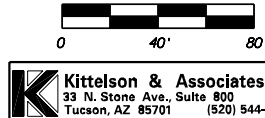
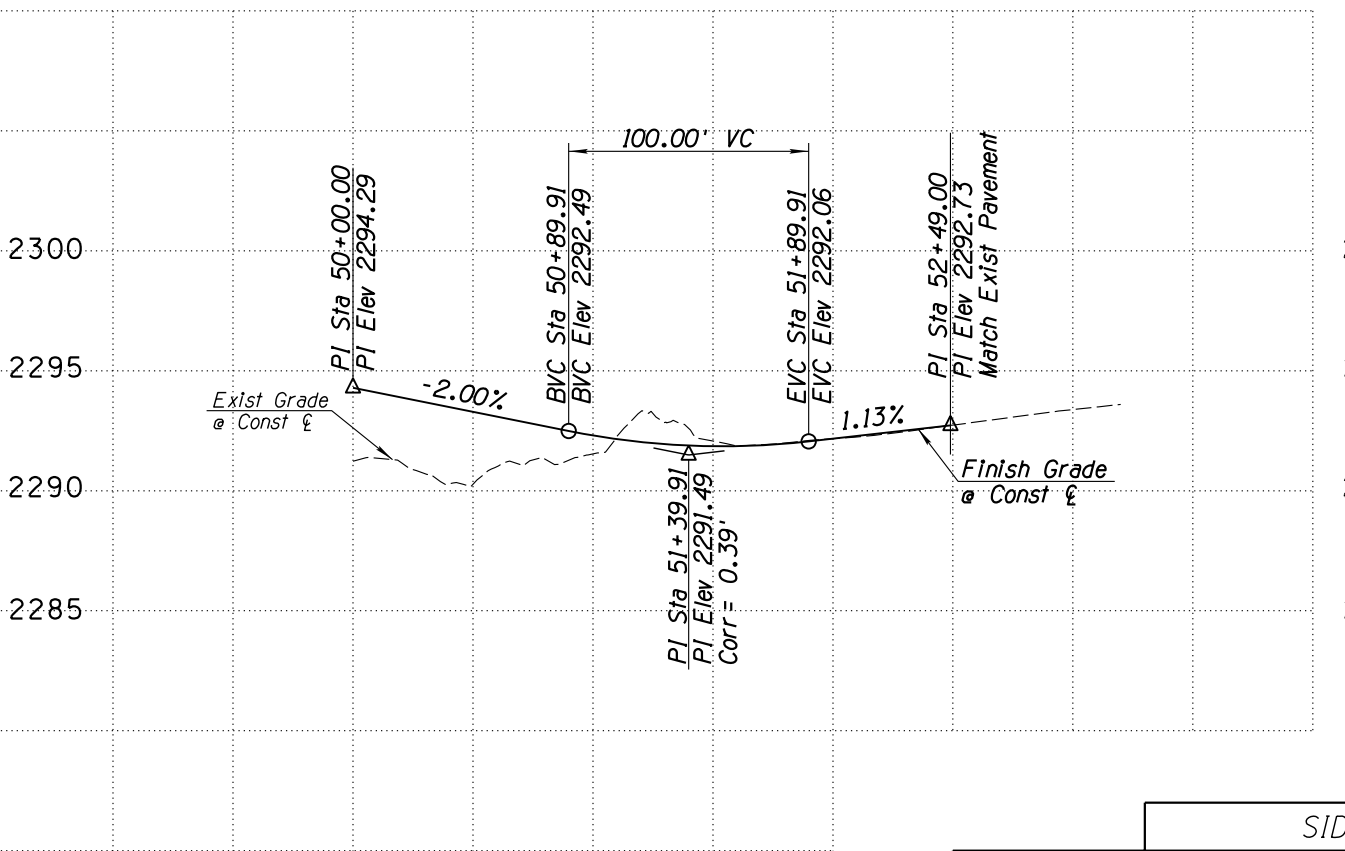
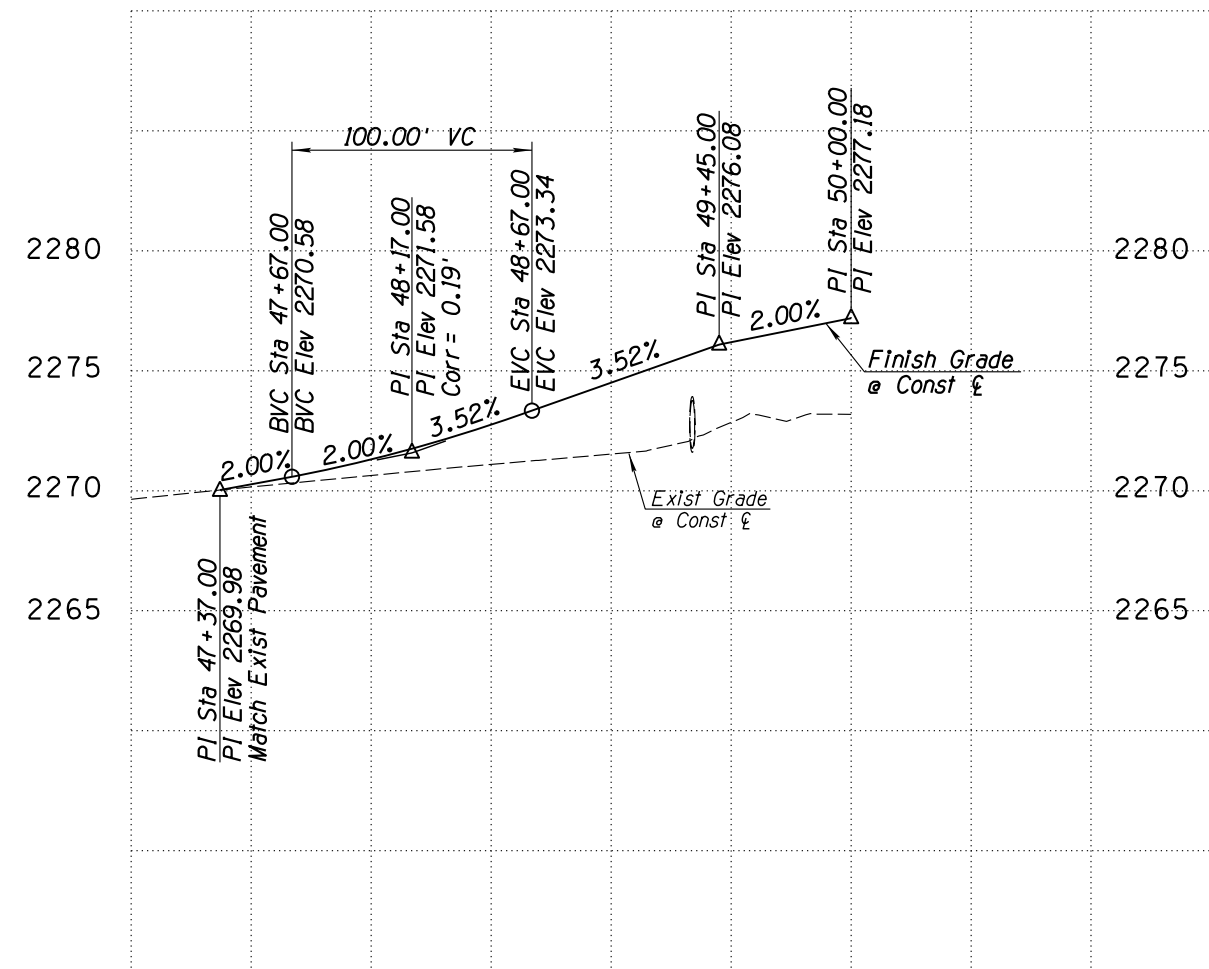
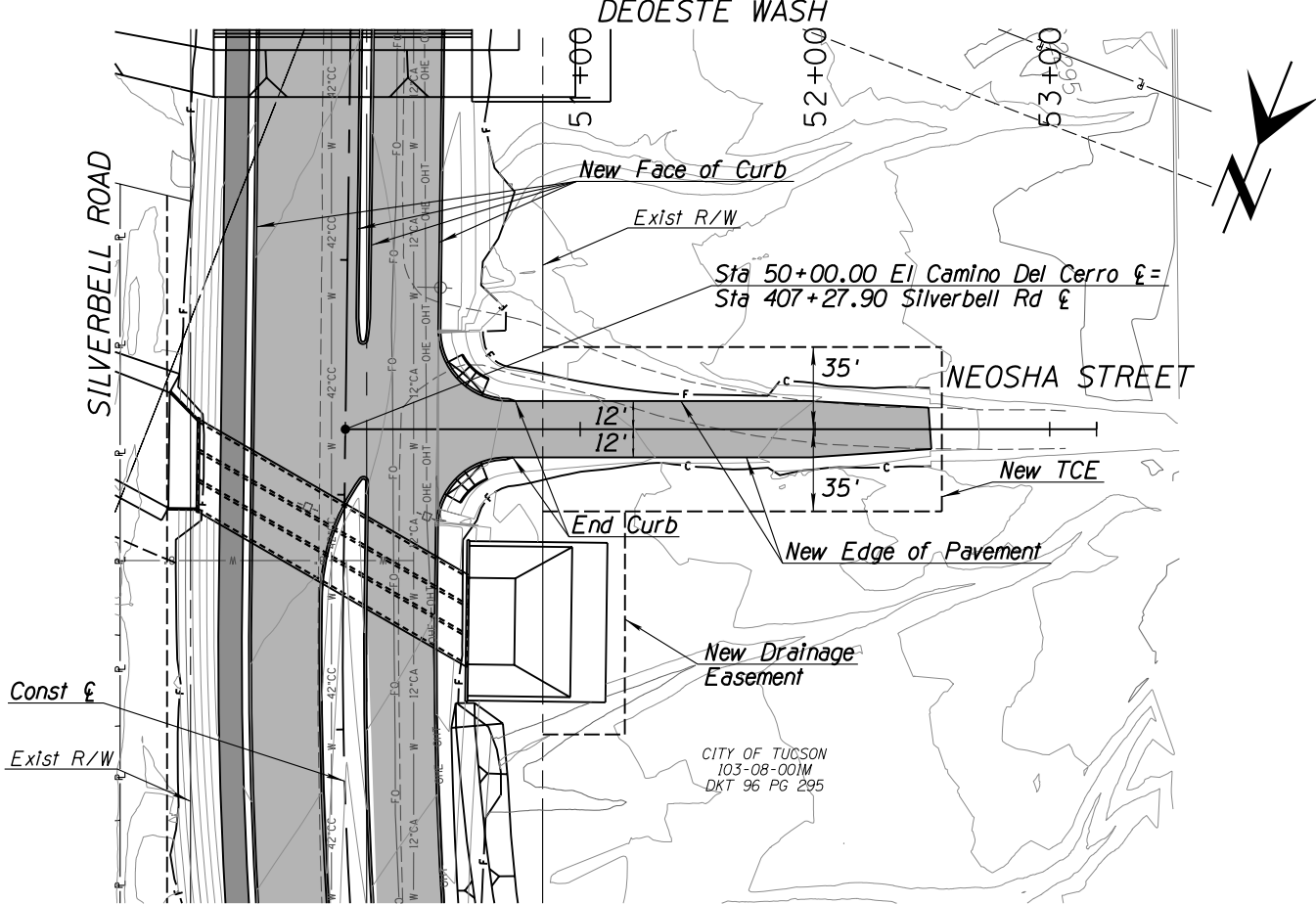
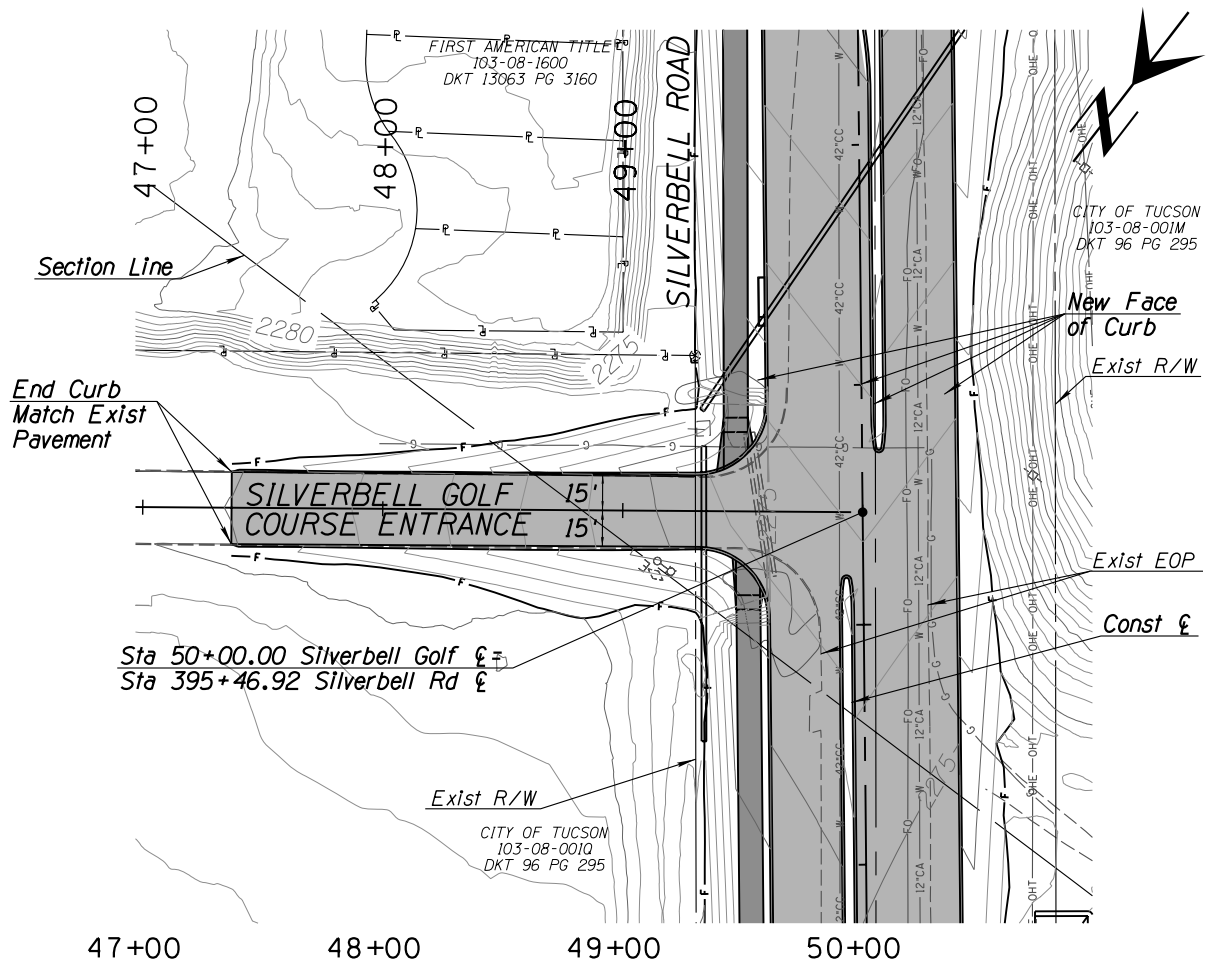
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

SIDE STREET PLAN & PROFILE					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				77	OF
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD				PP28	OF
CITY OF TUCSON				PP36	138
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'	
DSGN. BY	MDA/YSM	9/10		1" = 4'	
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005	



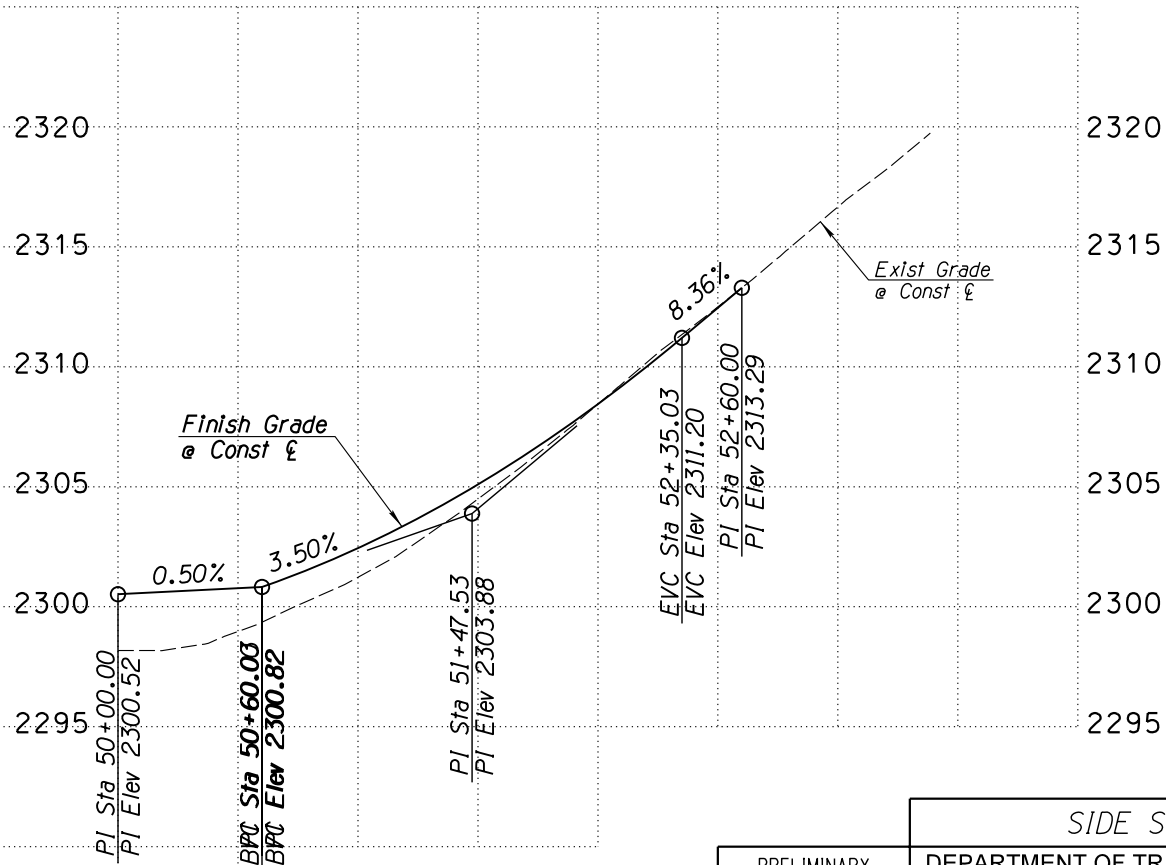
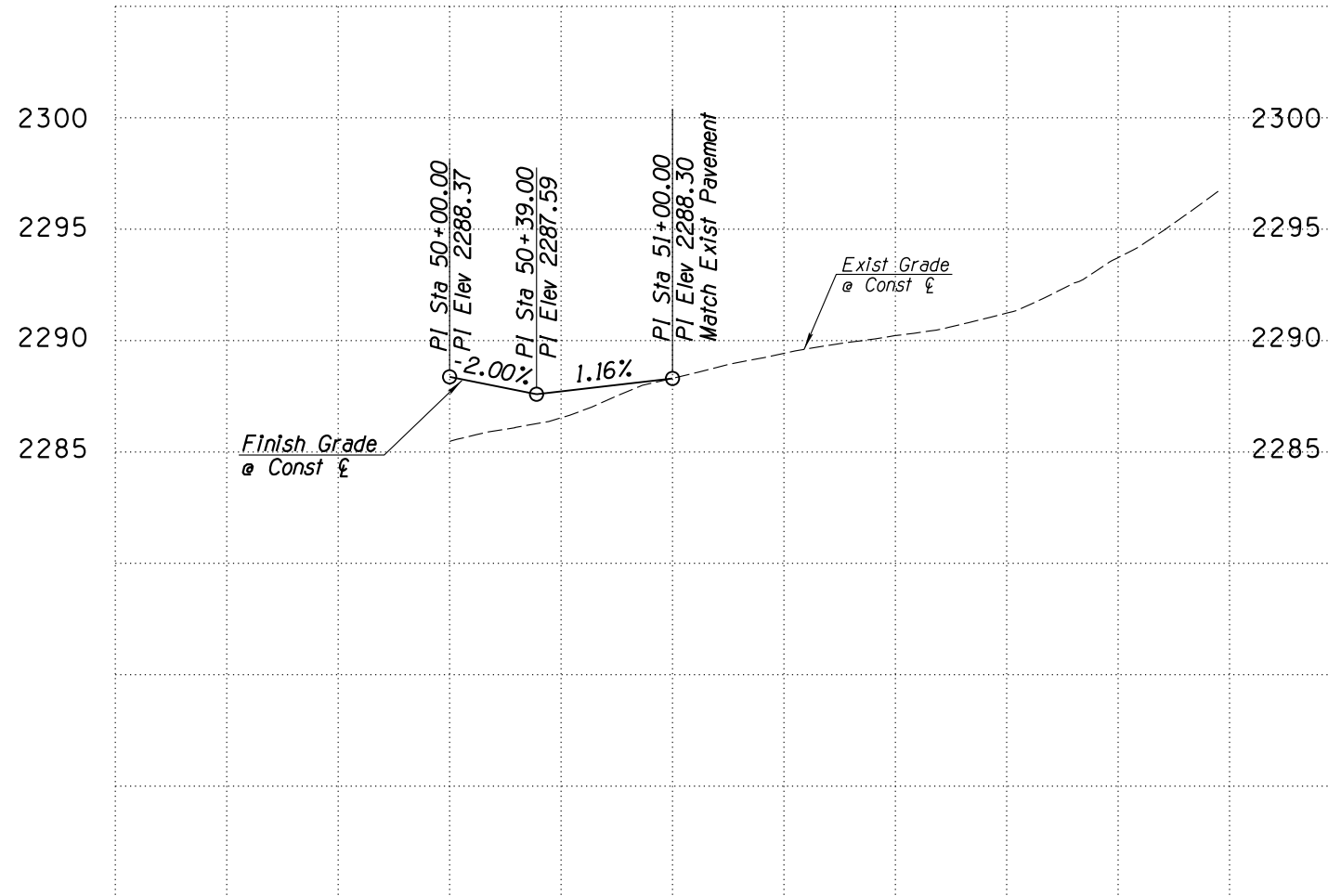
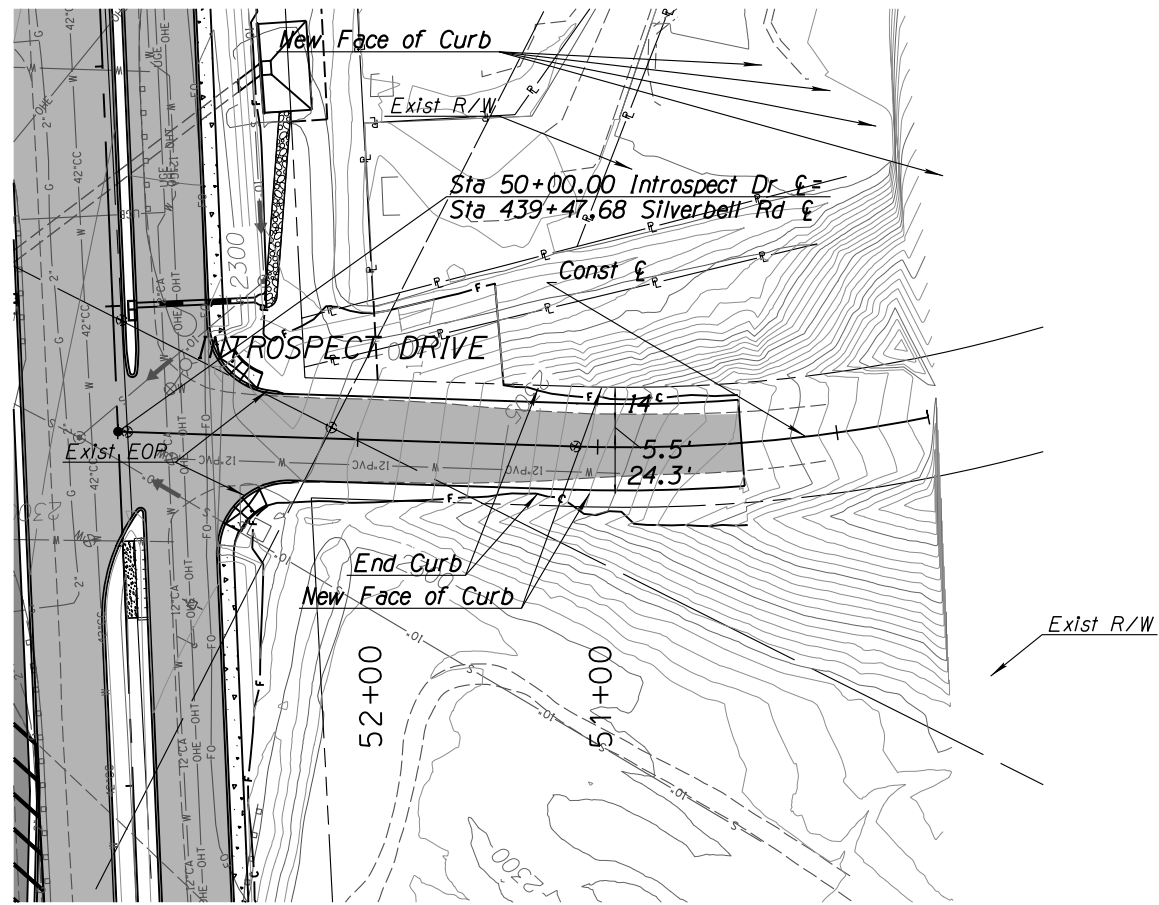
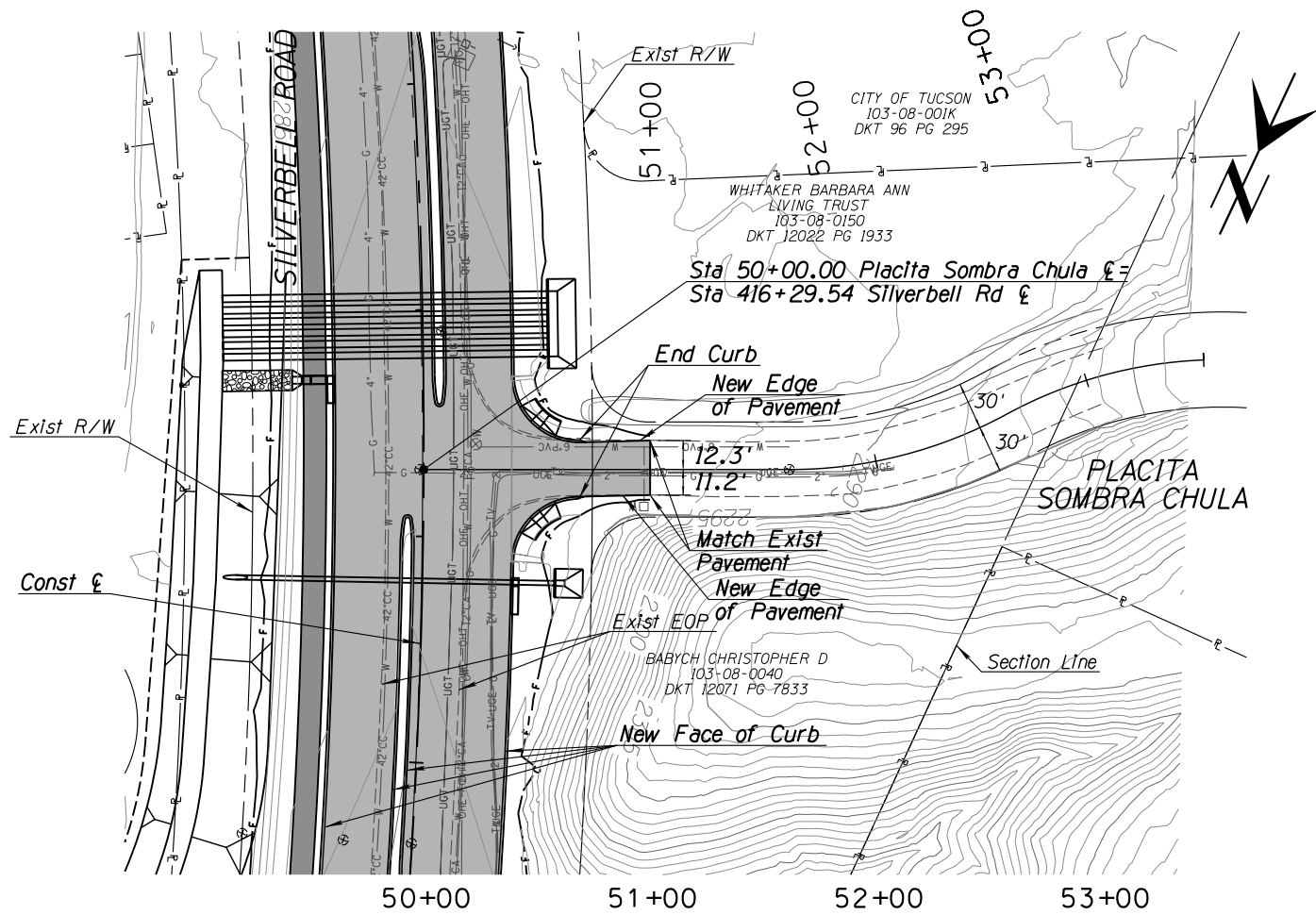
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

SIDE STREET PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			78 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP29 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005



PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

SIDE STREET PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			79
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP30 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005



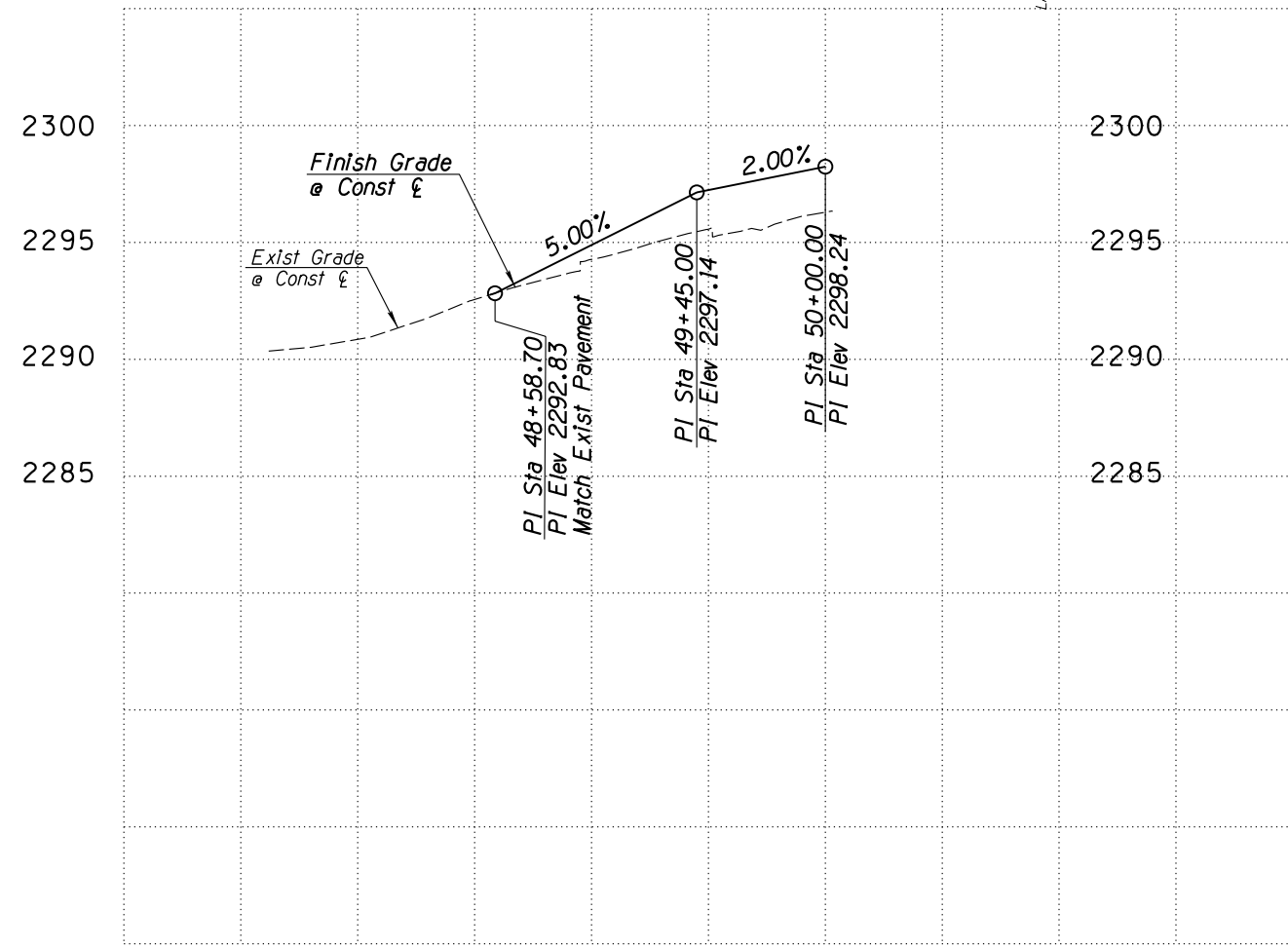
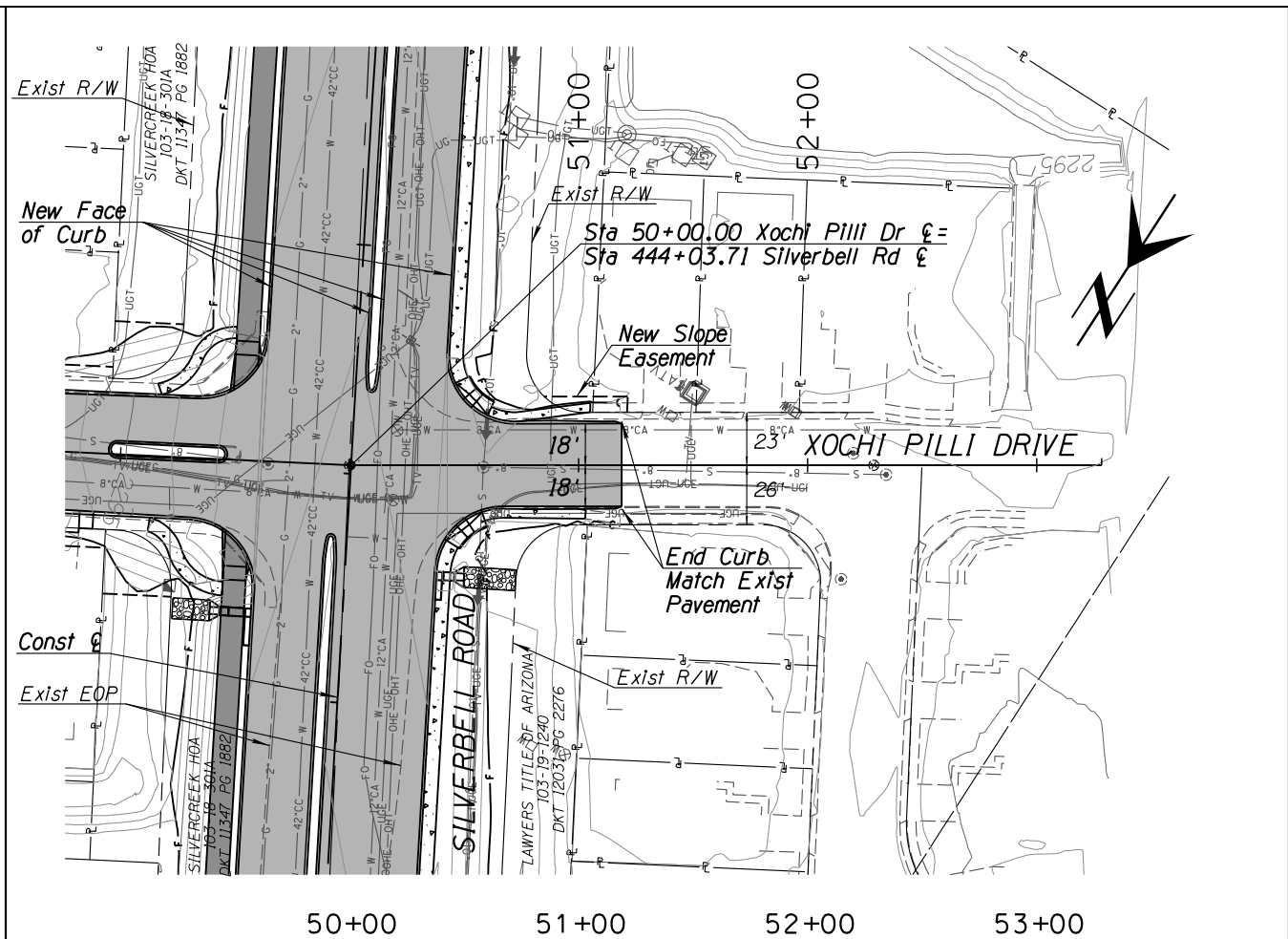
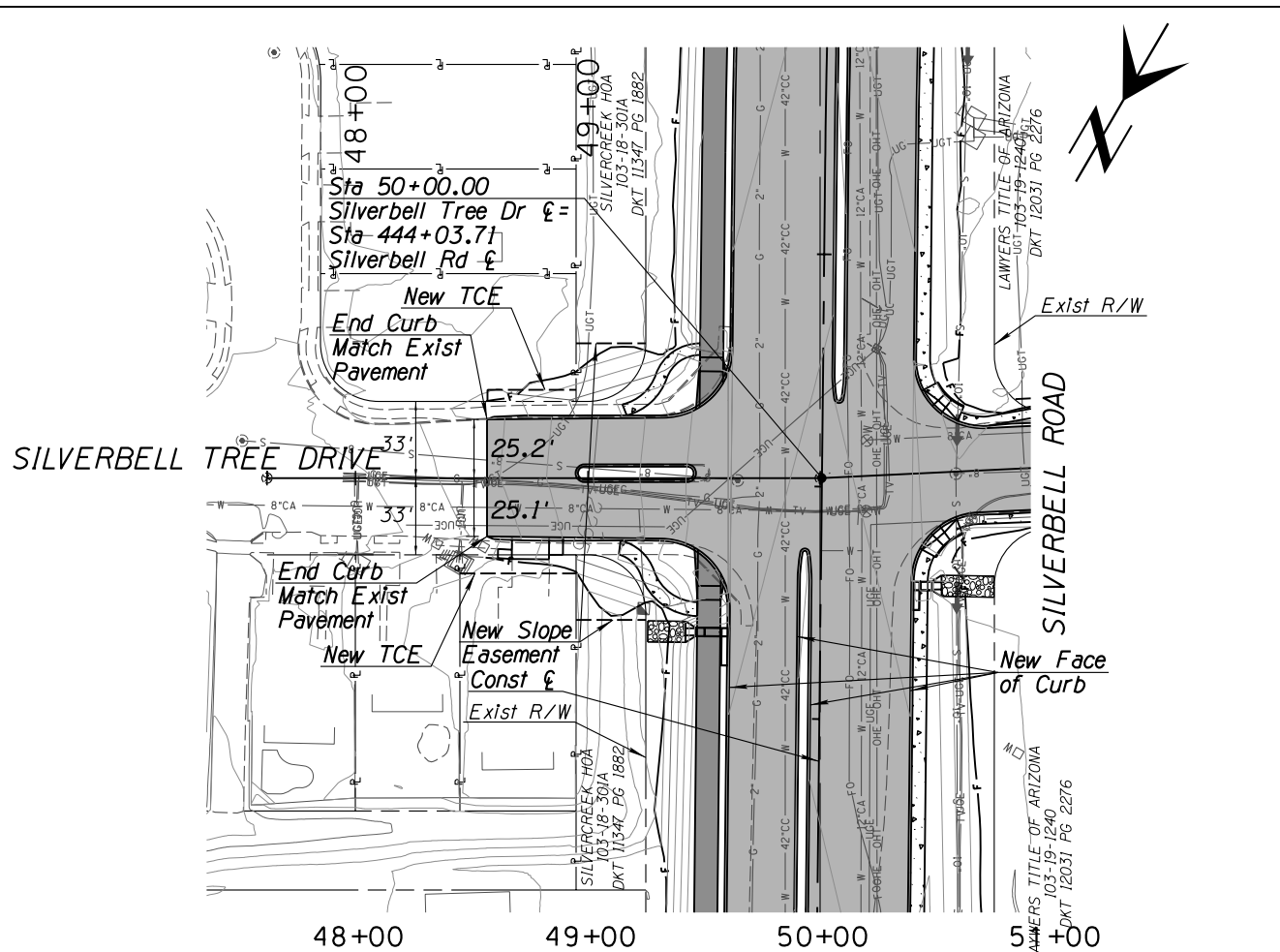
Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

SIDE STREET PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			80 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP31 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	1" = 4'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005





Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

SIDE STREET PLAN & PROFILE
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION
SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD

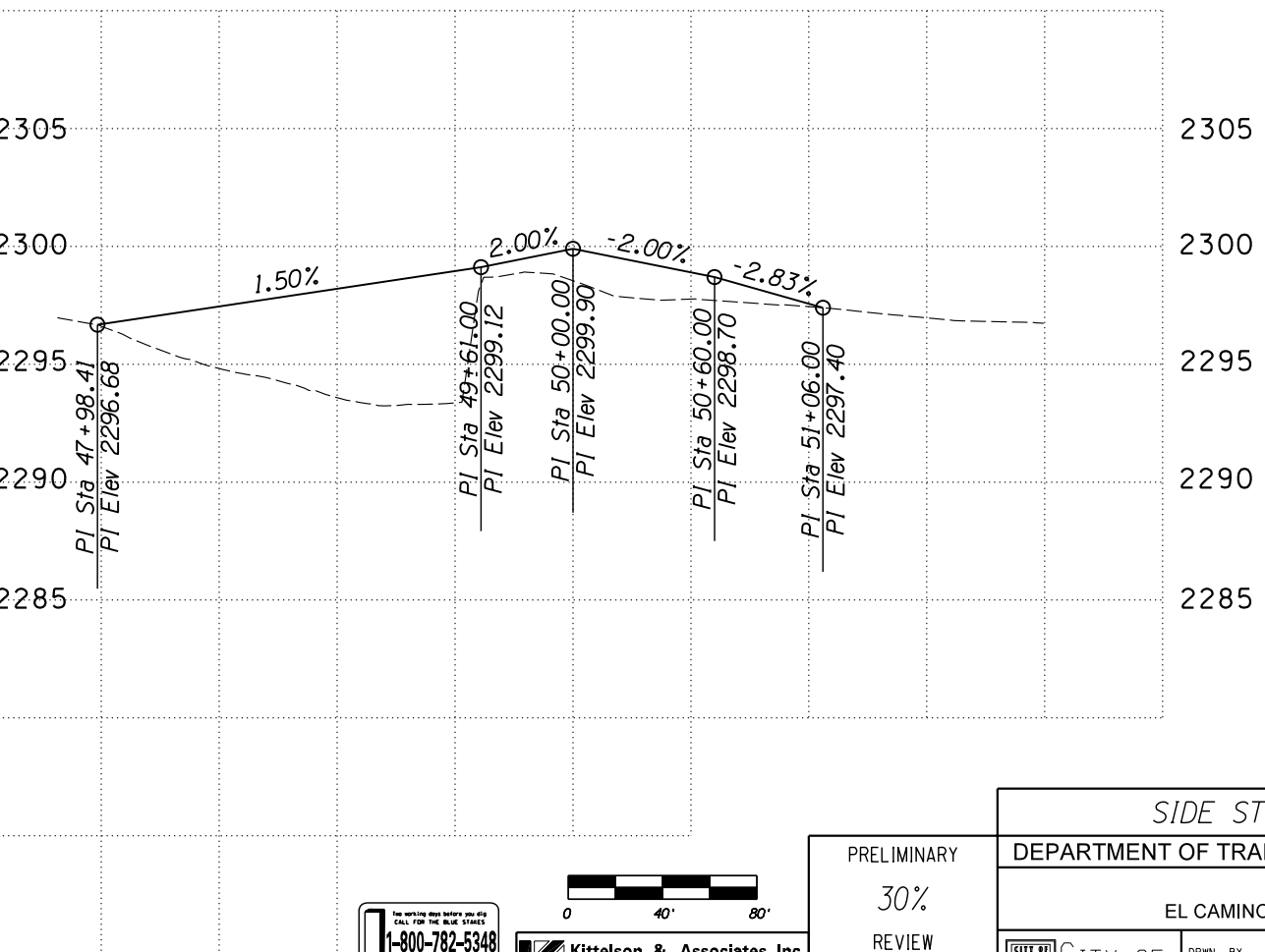
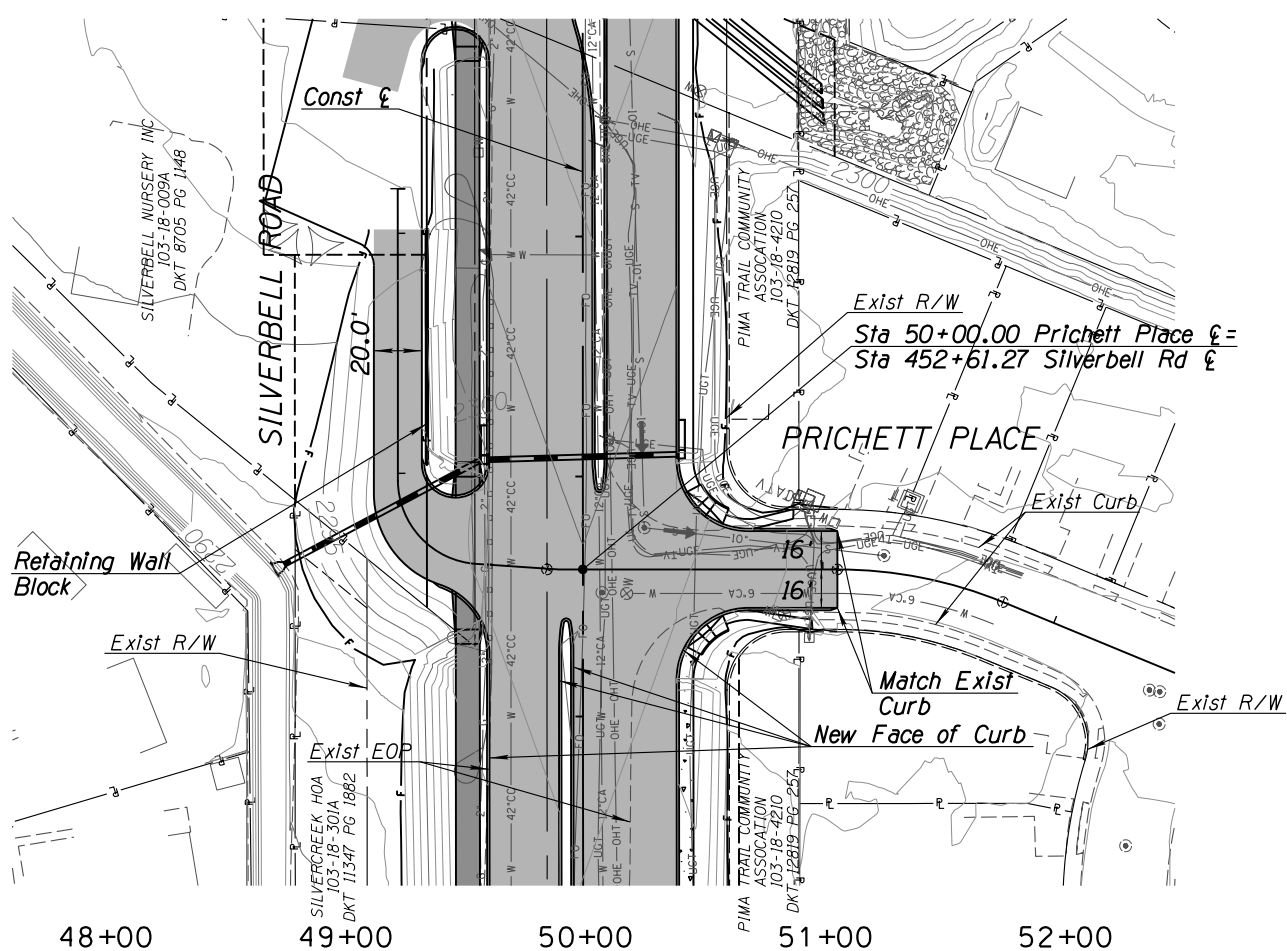
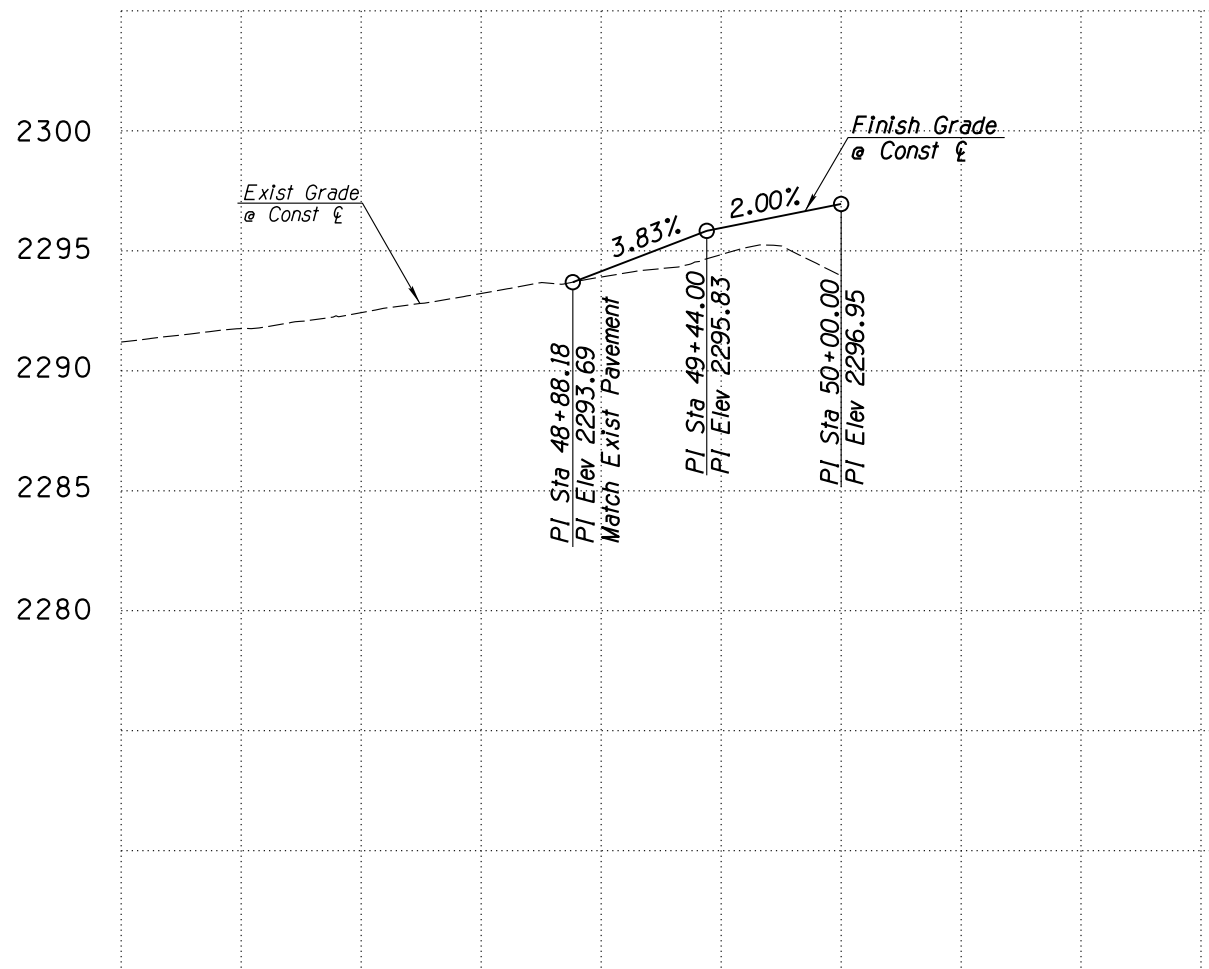
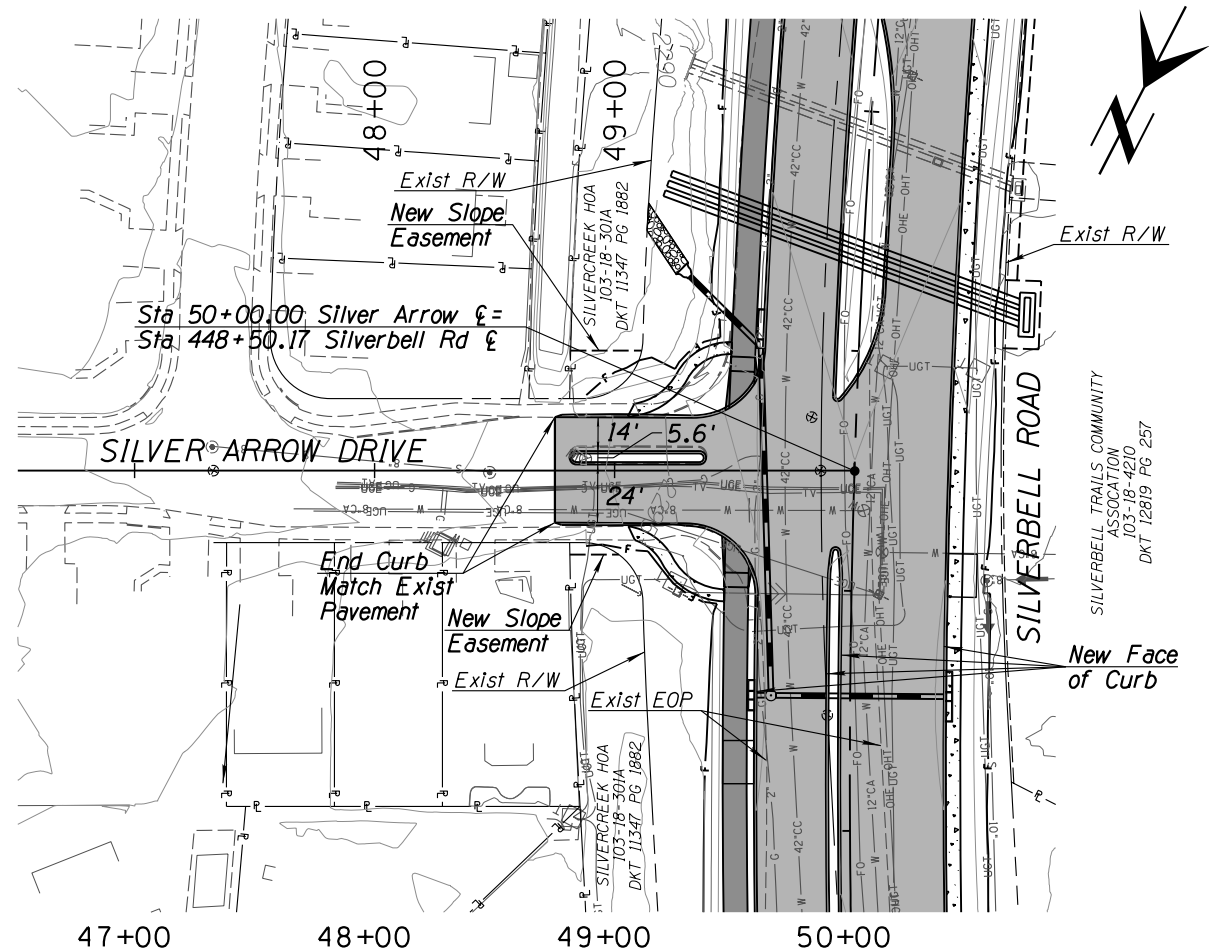
81
OF
138

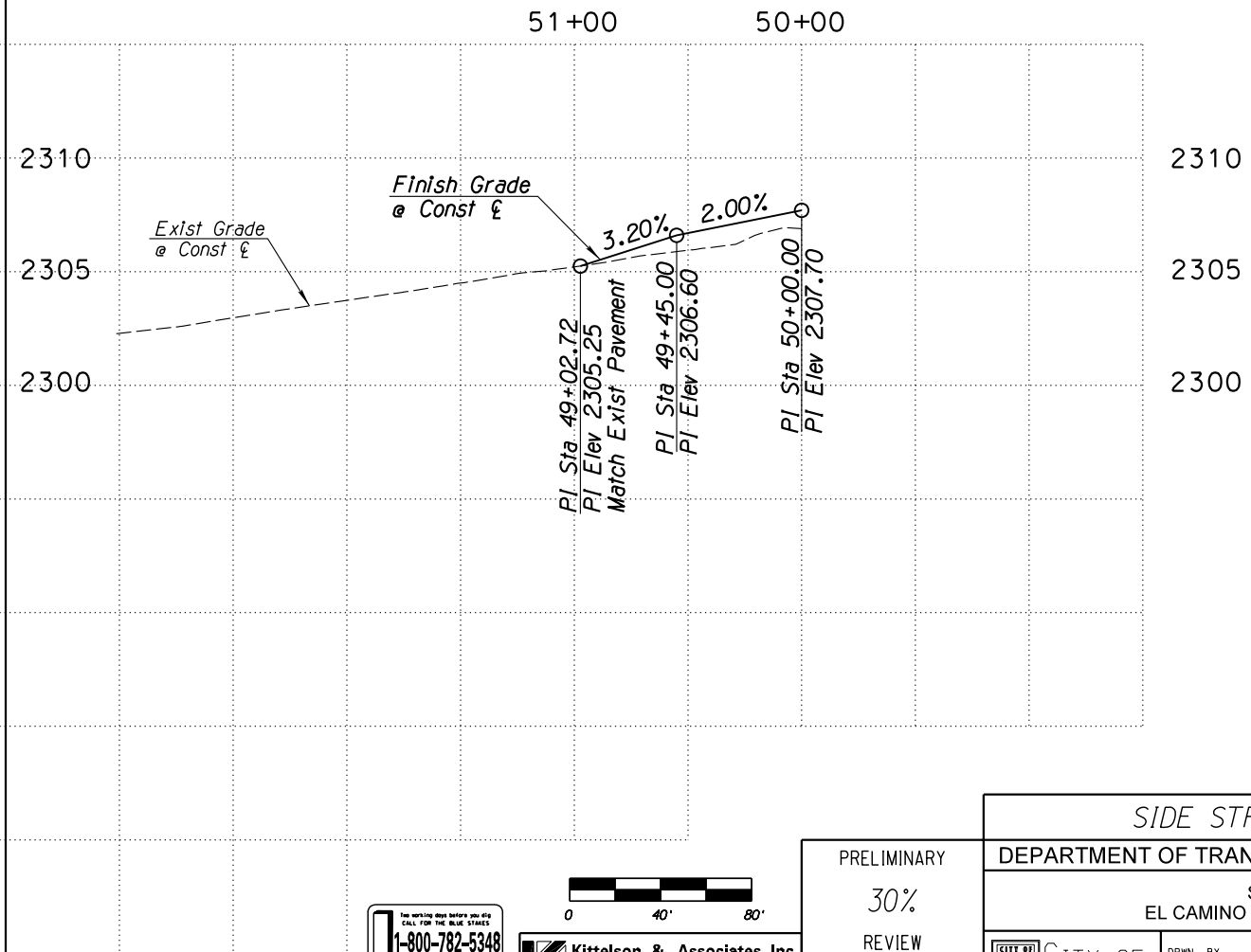
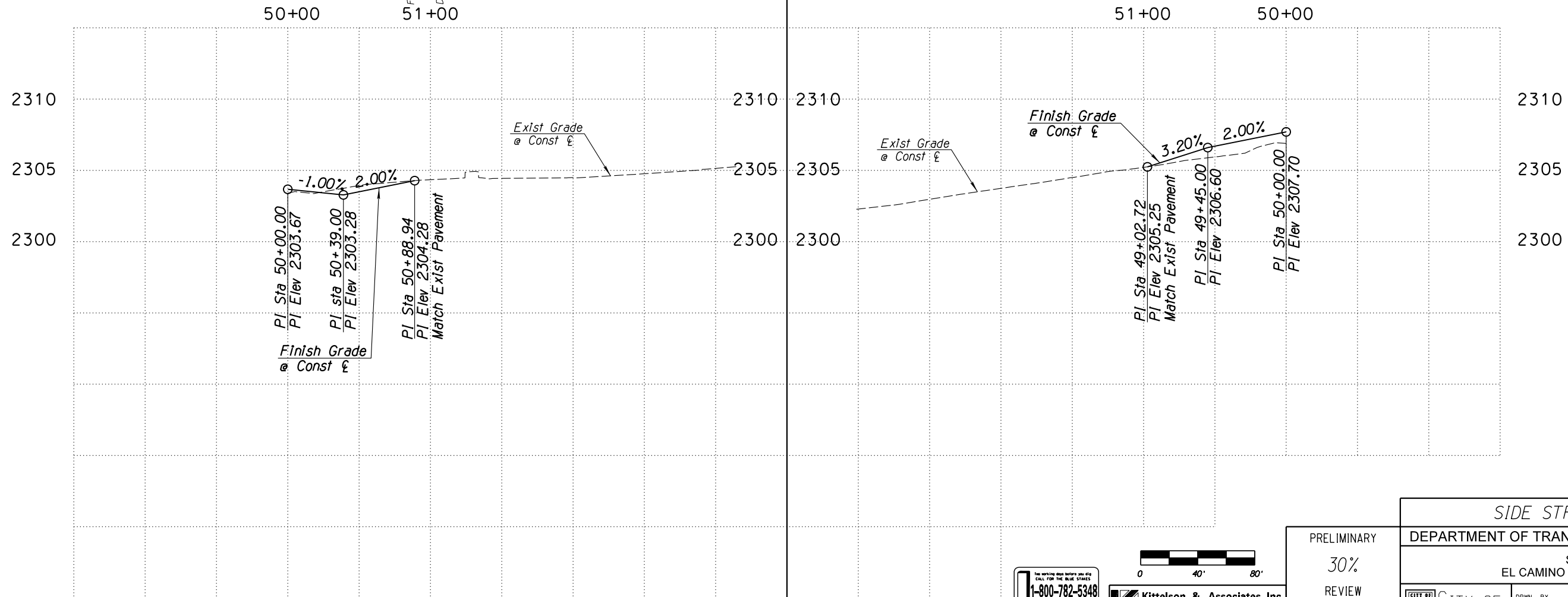
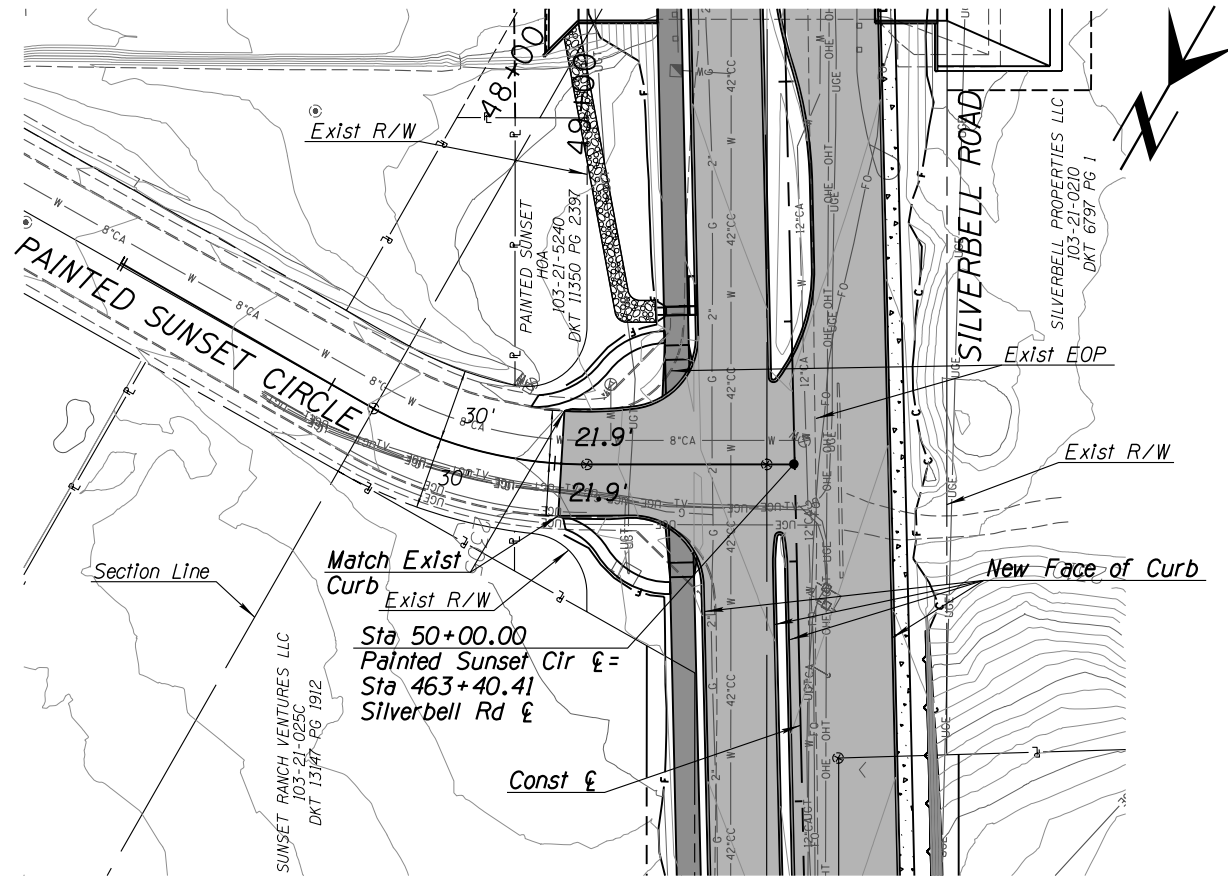
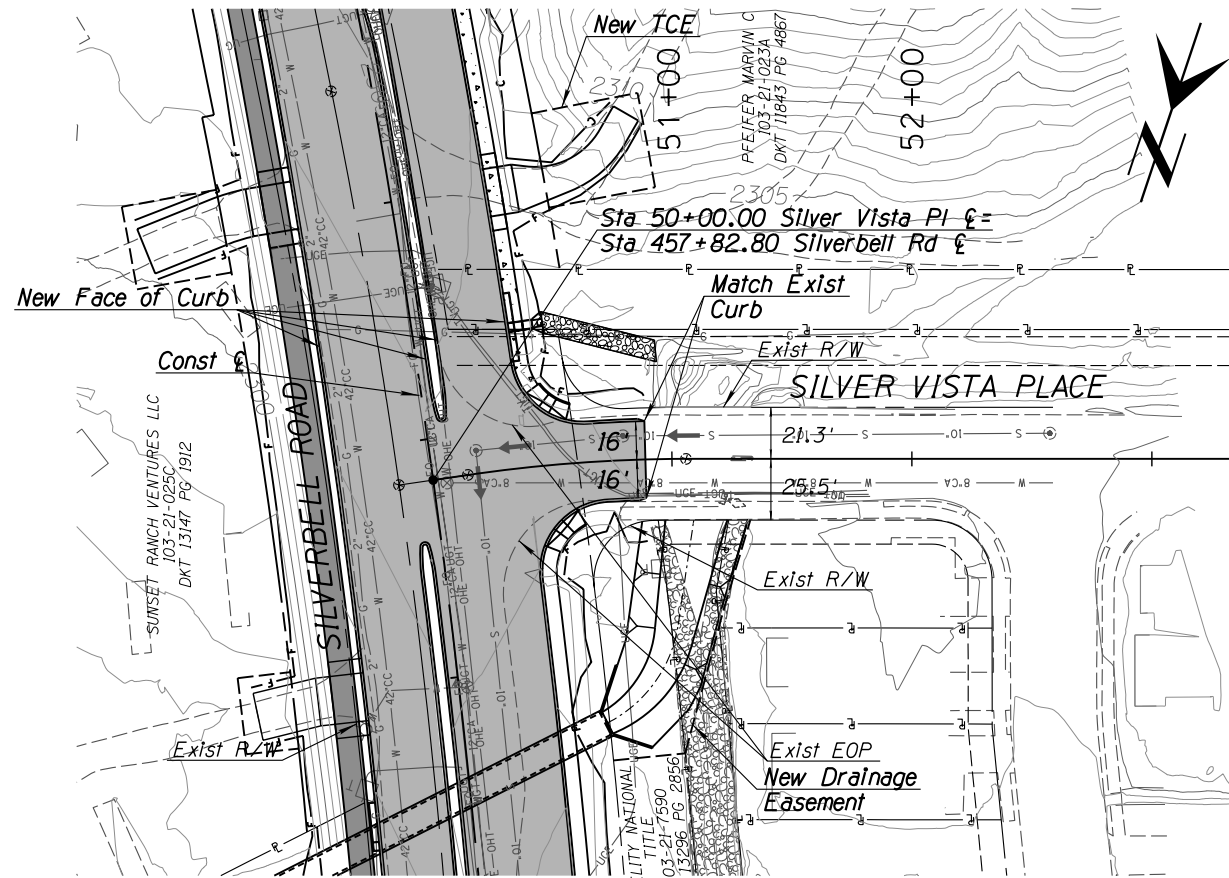
PP32
OF
PP36

DRWN. BY	LAS/TMR	9/10	REF. _____ SCALE: 1" = 40' 1" = 4'
DSGN. BY	MDA/YSM	9/10	
CHKD. BY	JAS	9/10	

CITY OF TUCSON

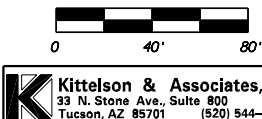
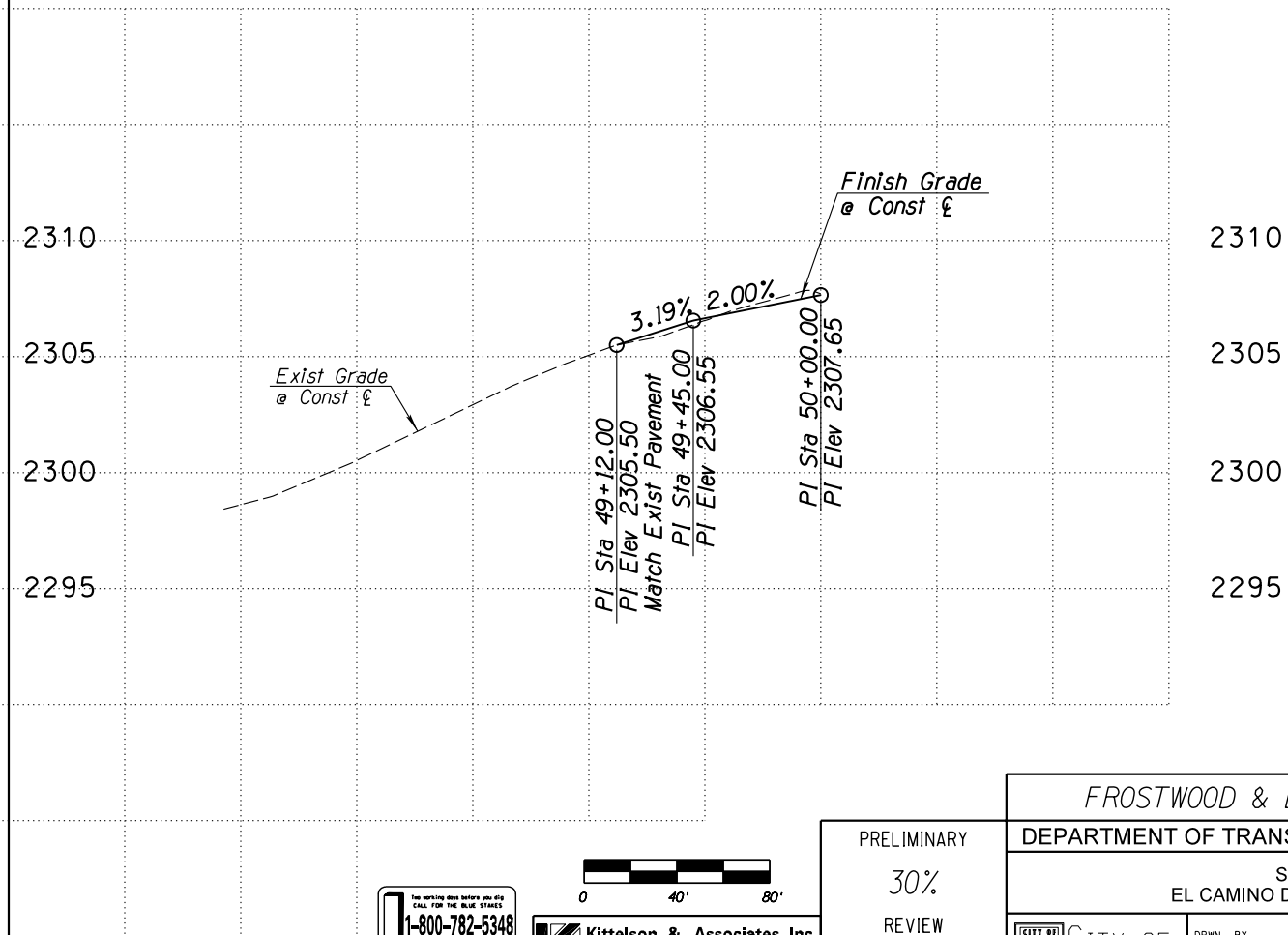
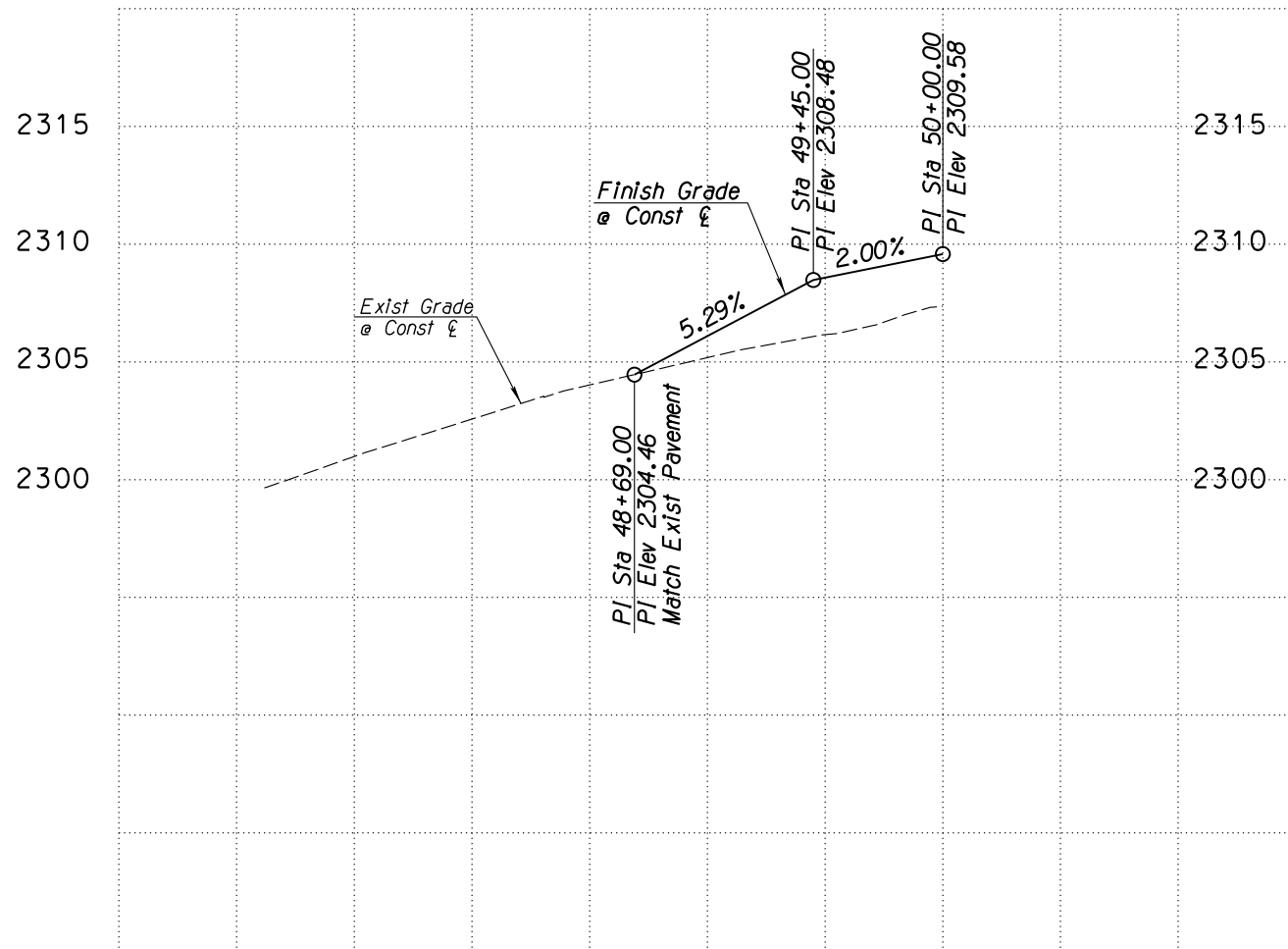
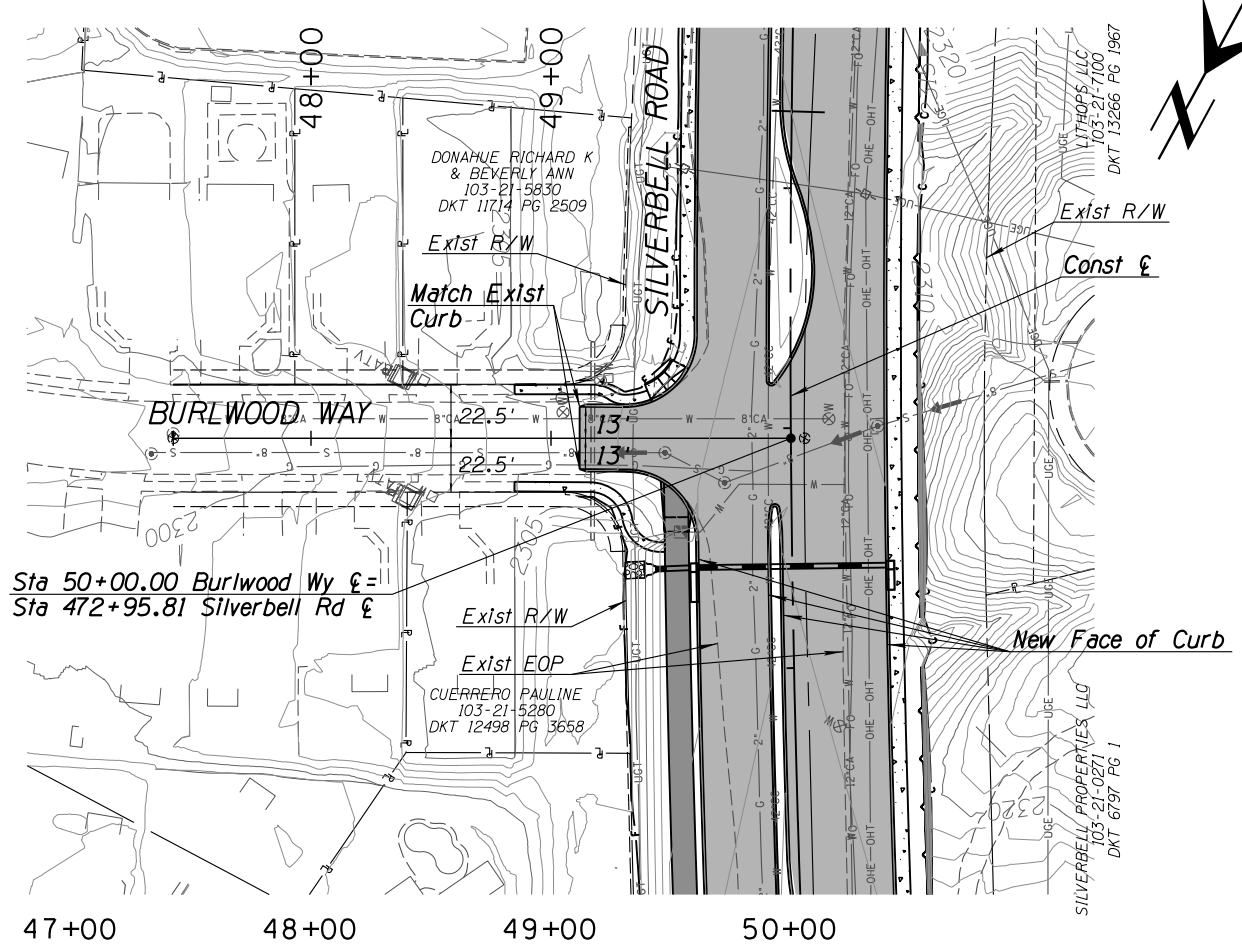
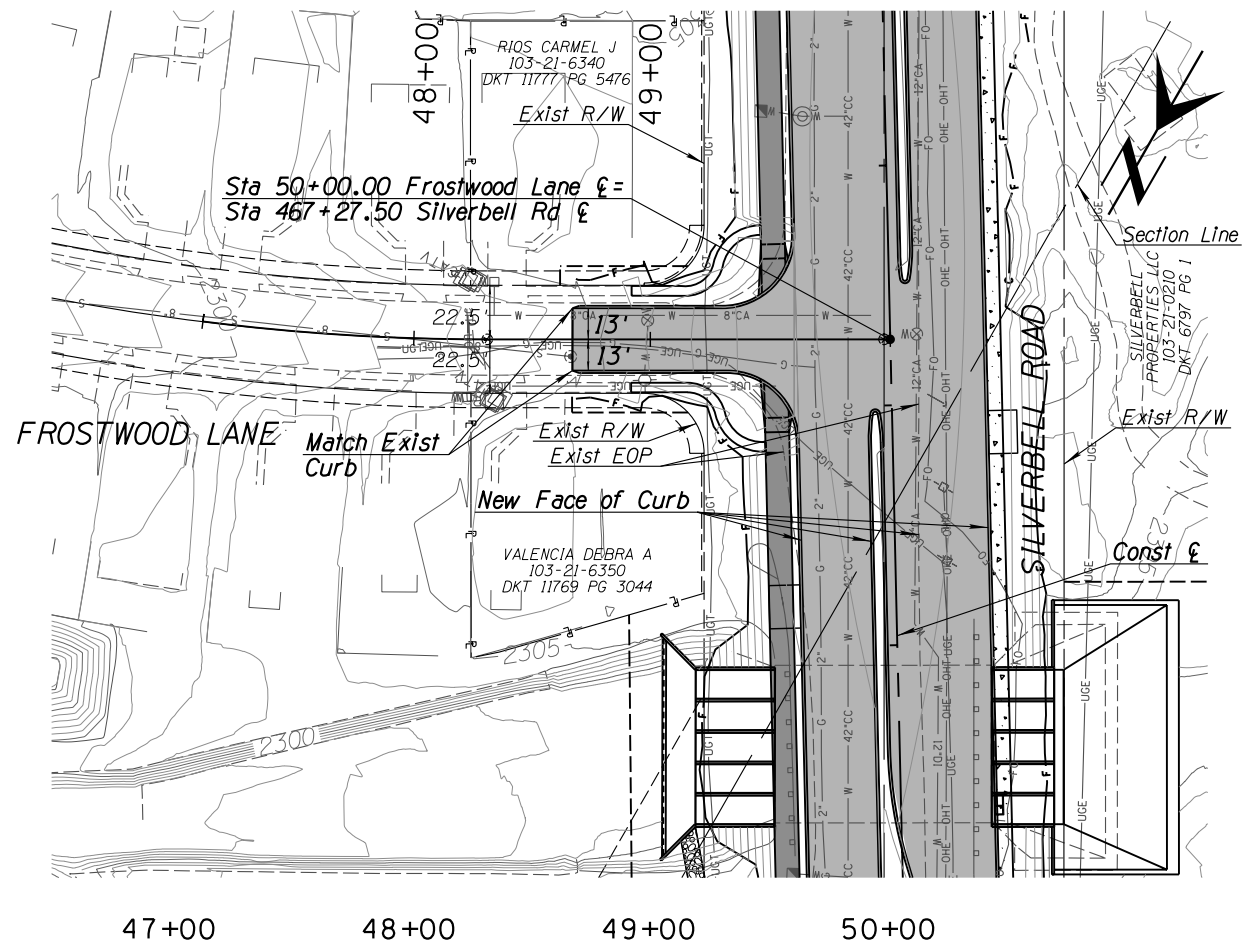
PLAN NO. I-2010-005





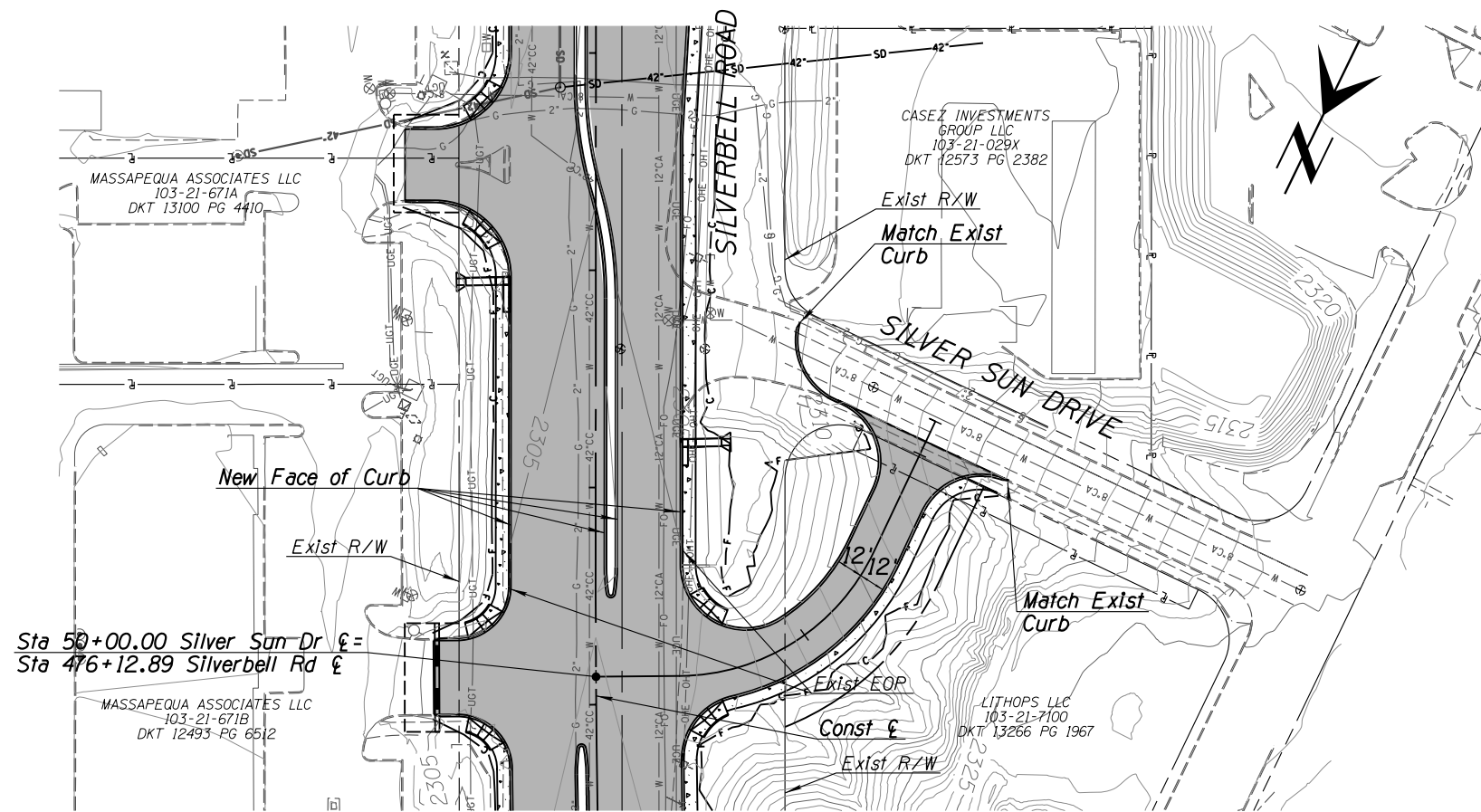
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

SIDE STREET PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			83
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PP34 OF PP36
DRWN. BY	LAS/TMR	9/10	REF. _____
DSGN. BY	MDA/YSM	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	PLAN NO. I-2010-005



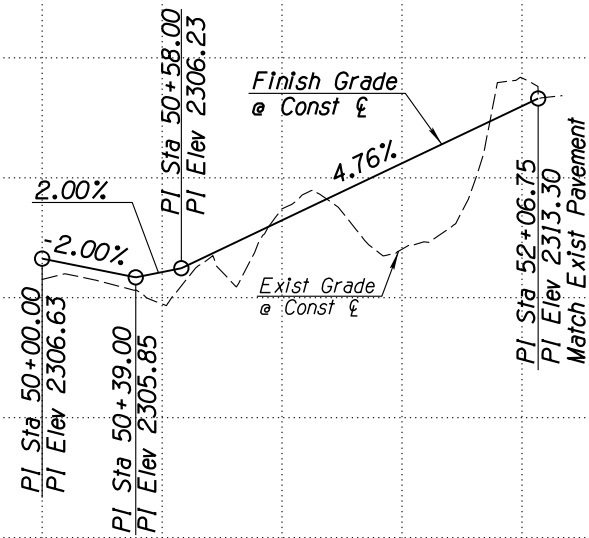
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

FROSTWOOD & BLURWOOD PLAN & PROFILE			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			84
SILVERBELL ROAD			PP35
EL CAMINO DEL CERRO TO GRANT ROAD			OF
			PP36 138
DRWN. BY	LAS/TMR	9/10	REF.
DSGN. BY	MDA/YSM	9/10	SCALE: 1" = 40'
CHKD. BY	JAS	9/10	1" = 4'
CITY OF TUCSON			PLAN NO. I-2010-005



50+00 51+00 52+00

2315
2310
2305



2315
2310
2305



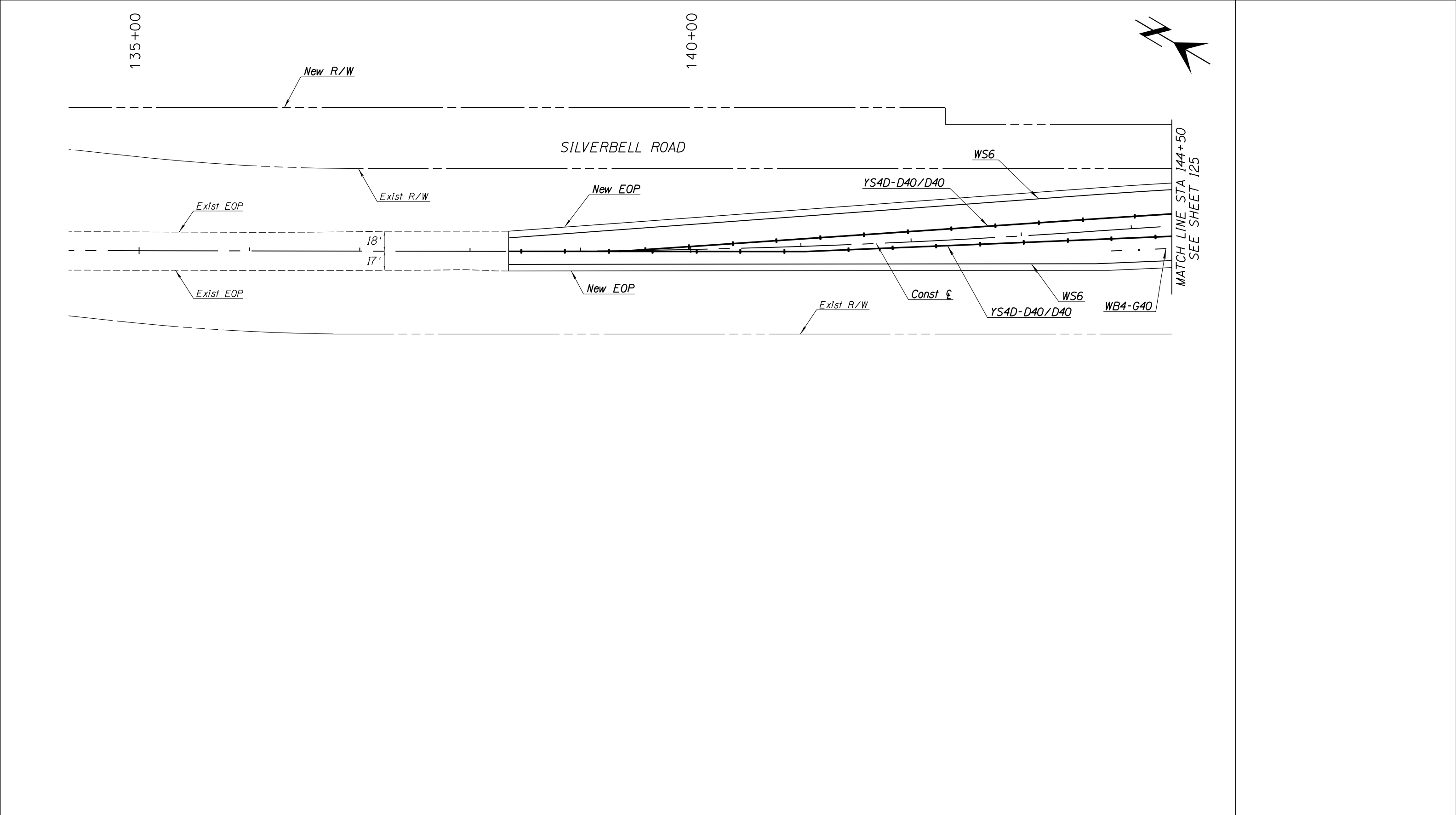
K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067



PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

SILVER SUN DRIVE PLAN & PROFILE

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			85
SILVERBELL ROAD			OF
EL CAMINO DEL CERRO TO GRANT ROAD			PP36 OF PP36 138
DRWN. BY	LAS/TMR	9/10	REF. _____ SCALE: 1" = 40' 1" = 4'
DSGN. BY	MDA/YSM	9/10	
CHKD. BY	JAS	9/10	
CITY OF TUCSON			PLAN NO. I-2010-005



NO.

DATE

REVISION

BY

CHKD.

APPR.

1-800-782-5348

Blue Stake Center

CALL TO COLLECT

K

Kittelson & Associates, Inc.

33 N. Stone Ave., Suite 800

Tucson, AZ 85701

(520) 544-4067

PRELIMINARY

30%

REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

CITY OF
TUCSON

DRWN. BY

LAS/TMR

9/10

DSGN. BY

MDA/YSM

9/10

CHKD. BY

JAS

9/10

REF.

SCALE: 1" = 40'

PLAN NO. I-2010-005

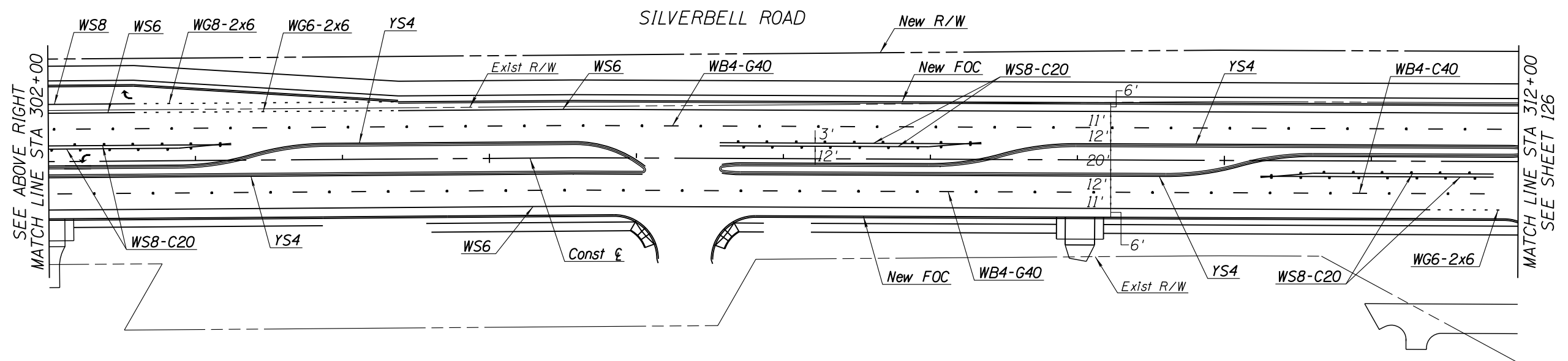
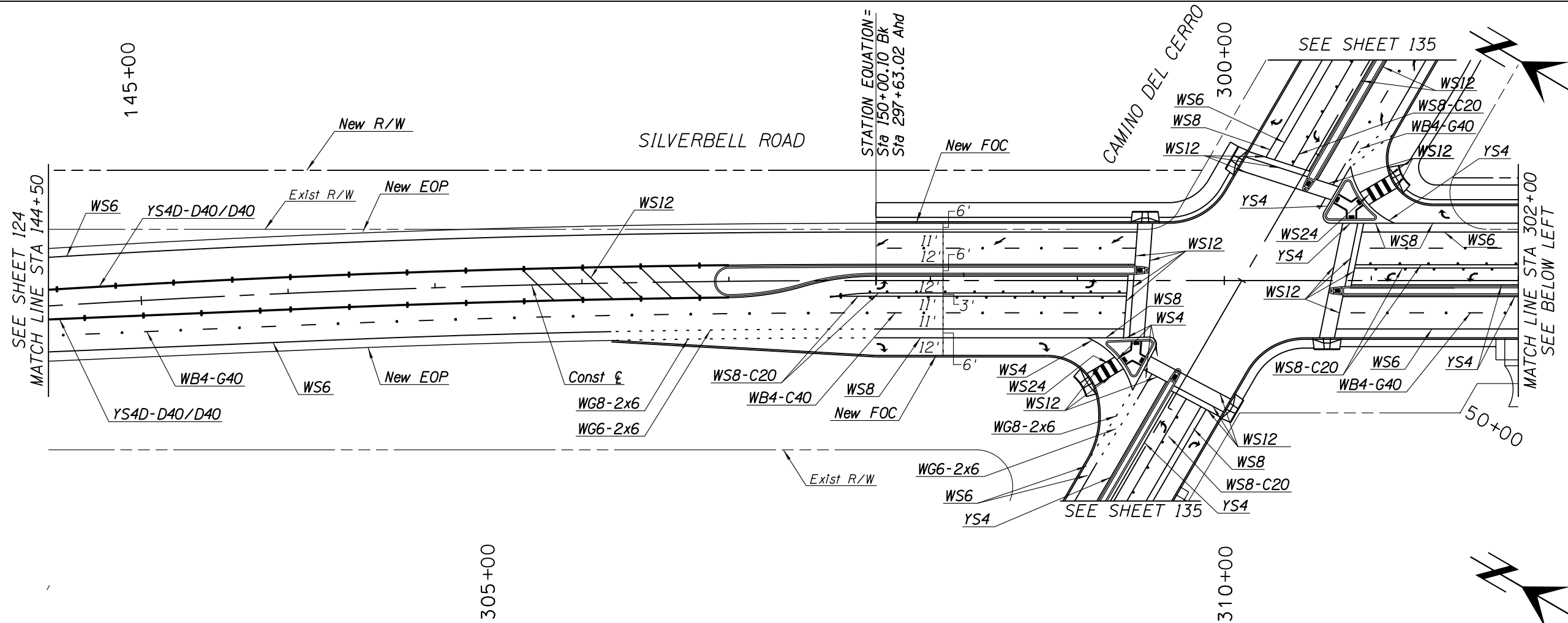
PAVEMENT MARKING PLAN

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

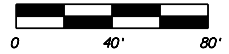
SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD

PM1
OF
PM15

124
OF
138



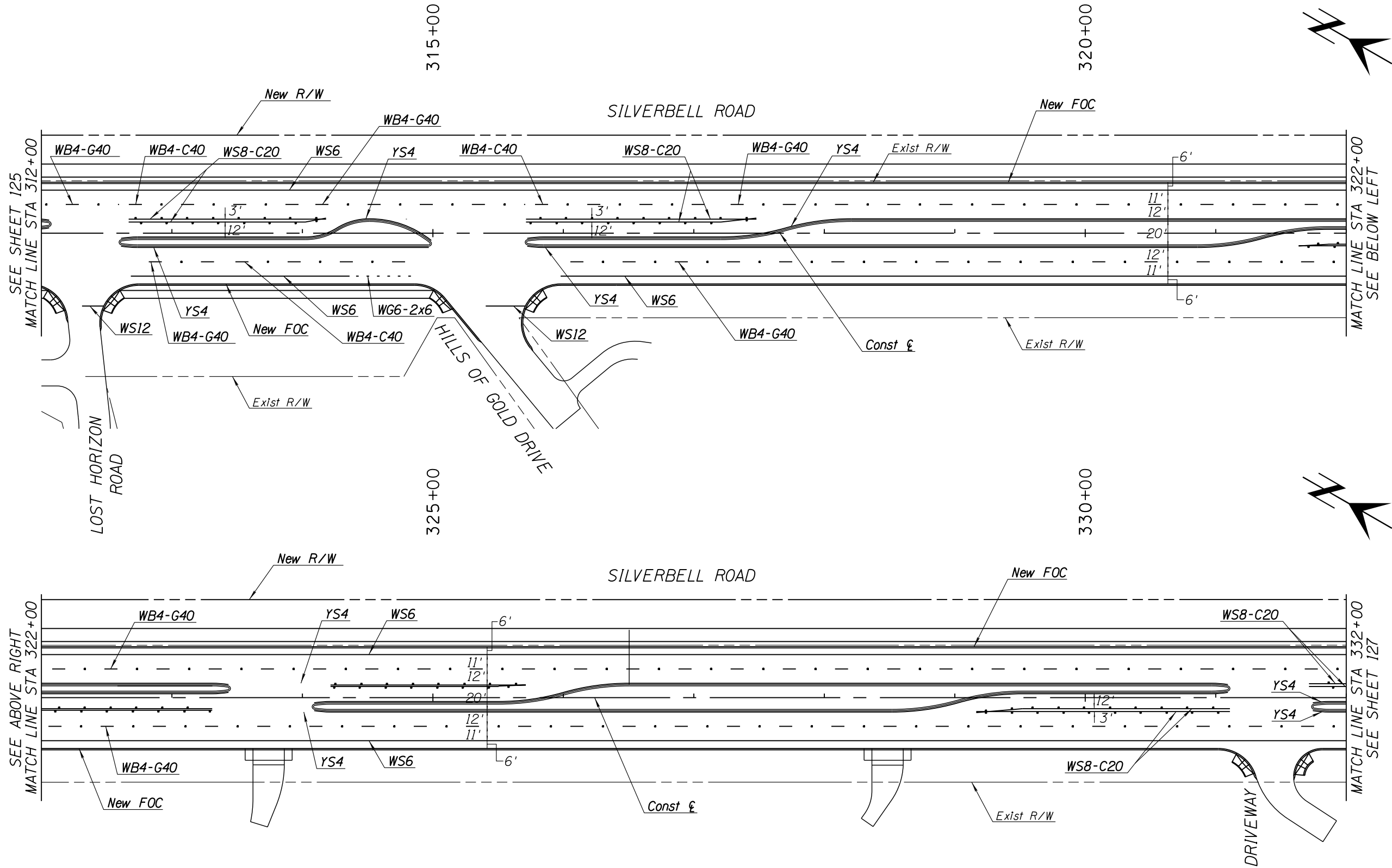
Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067



PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN				
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				125
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD				PM2 OF PM15
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10		
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005





1-800-782-5348
 Blue Stone Center
 CALL COLLECT

K Kittelson & Associates, Inc.
 33 N. Stone Ave., Suite 800
 Tucson, AZ 85701 (520) 544-4067

0 40' 80'

PRELIMINARY
 30%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PAVEMENT MARKING PLAN

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

SILVERBELL ROAD
 EL CAMINO DEL CERRO TO GRANT ROAD

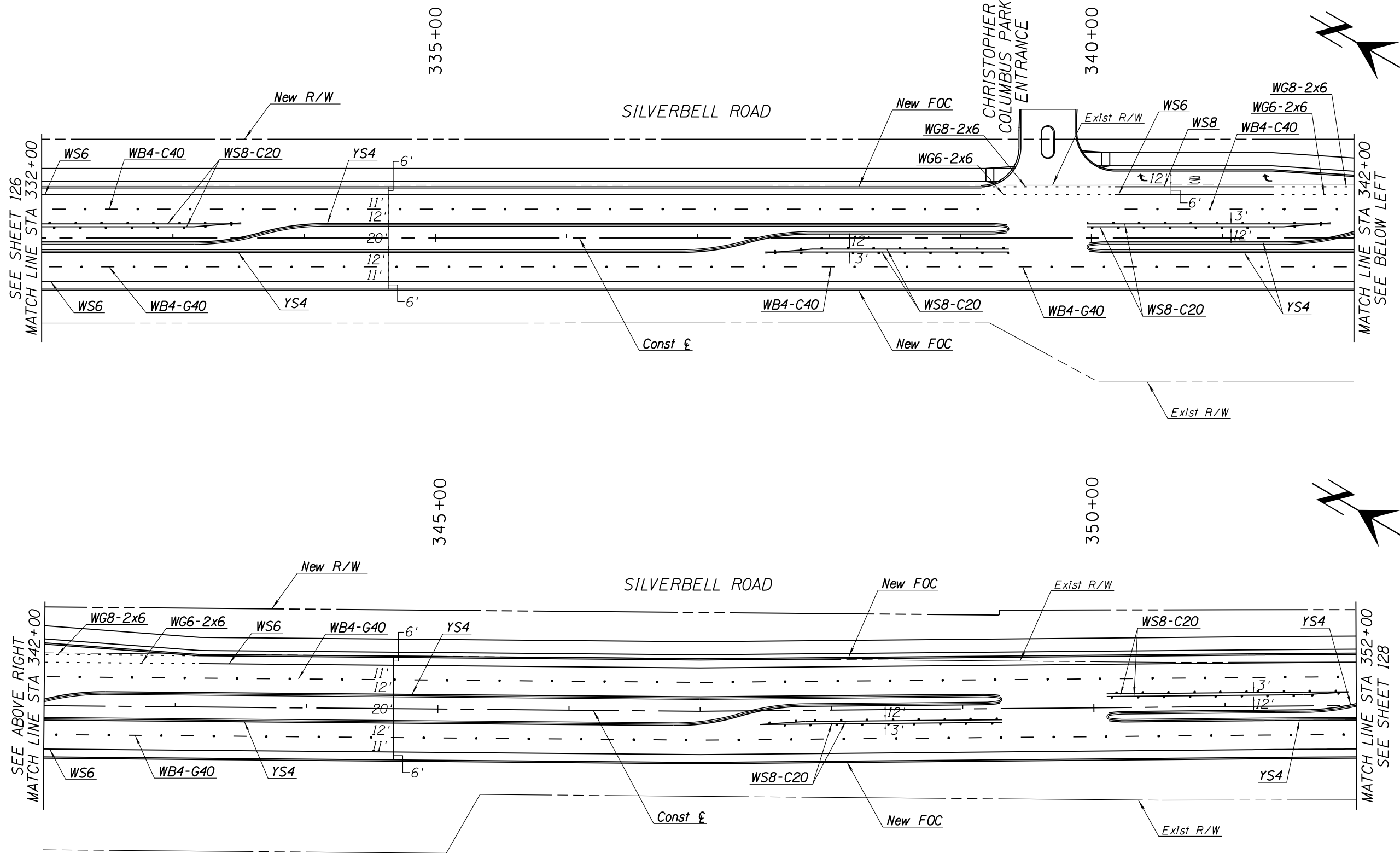
CITY OF TUCSON

126 OF 138
 PM3 OF PM15

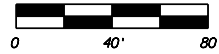
DRWN. BY	LAS/TMR	9/10
DSGN. BY	MDA/YSM	9/10
CHKD. BY	JAS	9/10

REF. _____ SCALE: 1" = 40'

PLAN NO. I-2010-005

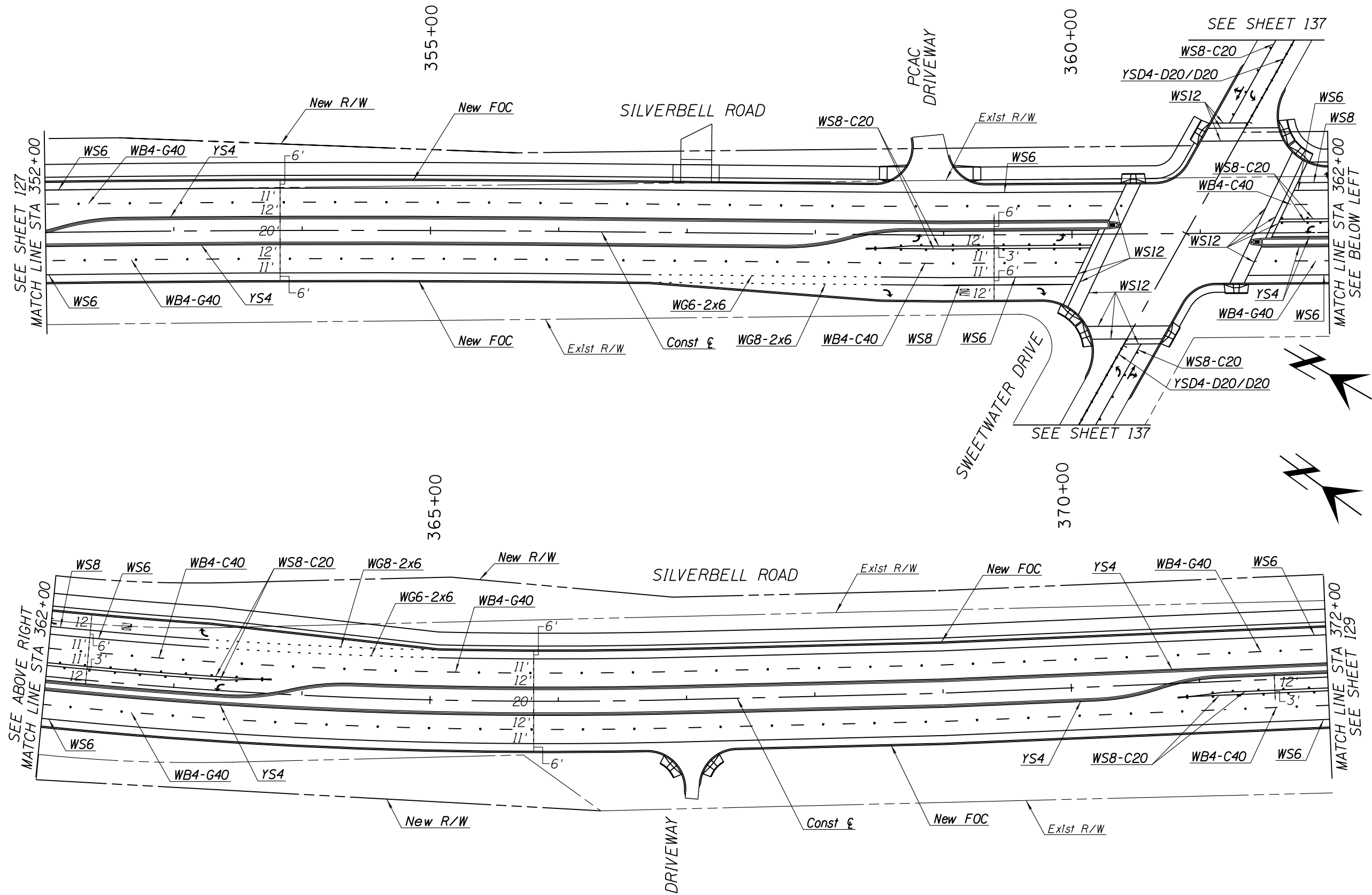


Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067



PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

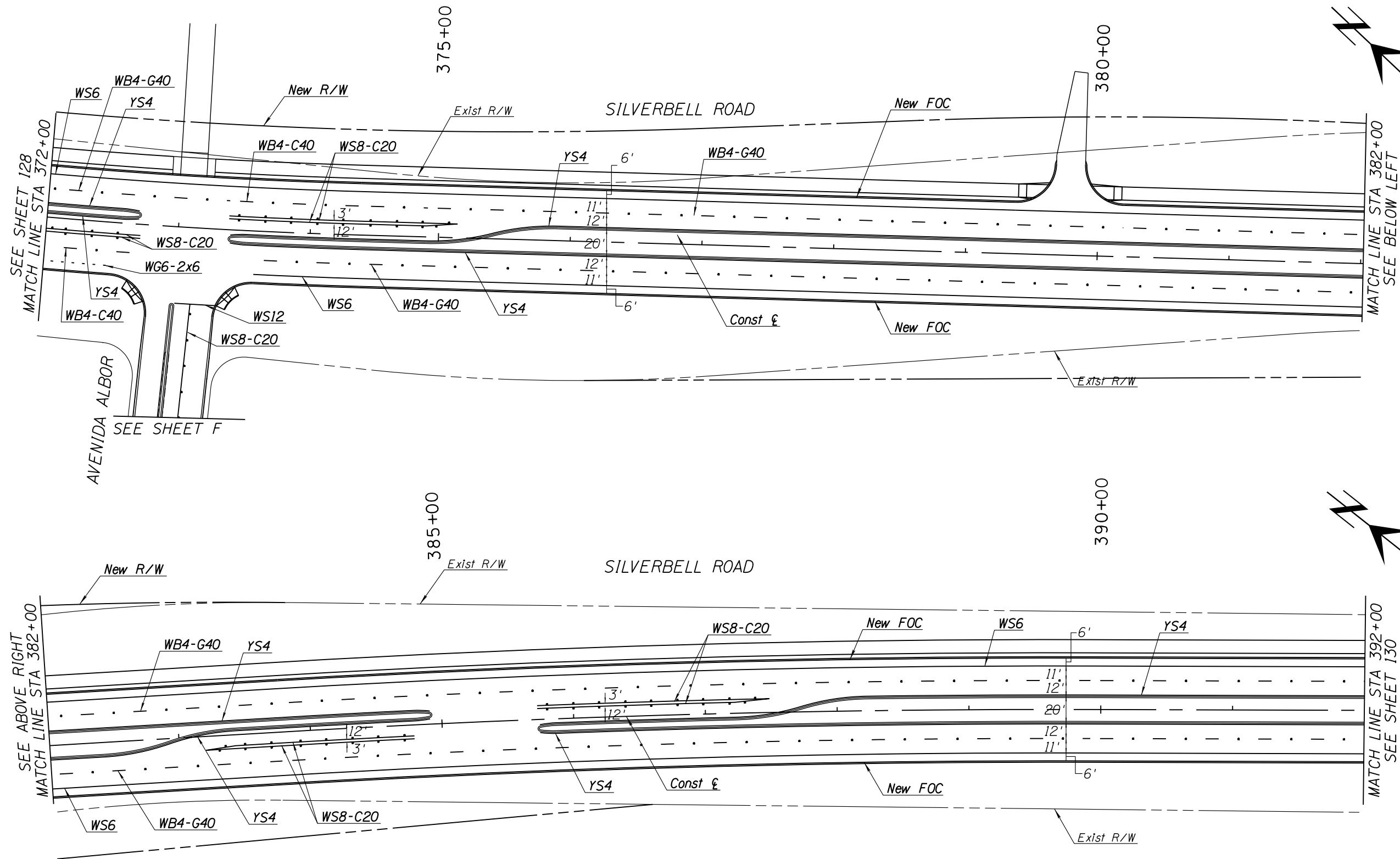
PAVEMENT MARKING PLAN				
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				127 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD				PM4 OF PM15
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10		1" = 4'
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005



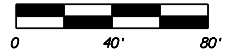
NO.	DATE	REVISION	BY	CHKD.	APPR.

PRELIMINARY
 30%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PAVEMENT MARKING PLAN					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					128 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD					PM5 OF PM15
CITY OF TUCSON	DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
	DSGN. BY	MDA/YSM	9/10		
	CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005

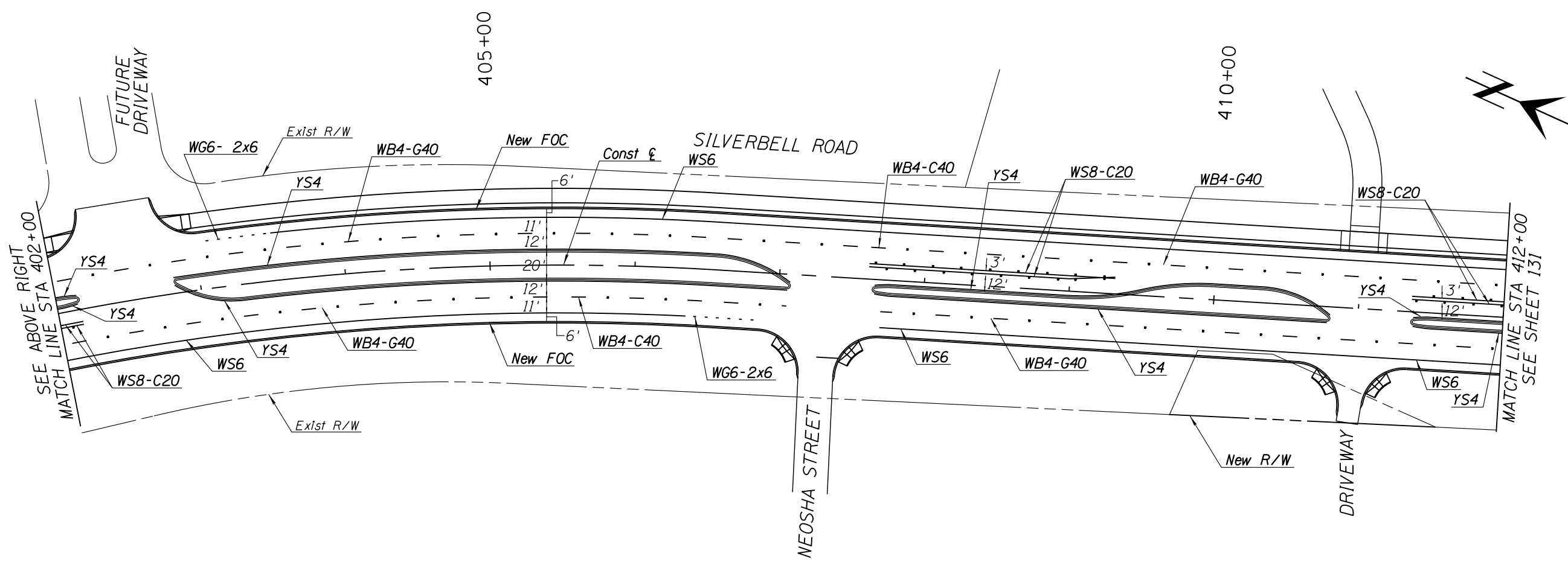
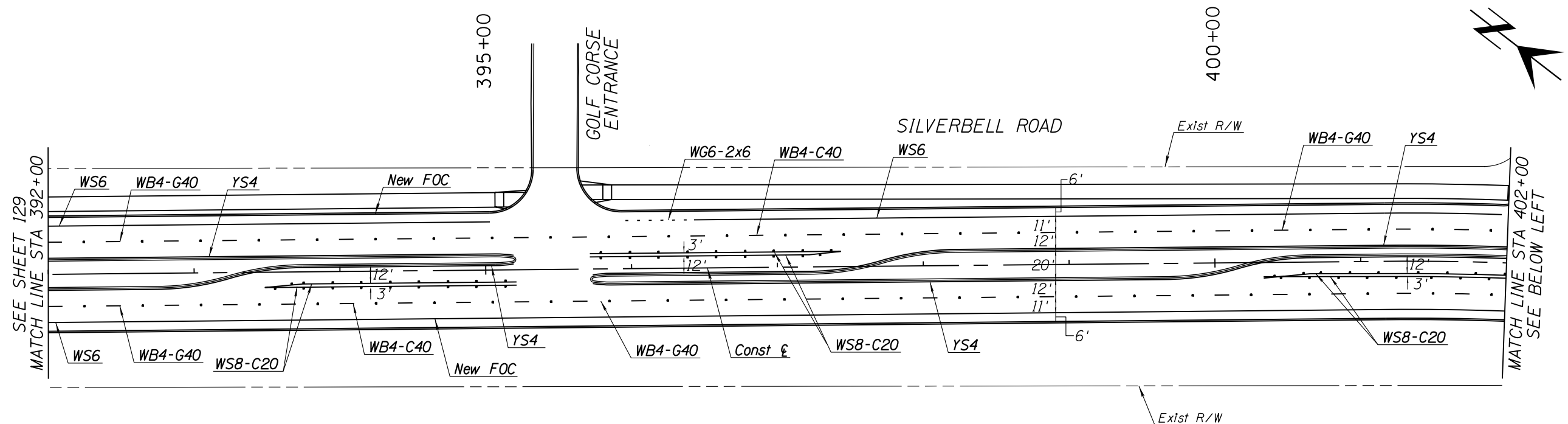


Kittelson & Associates, Inc.
 33 N. Stone Ave., Suite 800
 Tucson, AZ 85701 (520) 544-4067



PRELIMINARY
 30%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PAVEMENT MARKING PLAN					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					129 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD					PM6 OF PM15
CITY OF TUCSON	DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
	DSGN. BY	MDA/YSM	9/10		
	CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005



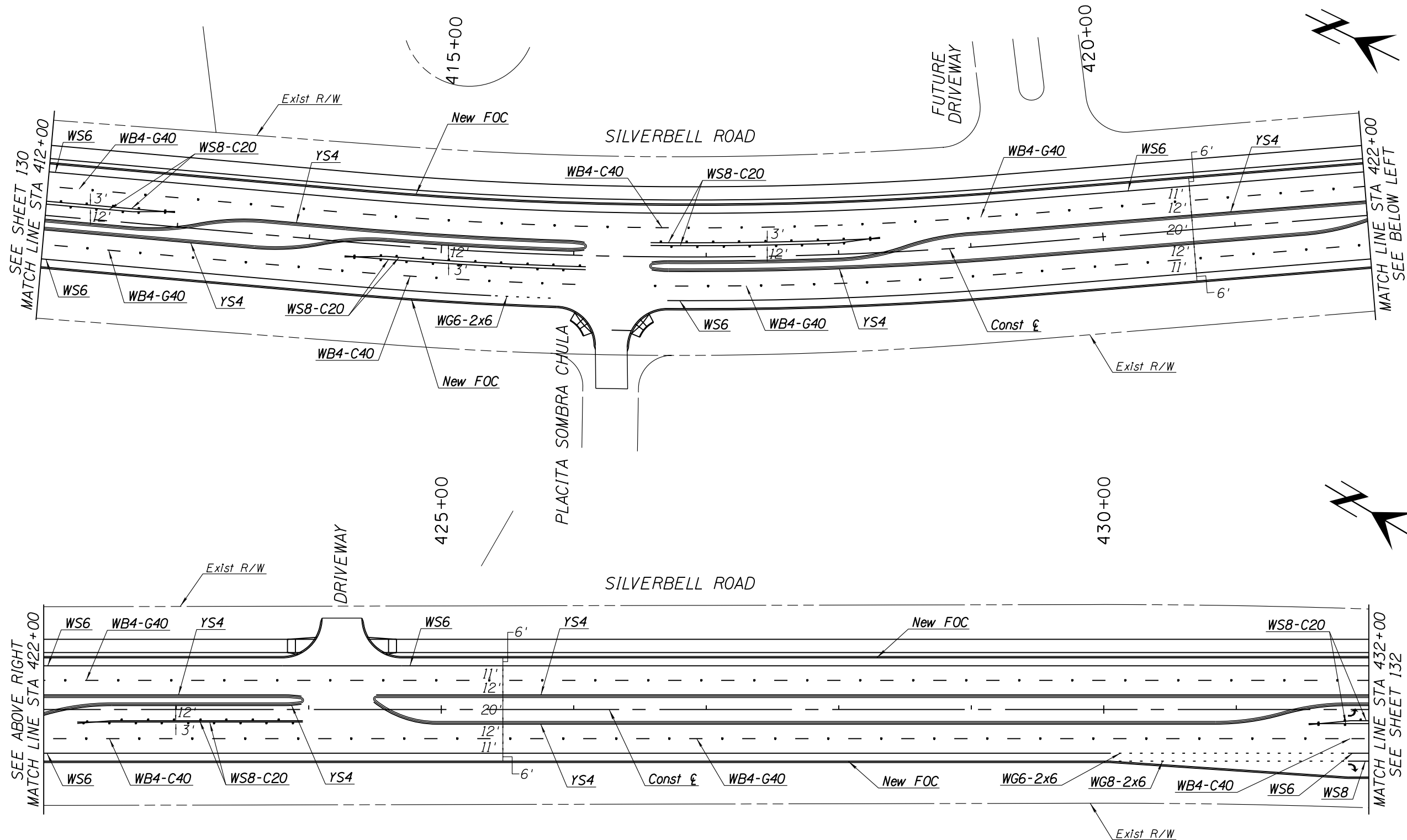
1-800-782-5348
 Blue Stone Center
 CALL COLLECT

K Kittelson & Associates, Inc.
 33 N. Stone Ave., Suite 800
 Tucson, AZ 85701 (520) 544-4067

0 40' 80'

PRELIMINARY
 30%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PAVEMENT MARKING PLAN				
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				130 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD				PM7 OF PM15
DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10		
CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005



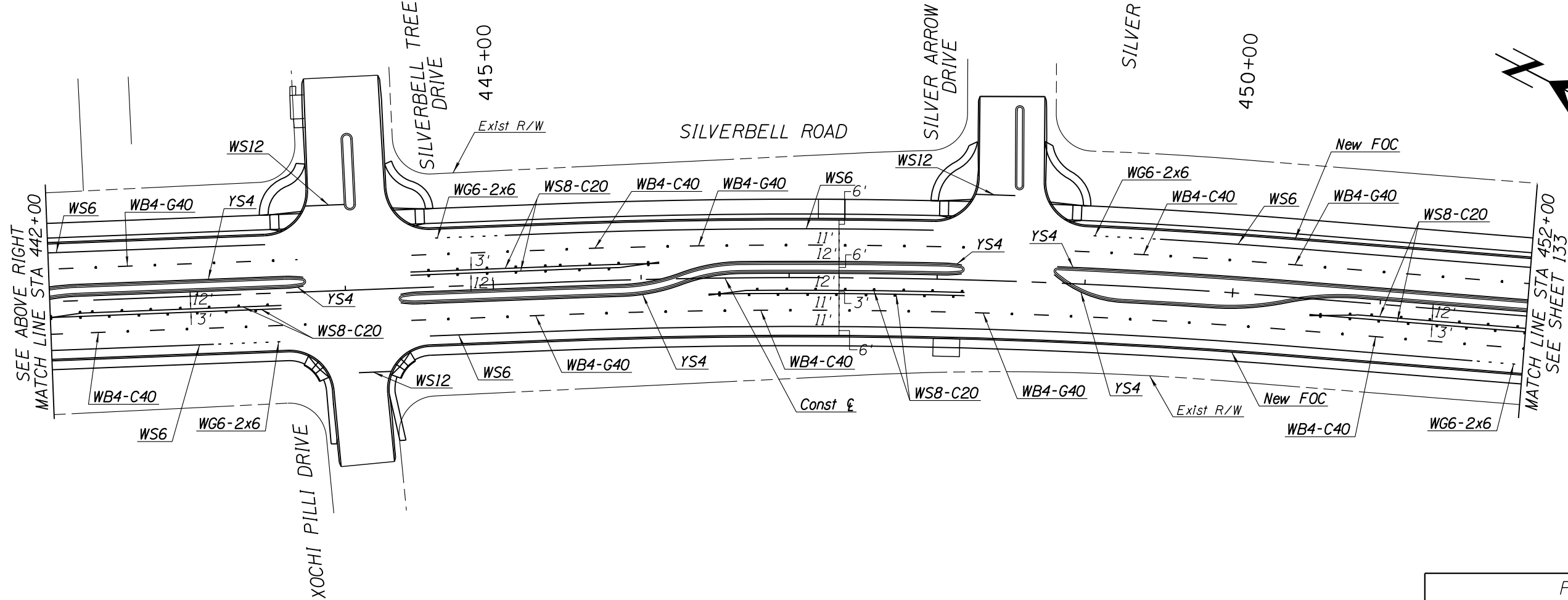
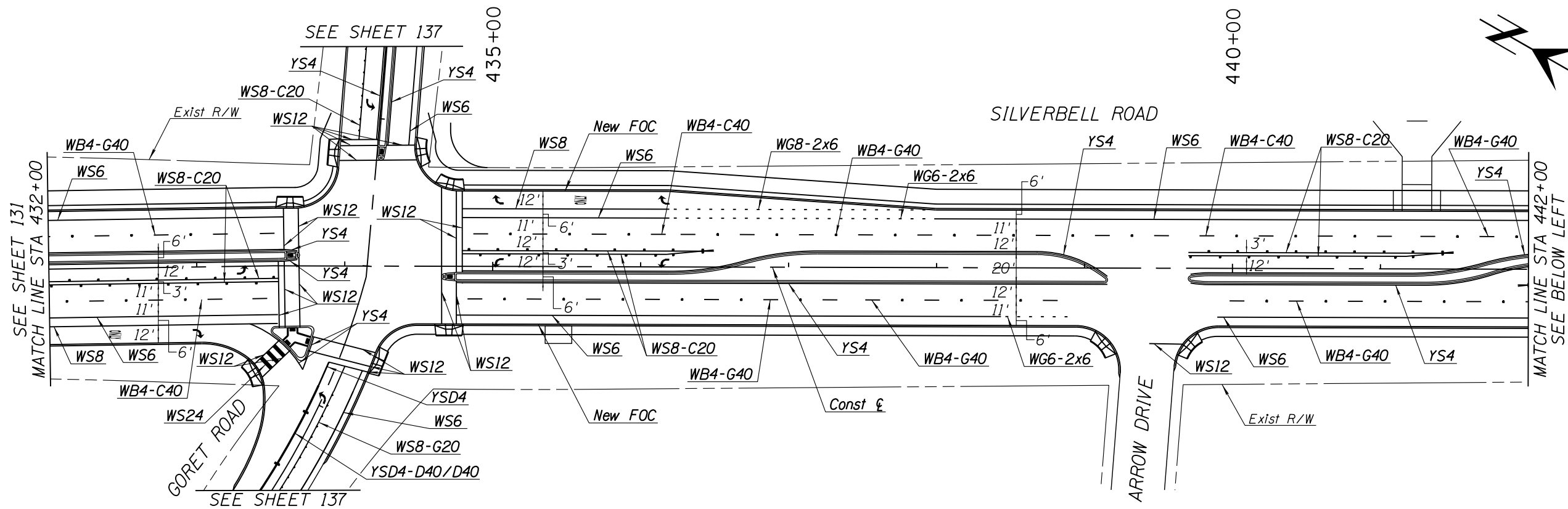
Kittelson & Associates, Inc.
 33 N. Stone Ave., Suite 800
 Tucson, AZ 85701 (520) 544-4067

PRELIMINARY

30%

 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

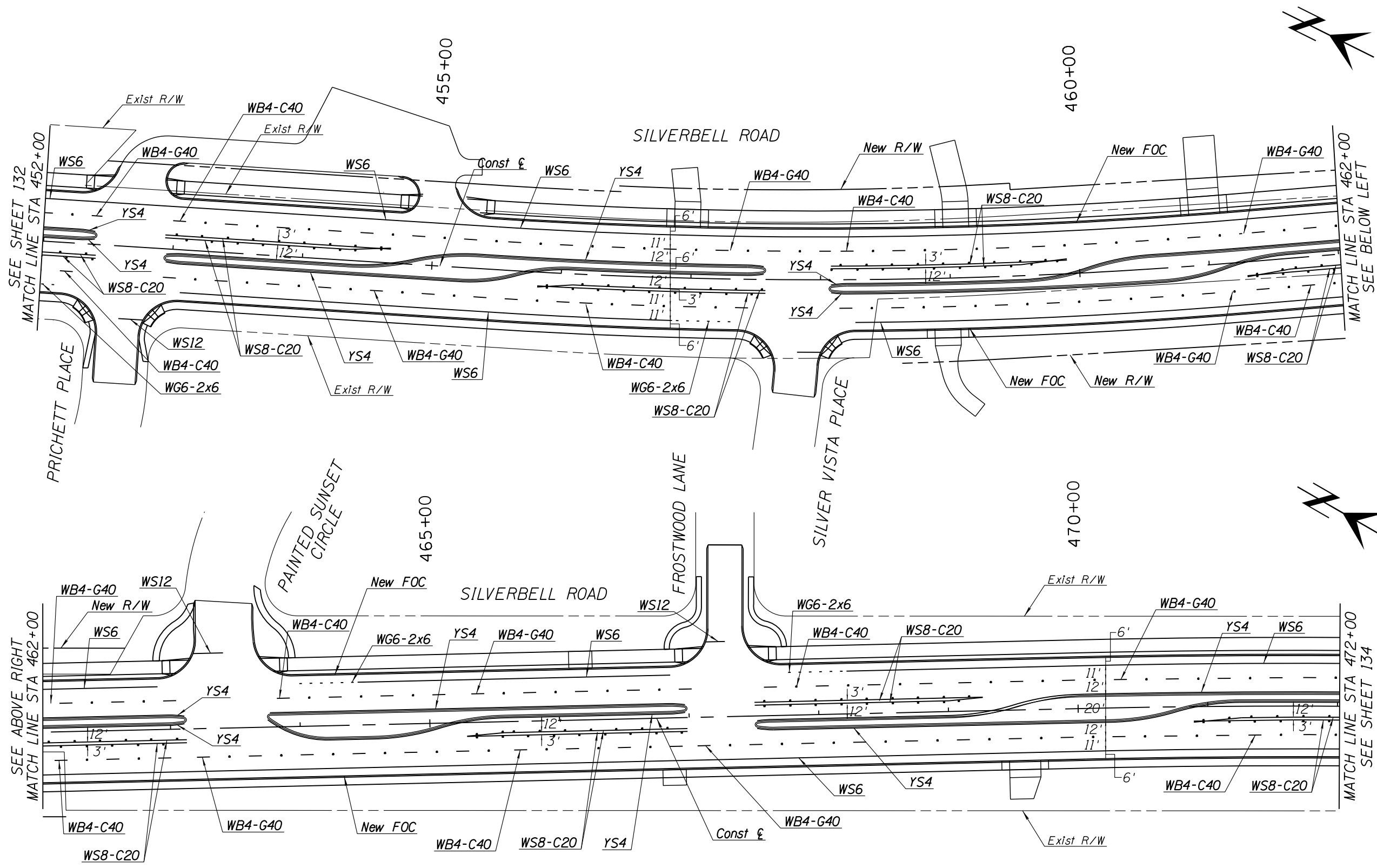
PAVEMENT MARKING PLAN			
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION			
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD			PM8 OF PM15
DRWN. BY	LAS/TMR	9/10	REF. _____ SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	
CHKD. BY	JAS	9/10	
PLAN NO.			I-2010-005



NO.	DATE	REVISION	BY	CHKD.	APPR.

PRELIMINARY
 30%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PAVEMENT MARKING PLAN					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					132 OF 138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD					PM9 OF PM15
CITY OF TUCSON	DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
	DSGN. BY	MDA/YSM	9/10		
	CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005



Kittelson & Associates, Inc.
 33 N. Stone Ave., Suite 800
 Tucson, AZ 85701 (520) 544-4067

0 40' 80'

PRELIMINARY
 30%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PAVEMENT MARKING PLAN
 DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION
 SILVERBELL ROAD
 EL CAMINO DEL CERRO TO GRANT ROAD

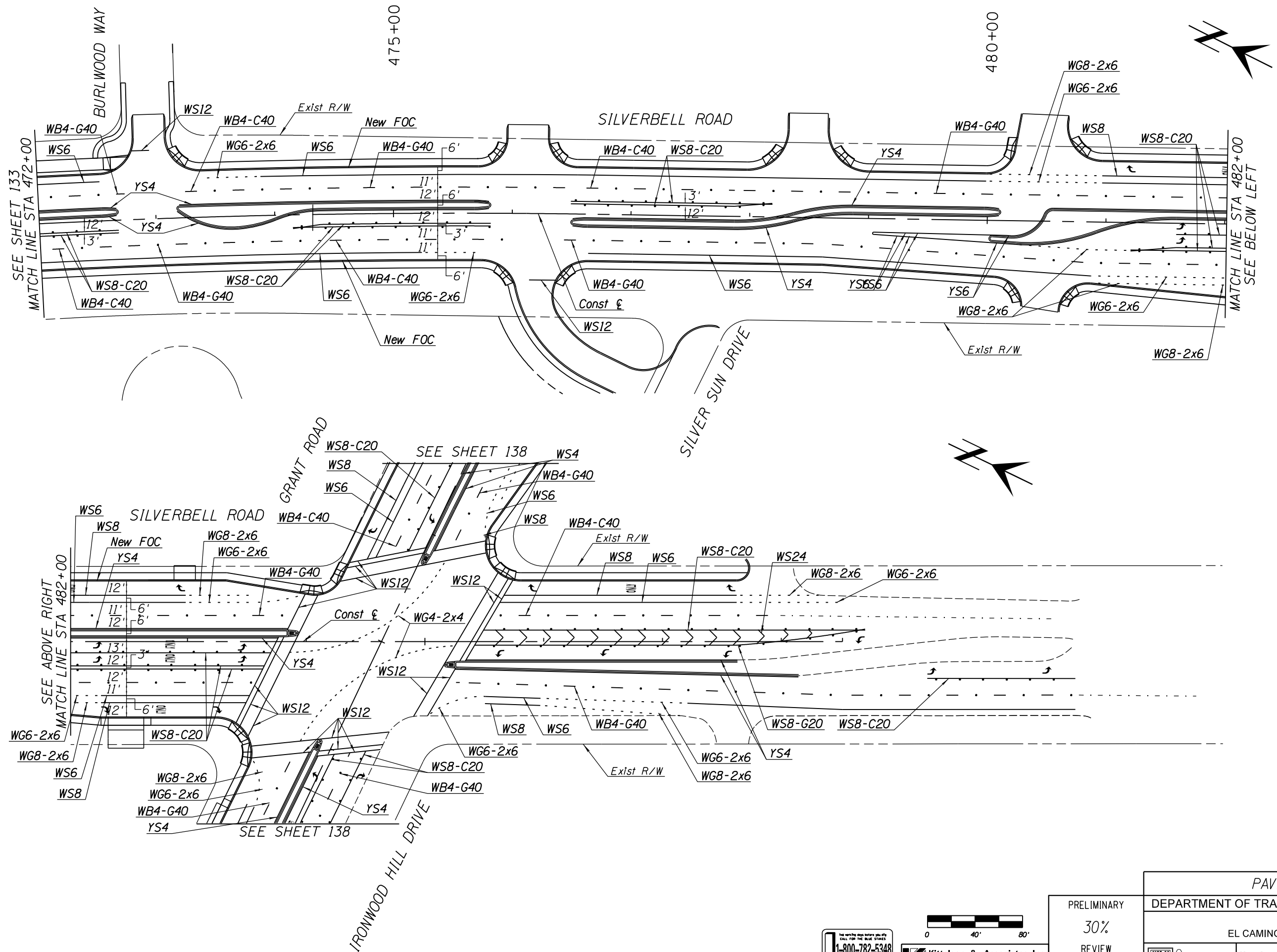
133 OF 138

PM10 OF PM15

CITY OF
 TUCSON

DRWN. BY	LAS/TMR	9/10	REF. _____ SCALE: 1" = 40'
DSGN. BY	MDA/YSM	9/10	
CHKD. BY	JAS	9/10	

PLAN NO. I-2010-005



7/6/2011
 H:\profile\9589 - Silverbell Road DCR\30%-South\07 Stripe\svb-str-11.dgn

Kittelson & Associates, Inc.
 33 N. Stone Ave., Suite 800
 Tucson, AZ 85701 (520) 544-4067

PRELIMINARY

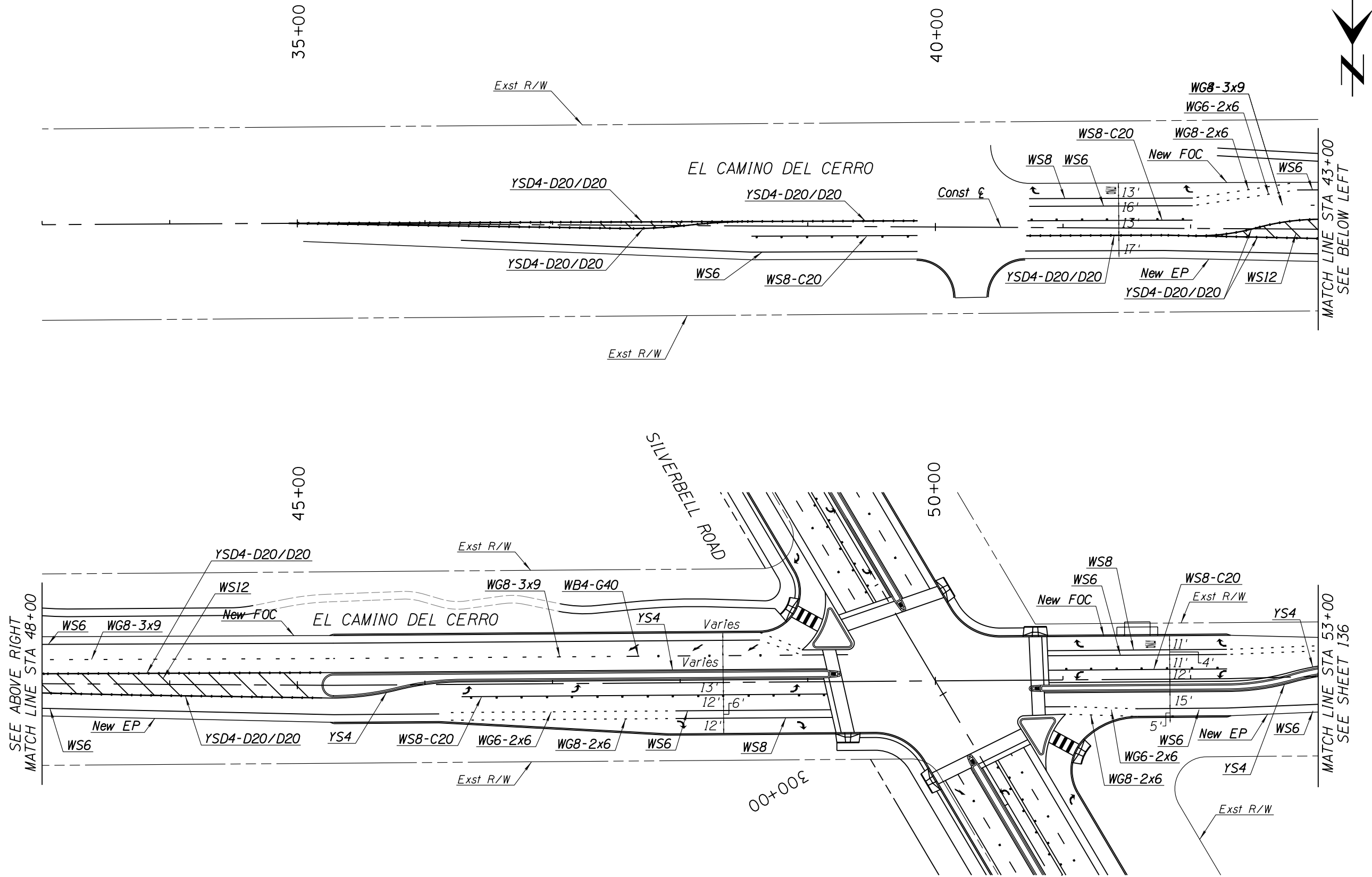
30%

 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PAVEMENT MARKING PLAN
 DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION
 SILVERBELL ROAD
 EL CAMINO DEL CERRO TO GRANT ROAD

134
 OF
 138

	CITY OF TUCSON	DRWN. BY LAS/TMR	9/10	REF. _____ SCALE: 1" = 40' PLAN NO. I-2010-005
		DSGN. BY MDA/YSM	9/10	
	CHKD. BY JAS	9/10		



For writing day before you die
CALL FOR THE BLUE STRIPE
Blue Stripe Center
CALL COLLECT

1-800-782-5348

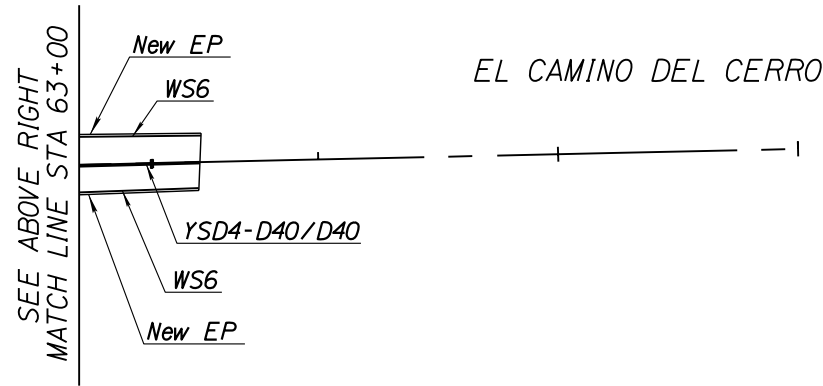
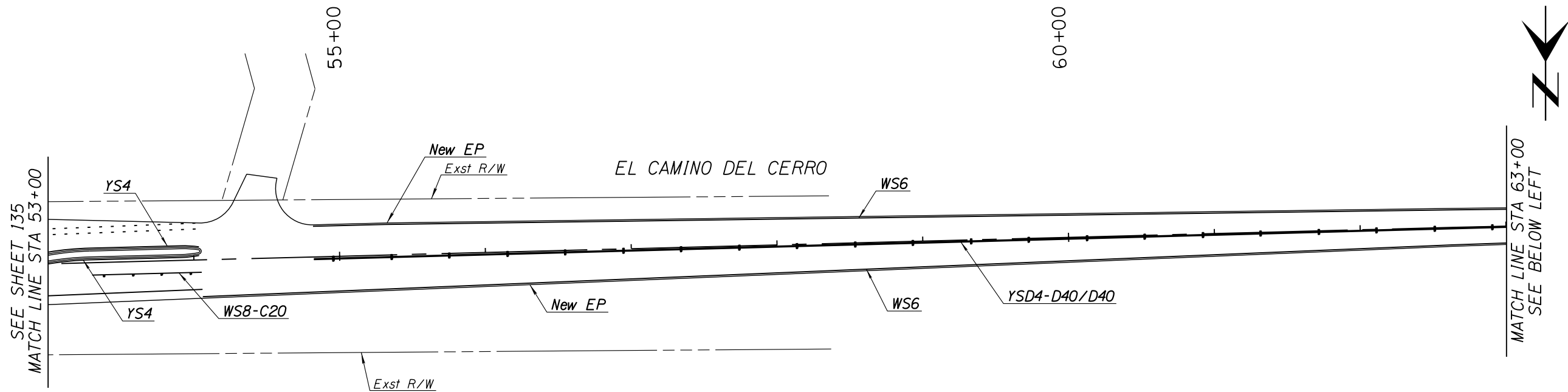
0 40' 80'

Kittelson & Associates, Inc.
 33 N. Stone Ave., Suite 800
 Tucson, AZ 85701 (520) 544-4067

PRELIMINARY
 30%
 REVIEW
 NOT FOR
 CONSTRUCTION
 OR RECORDING

PAVEMENT MARKING PLAN					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION					135
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD					PM12 OF PM15 138
	DRWN. BY	LAS/TMR	9/10	REF.	SCALE: 1" = 40'
	DSGN. BY	MDA/YSM	9/10		
	CHKD. BY	JAS	9/10	PLAN NO.	I-2010-005

NO.	DATE	REVISION	BY	CHKD.	APPR.



NO.

DATE

REVISION

BY

CHKD.

APPR.

1-800-782-5348

Blue Stripe Center

CALL COLLECT

K

Kittelson & Associates, Inc.

33 N. Stone Ave., Suite 800

Tucson, AZ 85701

(520) 544-4067

PRELIMINARY

30%

REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

CITY OF
TUCSON

DRWN. BY
LAS/TMR
9/10

DSGN. BY
MDA/YSM
9/10

CHKD. BY
JAS
9/10

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

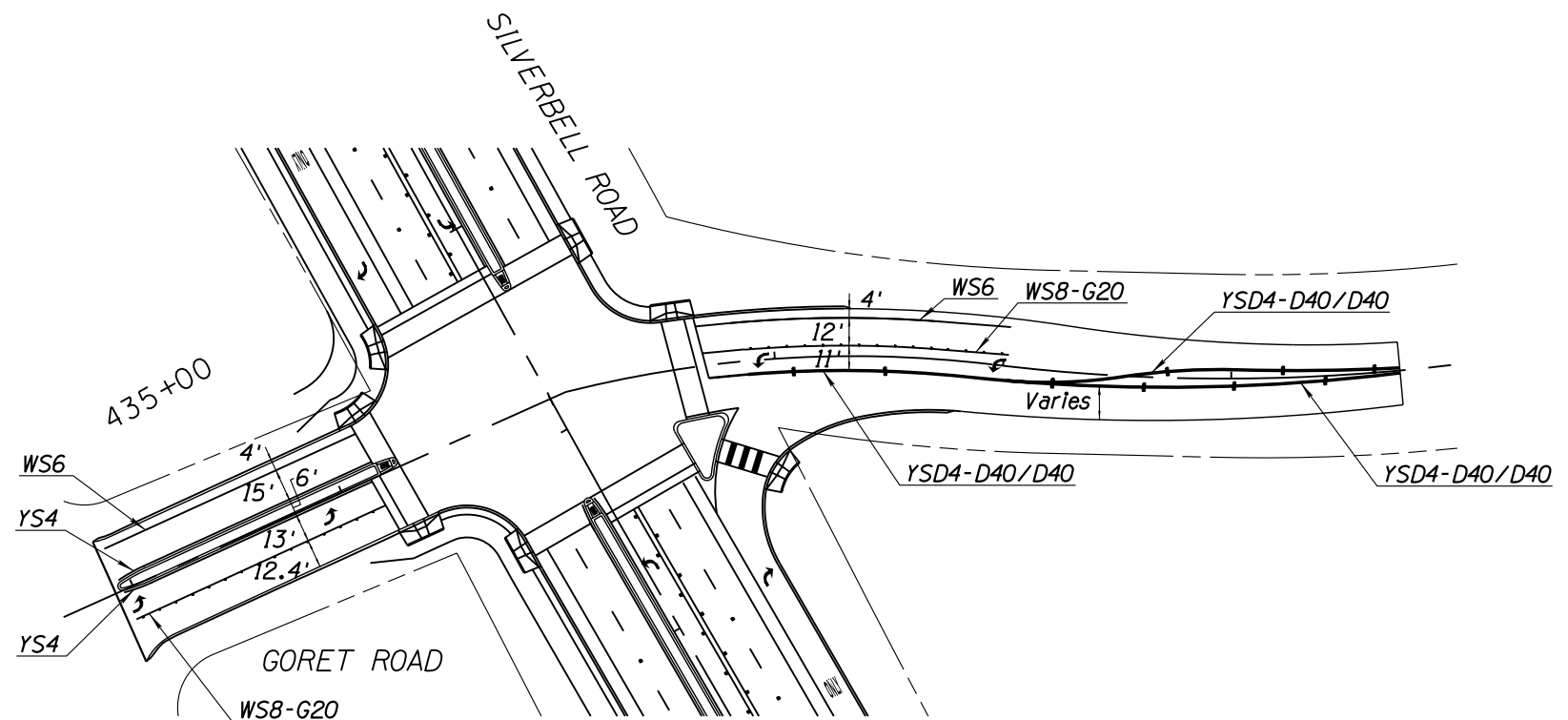
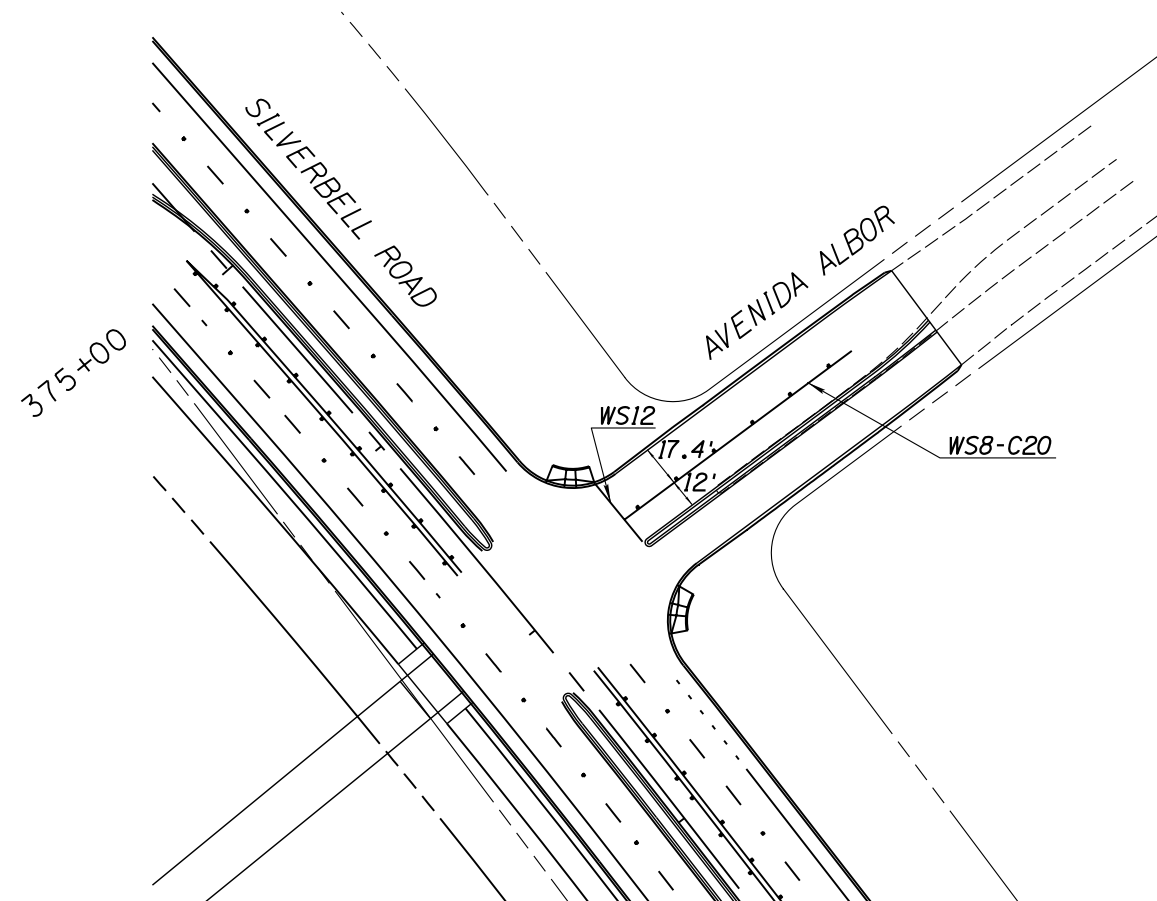
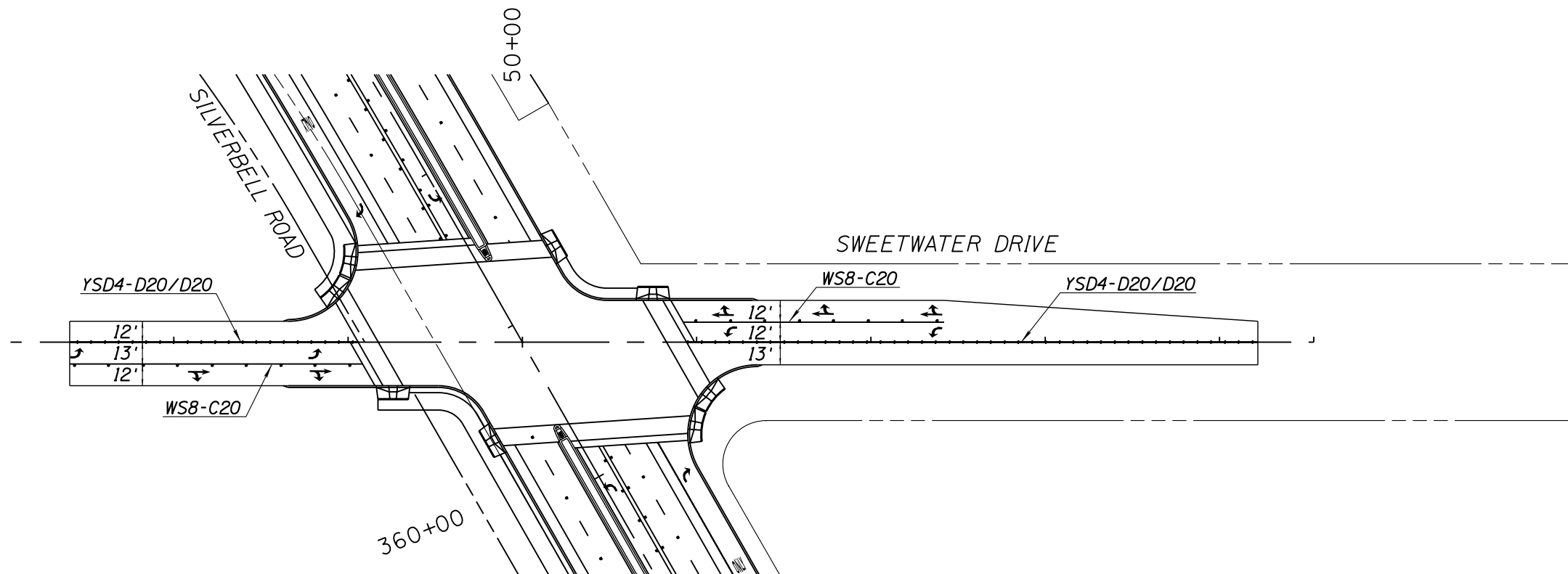
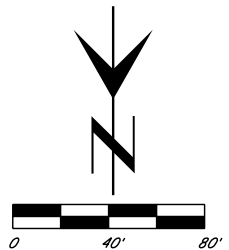
SILVERBELL ROAD
EL CAMINO DEL CERRO TO GRANT ROAD

PLAN NO. I-2010-005

136
OF
138

PM13
OF
PM15

SCALE: 1" = 40'



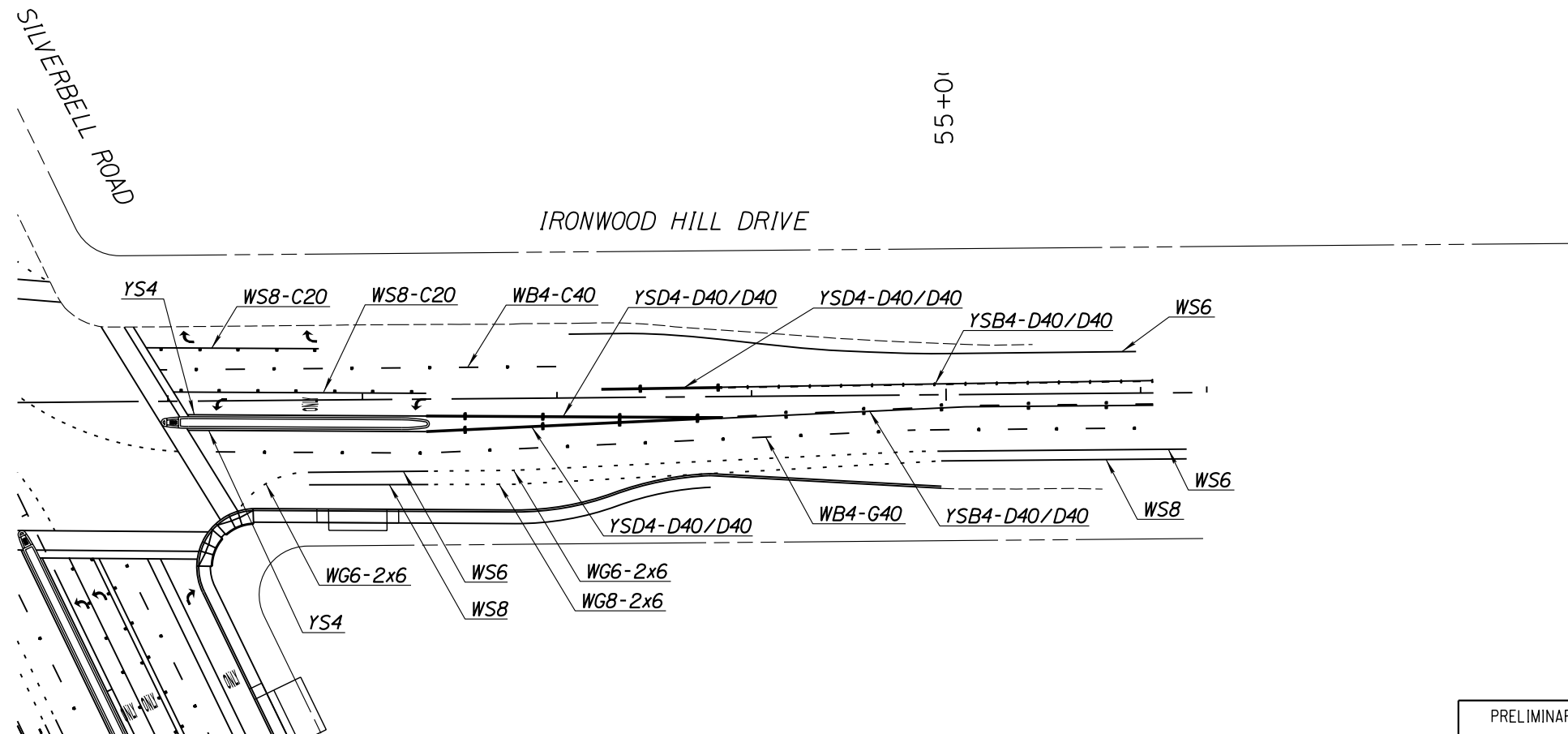
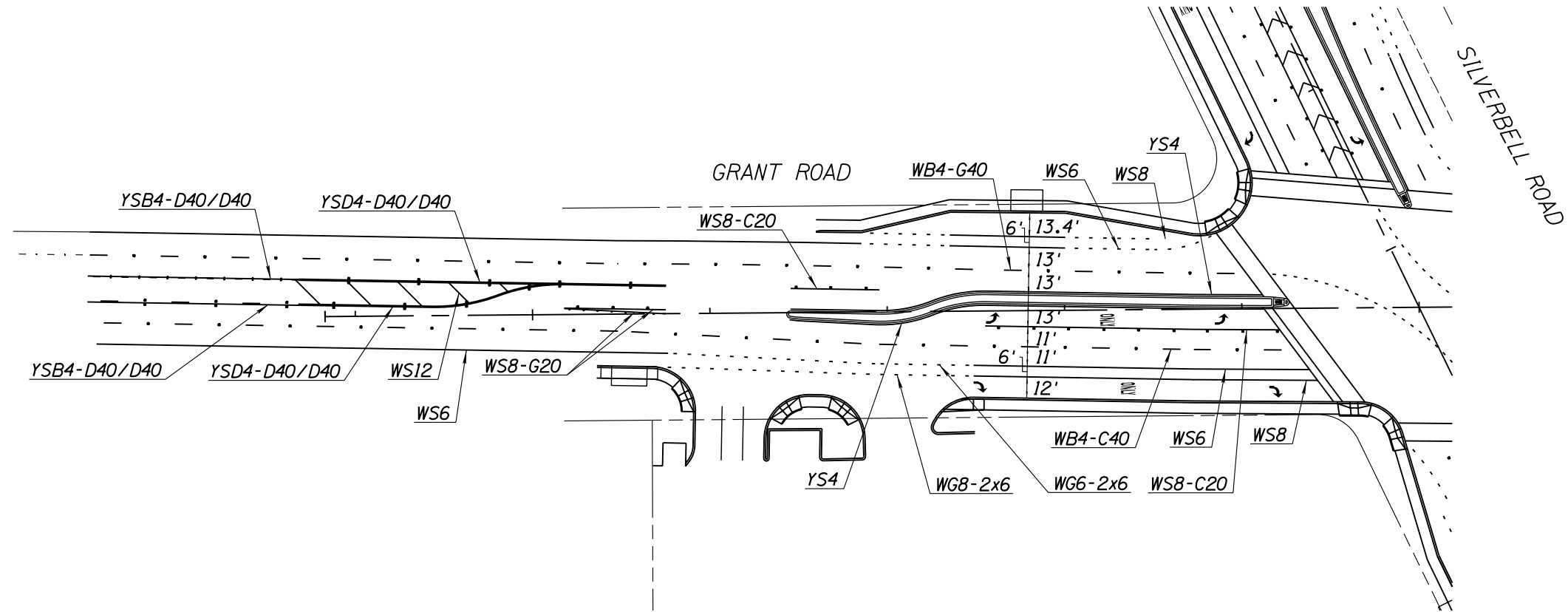
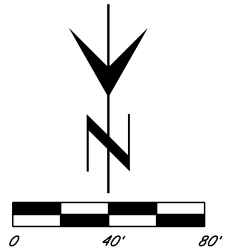
6/24/2011
C:\Documents and Settings\ymereszczak\Desktop\Projects\9589 - Silverbell Road DCR\30%-South\07 Stripe\svb-str-14.dgn

K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.
-----	------	----------	----	-------	-------

PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN					
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				137	OF
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD				PM14 OF PM15	138
 CITY OF TUCSON	DRWN. BY	LAS/TMR	2/10	REF. _____ SCALE: 1" = 40' 1" = XX'	
	DSGN. BY	MDA/YSM	2/10		
	CHKD. BY	JAS	2/10		
PLAN NO. I-2010-005					



6/24/2011
C:\Documents and Settings\ymereszczak\Desktop\Projects\9589 - Silverbell Road DCR\30%-South\07 Stripe\svb-str-15.dgn

K Kittelson & Associates, Inc.
33 N. Stone Ave., Suite 800
Tucson, AZ 85701 (520) 544-4067

NO.	DATE	REVISION	BY	CHKD.	APPR.
-----	------	----------	----	-------	-------

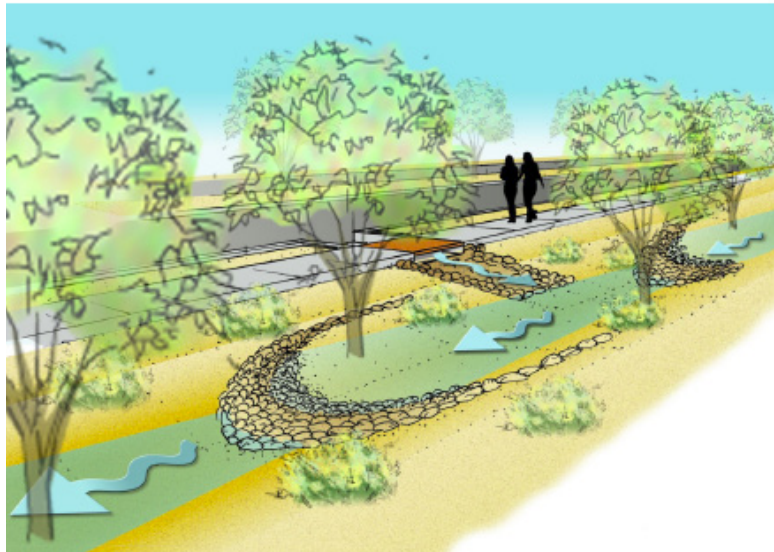
PRELIMINARY
30%
REVIEW
NOT FOR
CONSTRUCTION
OR RECORDING

PAVEMENT MARKING PLAN				
DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION				138
SILVERBELL ROAD EL CAMINO DEL CERRO TO GRANT ROAD				PM15 OF PM15 138
	DRWN. BY	LAS/TMR	2/10	REF. _____ SCALE: 1" = 40' 1" = XX'
	DSGN. BY	MDA/YSM	2/10	
	CHKD. BY	JAS	2/10	
PLAN NO. I-2010-005				

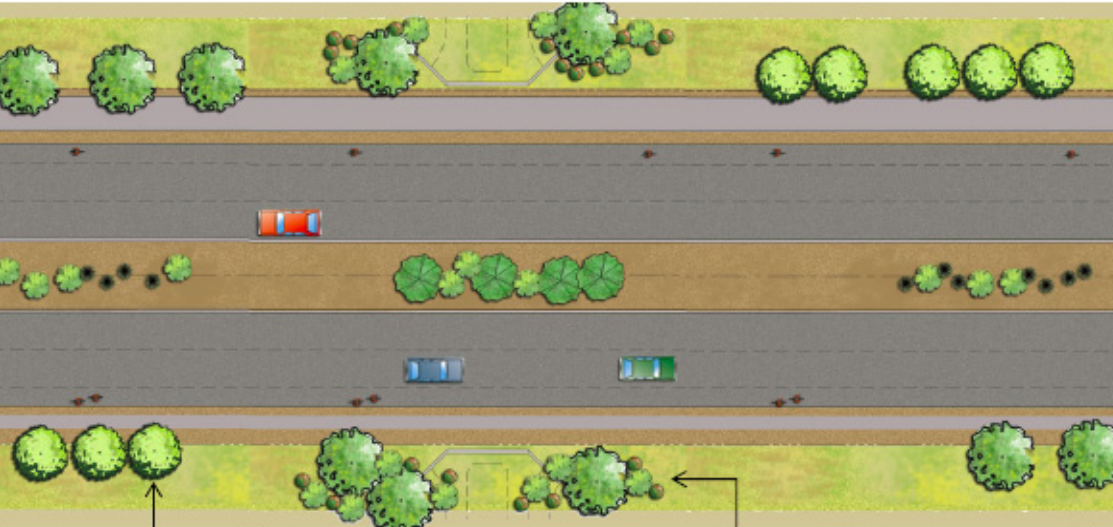
Appendix C

Landscape Concept Elements

Water Harvesting



Arrangement of Planting to Protect Wildlife



Trees only between drainage crossings

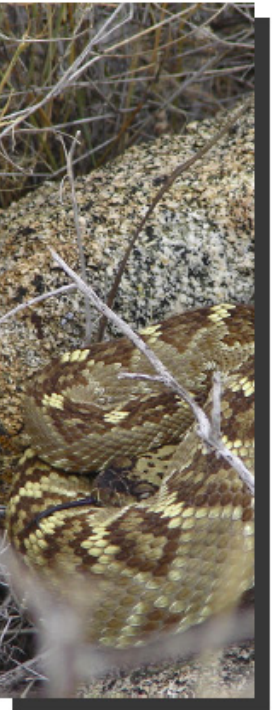
Concentrate understory species at drainage crossings

Landscape Themes

Archeology



Wildlife



Water/Geology/Topography



Median Bull Nose Paving

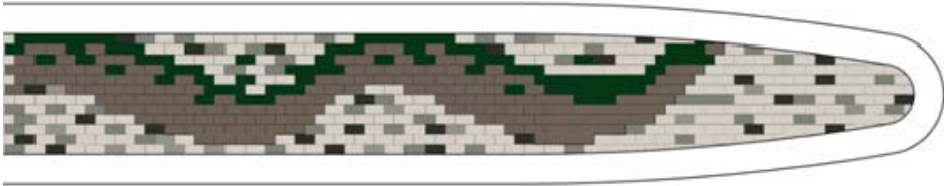
Archeology



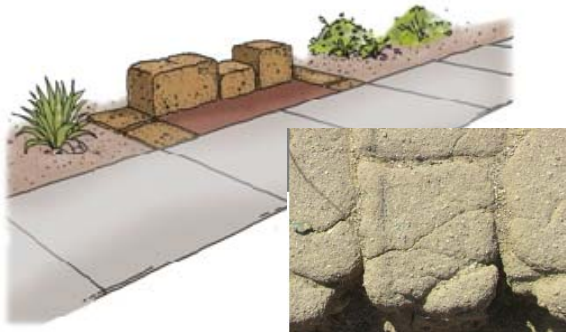
Wildlife



Water/Geology/Topography



Pedestrian Node Design



Colors



Plant Materials



Appendix D

Preliminary Project Costs

ENGINEERS OPINION OF PROBABLE COST
15% PRELIMINARY DESIGN
SILVERBELL ROAD (NORTH) - 4 LANE DIVIDED

Project Location : Silverbell Road, Ina Road to El Camino Del Cerro
Project Description : Roadway Widening

			TOTAL		
			INA TO DEL CERRO		
ITEM No.	ITEM DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
2010001	CLEARING AND GRUBBING	L SUM	1	\$80,000.00	\$80,000.00
2020001	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L SUM	1	\$30,000.00	\$30,000.00
2020020	REMOVAL OF CONCRETE CURB	L FT	246	\$4.00	\$984.00
2020025	REMOVAL OF CONCRETE SIDEWALK, DRIVEWAYS AND SLABS	SQ FT	1,443	\$2.00	\$2,886.00
2020029	REMOVAL OF ASPHALTIC CONCRETE PAVEMENT	SQ YD	85,392	\$1.50	\$128,088.00
2020072	REMOVE AND SALVAGE GUARDRAIL	L FT	107	\$5.00	\$535.00
2030301	ROADWAY EXCAVATION	CU YD	37,000	\$7.00	\$259,000.00
2030401	DRAINAGE EXCAVATION	CU YD	6,840	\$6.00	\$41,040.00
2030456	GRADED CHANNEL	L.FT.	1,409	\$20.00	\$28,180.00
2030901	BORROW	CU YD	420,000	\$14.00	\$5,880,000.00
3030021	AGGREGATE BASE COURSE	CU YD	31,479	\$25.00	\$786,975.00
4040111	BITUMINOUS TACK COAT	TON	54	\$725.00	\$39,150.00
4060004	ASPHALTIC CONCRETE (1/2" MIX)	TON	30,811	\$50.00	\$1,540,550.00
4130040	ASPHALTIC CONRETE (ASPHALT-RUBBER)	TON	17,606	\$70.00	\$1,232,420.00
5011022	PIPE, REINFORCED CONCRETE 24"	L.FT.	2,757	\$55.00	\$151,635.00
5011032	PIPE, REINFORCED CONCRETE 30"	L.FT.	1,606	\$65.00	\$104,390.00
5011042	PIPE, REINFORCED CONCRETE 36"	L.FT.	2,355	\$85.00	\$200,175.00
5011047	PIPE, REINFORCED CONCRETE 42"	L.FT.	475	\$100.00	\$47,500.00
5011052	PIPE, REINFORCED CONCRETE 48"	L.FT.	1,194	\$120.00	\$143,280.00
5011057	PIPE, REINFORCED CONCRETE 54"	L.FT.	288	\$200.00	\$57,600.00
5012524	STORM DRAIN PIPE, 24"	L FT	3,200	\$55.00	\$176,000.00
5030106	RCBC WINGWALLS (INLET)	EACH	13	\$15,000.00	\$195,000.00
5030141	GRATED CATCH BASINS	EACH	3	\$3,500.00	\$10,500.00
5030166	RCBC WINGWALLS (OUTLET)	EACH	13	\$15,000.00	\$195,000.00
5030601	CATCH BASIN	EA	55	\$5,500.00	\$302,500.00
5030602	CATCH BASIN W/ SPILLWAY SCUPPER	EA	25	\$4,500.00	\$112,500.00
5050089	MANHOLE, STORM DRAIN	EA	8	\$3,500.00	\$28,000.00
5090600	SEWER MISC WORK	L SUM	1	\$25,000.00	\$25,000.00
5107005	POTABLE WATER, CORROSION RPT	L SUM	1	\$5,000.00	\$5,000.00
5110001	MISC WATER ADJUSTMENTS	L SUM	1	\$500,000.00	\$500,000.00

continued			TOTAL		
			INA TO DEL CERRO		
ITEM No.	ITEM DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
6010001	REINFORCED CONCRETE BOX CULVERT (1-10' X 4')	L.FT.	140	\$900.00	\$126,000.00
6010002	REINFORCED CONCRETE BOX CULVERT (1-10' X 5')	L.FT.	167	\$1,000.00	\$167,000.00
6010003	REINFORCED CONCRETE BOX CULVERT (1-10' X 6')	L.FT.	153	\$1,000.00	\$153,000.00
6010004	REINFORCED CONCRETE BOX CULVERT (2-8' X 4')	L.FT.	122	\$1,000.00	\$122,000.00
6010005	REINFORCED CONCRETE BOX CULVERT (2-8' X 5')	L.FT.	147	\$1,100.00	\$161,700.00
6010006	REINFORCED CONCRETE BOX CULVERT (2-10' X 4')	L.FT.	128	\$1,100.00	\$140,800.00
6010007	REINFORCED CONCRETE BOX CULVERT (2-10' X 5')	L.FT.	274	\$1,200.00	\$328,800.00
6010008	REINFORCED CONCRETE BOX CULVERT (2-12'X 8')	L.FT.	161	\$1,500.00	\$241,500.00
6010009	REINFORCED CONCRETE BOX CULVERT (3-10' X 5')	L.FT.	168	\$2,000.00	\$336,000.00
6010010	REINFORCED CONCRETE BOX CULVERT (4-10'X 4')	L.FT.	148	\$2,500.00	\$370,000.00
6010011	REINFORCED CONCRETE BOX CULVERT (5-12' X 10')	L.FT.	167	\$4,000.00	\$668,000.00
6010902	BRIDGE	SQ. FT.	12,720	\$125.00	\$1,590,000.00
6016087	PIPE HEADWALLS	EACH	34	\$5,500.00	\$187,000.00
6080000	SIGNING	L SUM	1	\$135,000.00	\$135,000.00
6200001	SOIL NAILING (CUT WALLS)	S.F.	9,400	\$45.00	\$423,000.00
6200002	SOIL NAILING, ARCHITECTURAL FACE	S.F.	9,400	\$30.00	\$282,000.00
6200003	SOIL NAILING, DRAINAGE SWALE	L.F.	1,700	\$15.00	\$25,500.00
7040000	PAVEMENT MARKINGS	L SUM	1	\$110,000.00	\$110,000.00
7320085	FIBER OPTIC COMMUNICATIONS CONDUIT	LSUM	1	\$330,000.00	\$330,000.00
7370000	TRAFFIC SIGNAL (SUNSET NORTH)	L SUM	1	\$225,000.00	\$225,000.00
7370001	TRAFFIC SIGNAL (SUNSET SOUTH)	L SUM	1	\$225,000.00	\$225,000.00
8070000	LANDSCAPING	L SUM	1	\$1,200,000.00	\$1,200,000.00
8070000	IRRIGATION	L SUM	1	\$400,000.00	\$400,000.00
9080001	CONCRETE CURB	L FT	47,338	\$9.00	\$426,042.00
9080051	CONCRETE CURB AND GUTTER	L FT	37,203	\$15.00	\$558,045.00
9080201	CONCRETE SIDEWALK	SQ FT	8,294	\$3.00	\$24,882.00
9080202	ASPHALT MULTI-USE PATH	SQ FT	194,044	\$3.00	\$582,132.00
9080280	CURB ACCESS RAMP	EA	15	\$1,000.00	\$15,000.00
9080287	CURB ACCESS RAMP (SPECIAL) (MULTI-USE PATH)	EA	4	\$1,200.00	\$4,800.00

continued			TOTAL		
			INA TO DEL CERRO		
ITEM No.	ITEM DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
9080303	CONCRETE DRIVEWAY	SQ FT	9,307	\$5.00	\$46,535.00
9090002	SURVEY MONUMENT	EA	13	\$300.00	\$3,900.00
9130001	DUMPED RIPRAP	CU. YD.	258	\$100.00	\$25,800.00
9130005	GABION LINED OUTLET	CU. YD.	407	\$150.00	\$61,050.00
9201000	CONCRETE CHANNEL LINING	SQ. YD.	5,018	\$80.00	\$401,440.00
9300110	MISC UTILITY RELOCATIONS	L SUM	1	\$250,000.00	\$250,000.00
9320001	CONCRETE UNIT PAVERS (MEDIAN NOSES)	SQ FT	32,396	\$7.00	\$226,772.00
9330001	METAL HANDRAIL	L FT	276	\$21.00	\$5,796.00
INTERMEDIATE CONSTRUCTION SUBTOTAL				\$22,883,382.00	
CONTINGENCIES			25.0%		\$5,720,845.50
INTERMEDIATE CONSTRUCTION SUBTOTAL				\$28,604,227.50	
EROSION CONTROL AND POLLUTION PROVENTION (AZPDES)		4.0%			\$1,144,169.10
CONTRACTOR QUALITY CONTROL		3.0%			\$858,126.83
SURVEY AND CONSTRUCTION LAYOUT		3.0%			\$858,126.83
ENGINEERS FIELD OFFICE		1.0%			\$286,042.28
MAINTENANCE AND PROTECTION OF TRAFFIC		5.0%			\$1,430,211.38
INTERMEDIATE CONSTRUCTION SUBTOTAL				\$33,180,903.90	
MOBILIZATION		8.0%			\$2,654,472.31
CONSTRUCTION COST SUBTOTAL					\$35,835,376.21
CONSTRUCTION ENGINEERING/ADMIN		12.0%			\$4,300,245.15
CONSTRUCTION COST TOTAL				\$40,135,621.36	
FINAL DESIGN		10.0%			\$3,583,537.62
INDIVIDUAL 401/404 PERMITS					\$250,000.00
ARCHAEOLOGICAL CLEARANCE					\$8,000,000.00
RIGHT OF WAY/EASEMENT ACQUISITION					\$3,100,000.00
PROJECT COST				\$55,069,158.98	

ENGINEERS OPINION OF PROBABLE COST
15% PRELIMINARY DESIGN
SILVERBELL ROAD (NORTH) - 3 LANE/4-LANE ALTERNATIVE

Project Location : Silverbell Road, Ina Road to El Camino Del Cerro
Project Description : Roadway Widening

			TOTAL		
			INA TO DEL CERRO		
ITEM No.	ITEM DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
2010001	CLEARING AND GRUBBING	L SUM	1	\$80,000.00	\$80,000
2020001	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L SUM	1	\$30,000.00	\$30,000
2020020	REMOVAL OF CONCRETE CURB	L FT	246	\$4.00	\$984
2020025	REMOVAL OF CONCRETE SIDEWALK, DRIVEWAYS AND SLABS	SQ FT	1,443	\$2.00	\$2,886
2020029	REMOVAL OF ASPHALTIC CONCRETE PAVEMENT	SQ YD	85,392	\$1.50	\$128,088
2020072	REMOVE AND SALVAGE GUARDRAIL	L FT	107	\$5.00	\$535
2030301	ROADWAY EXCAVATION	CU YD	34,000	\$7.00	\$238,000
2030401	DRAINAGE EXCAVATION	CU YD	6,840	\$6.00	\$41,040
2030456	GRADED CHANNEL	L.FT.	1,409	\$20.00	\$28,180
2030601	ROADSIDE DITCH	L.FT.	16,437	\$10.00	\$164,370
2030901	BORROW	CU YD	365,000	\$14.00	\$5,110,000
3030021	AGGREGATE BASE COURSE	CU YD	31,570	\$25.00	\$789,250
4040111	BITUMINOUS TACK COAT	TON	51	\$725.00	\$36,975
4060004	ASPHALTIC CONCRETE (1/2" MIX)	TON	29,100	\$50.00	\$1,455,000
4130040	ASPHALTIC CONRETE (ASPHALT-RUBBER)	TON	16,589	\$70.00	\$1,161,230
5011022	PIPE, REINFORCED CONCRETE 24"	L.FT.	2,553	\$55.00	\$140,415
5011032	PIPE, REINFORCED CONCRETE 30"	L.FT.	1,437	\$65.00	\$93,405
5011042	PIPE, REINFORCED CONCRETE 36"	L.FT.	2,111	\$85.00	\$179,435
5011047	PIPE, REINFORCED CONCRETE 42"	L.FT.	399	\$100.00	\$39,900
5011052	PIPE, REINFORCED CONCRETE 48"	L.FT.	1,085	\$120.00	\$130,200
5011057	PIPE, REINFORCED CONCRETE 54"	L.FT.	250	\$200.00	\$50,000
5012524	STORM DRAIN PIPE, 24"	L FT	800	\$55.00	\$44,000
5030106	RCBC WINGWALLS (INLET)	EACH	13	\$15,000.00	\$195,000
5030141	GRATED CATCH BASINS	EACH	3	\$3,500.00	\$10,500
5030166	RCBC WINGWALLS (OUTLET)	EACH	13	\$15,000.00	\$195,000
5030601	CATCH BASIN	EA	14	\$5,500.00	\$75,625
5030602	CATCH BASIN W/ SPILLWAY SCUPPER	EA	6	\$4,500.00	\$28,125
5050089	MANHOLE, STORM DRAIN	EA	2	\$3,500.00	\$7,000
5090600	SEWER MISC WORK	L SUM	1	\$25,000.00	\$25,000
5107005	POTABLE WATER, CORROSION RPT	L SUM	1	\$5,000.00	\$5,000
5110001	MISC WATER ADJUSTMENTS	L SUM	1	\$500,000.00	\$500,000

			TOTAL		
			INA TO DEL CERRO		
ITEM No.	ITEM DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
6010001	REINFORCED CONCRETE BOX CULVERT (1-10' X 4')	L.FT.	140	\$900.00	\$126,000
6010002	REINFORCED CONCRETE BOX CULVERT (1-10' X 5')	L.FT.	167	\$1,000.00	\$167,000
6010003	REINFORCED CONCRETE BOX CULVERT (1-10' X 6')	L.FT.	135	\$1,000.00	\$153,000
6010004	REINFORCED CONCRETE BOX CULVERT (2-8' X 4')	L.FT.	104	\$1,000.00	\$122,000
6010005	REINFORCED CONCRETE BOX CULVERT (2-8' X 5')	L.FT.	127	\$1,100.00	\$161,700
6010006	REINFORCED CONCRETE BOX CULVERT (2-10' X 4')	L.FT.	110	\$1,100.00	\$140,800
6010007	REINFORCED CONCRETE BOX CULVERT (2-10' X 5')	L.FT.	245	\$1,200.00	\$328,800
6010008	REINFORCED CONCRETE BOX CULVERT (2-12'X 8')	L.FT.	143	\$1,500.00	\$241,500
6010009	REINFORCED CONCRETE BOX CULVERT (3-10' X 5')	L.FT.	143	\$2,000.00	\$336,000
6010010	REINFORCED CONCRETE BOX CULVERT (4-10'X 4')	L.FT.	148	\$2,500.00	\$370,000
6010011	REINFORCED CONCRETE BOX CULVERT (5-12' X 10')	L.FT.	148	\$4,000.00	\$668,000
6010902	BRIDGE	SQ. FT.	10,809	\$125.00	\$1,351,125
6016087	PIPE HEADWALLS	EACH	34	\$5,500.00	\$187,000
6080000	SIGNING	L SUM	1	\$135,000.00	\$135,000
6200001	SOIL NAILING (CUT WALLS)	S.F.	9,400	\$45.00	\$423,000
6200002	SOIL NAILING, ARCHITECTURAL FACE	S.F.	9,400	\$30.00	\$282,000
6200003	SOIL NAILING, DRAINAGE SWALE	L.F.	1,700	\$15.00	\$25,500
7040000	PAVEMENT MARKINGS	L SUM	1	\$110,000.00	\$110,000
7320085	FIBER OPTIC COMMUNICATIONS CONDUIT	LSUM	1	\$300,000.00	\$300,000
7370000	TRAFFIC SIGNAL (SUNSET NORTH)	L SUM	1	\$225,000.00	\$225,000
7370001	TRAFFIC SIGNAL (SUNSET SOUTH)	L SUM	1	\$225,000.00	\$225,000
8070000	LANDSCAPING	L SUM	1	\$1,200,000.00	\$1,200,000
8070000	IRRIGATION	L SUM	1	\$400,000.00	\$400,000
9080001	CONCRETE CURB	L FT	22,425	\$9.00	\$201,825
9080051	CONCRETE CURB AND GUTTER	L FT	2,376	\$15.00	\$35,640
9080201	CONCRETE SIDEWALK	SQ FT	9,782	\$3.00	\$29,346
9080202	ASPHALT MULTI-USE PATH	SQ FT	191,032	\$3.00	\$573,096
9080280	CURB ACCESS RAMP	EA	15	\$1,000.00	\$15,000
9080287	CURB ACCESS RAMP (SPECIAL) (MULTI-USE PATH)	EA	4	\$1,200.00	\$4,800

continued

			TOTAL		
			INA TO DEL CERRO		
ITEM No.	ITEM DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
9080303	CONCRETE DRIVEWAY	SQ FT	9,307	\$5.00	\$46,535
9090002	SURVEY MONUMENT	EA	13	\$300.00	\$3,900
9130001	DUMPED RIPRAP	CU. YD.	258	\$100.00	\$25,800
9130005	GABION LINED OUTLET	CU. YD.	407	\$150.00	\$61,050
9201000	CONCRETE CHANNEL LINING	SQ. YD.	5,018	\$80.00	\$401,440
9300110	MISC UTILITY RELOCATIONS	L SUM	1	\$250,000.00	\$250,000
9320001	CONCRETE UNIT PAVERS (MEDIAN NOSES)	SQ FT	19,211	\$7.00	\$134,477
9330001	METAL HANDRAIL	L FT	276	\$21.00	\$5,796
INTERMEDIATE CONSTRUCTION SUBTOTAL			\$20,452,273		
CONTINGENCIES			25.0%		\$5,113,068
INTERMEDIATE CONSTRUCTION SUBTOTAL			\$25,565,341		
ERROSION CONTROL AND POLLUTION PROVENTION (AZDES)			4.0%		\$1,022,614
CONTRACTOR QUALITY CONTROL			3.0%		\$766,960
SURVEY AND CONSTRUCTION LAYOUT			3.0%		\$766,960
ENGINEERS FIELD OFFICE			1.0%		\$255,653
MAINTENANCE AND PROTECTION OF TRAFFIC			5.0%		\$1,278,267
INTERMEDIATE CONSTRUCTION SUBTOTAL			\$29,655,796		
MOBILIZATION			8.0%		\$2,372,464
CONSTRUCTION SUBTOTAL			\$32,028,260		
CONSTRUCTION ENGINEERING/ADMIN			12.0%		\$3,843,391
CONSTRUCTION TOTAL			\$35,871,651		
FINAL DESIGN			10.0%		\$3,202,826
INDIVIDUAL 401/404 PERMITS					\$250,000
ARCHAEOLOGICAL CLEARANCE					\$7,000,000
RIGHT OF WAY/EASEMENT ACQUISITION					\$2,200,000
PROJECT TOTAL			\$48,524,477		

ENGINEERS OPINION OF PROBABLE COST
30% PRELIMINARY DESIGN
SILVERBELL ROAD (SOUTH)

Project Location : Silverbell Road, El Camino Del Cerro to Grant Road
Project Description : Roadway Widening

			TOTAL		
			INA TO DEL CERRO		
ITEM No.	ITEM DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
2010001	CLEARING AND GRUBBING	L SUM	1	\$100,000.00	\$100,000
2020001	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L SUM	1	\$40,000.00	\$40,000
2020020	REMOVAL OF CONCRETE CURB	L FT	3,930	\$4.00	\$15,720
2020025	REMOVAL OF CONCRETE SIDEWALK, DRIVEWAYS AND SLABS	SQ FT	16,500	\$2.00	\$33,000
2020029	REMOVAL OF ASPHALTIC CONCRETE PAVEMENT	SQ YD	116,173	\$1.50	\$174,260
2020072	REMOVE AND SALVAGE GUARDRAIL	L FT	1,280	\$5.00	\$6,400
2030301	ROADWAY EXCAVATION	CU YD	49,000	\$7.00	\$343,000
2030401	DRAINAGE EXCAVATION	CU YD	12,718	\$6.00	\$76,308
2030456	GRADED CHANNEL	L.FT.	3,529	\$20.00	\$70,580
2030901	BORROW	CU YD	151,000	\$14.00	\$2,114,000
3030021	AGGREGATE BASE COURSE	CU YD	40,603	\$25.00	\$1,015,075
4040111	BITUMINOUS TACK COAT	TON	61	\$725.00	\$44,225
4060004	ASPHALTIC CONCRETE (1/2" MIX)	TON	34,773	\$50.00	\$1,738,650
4130040	ASPHALTIC CONRETE (ASPHALT-RUBBER)	TON	19,870	\$70.00	\$1,390,900
5011022	PIPE, REINFORCED CONCRETE 24"	L.FT.	1,875	\$55.00	\$103,125
5011032	PIPE, REINFORCED CONCRETE 30"	L.FT.	1,300	\$65.00	\$84,500
5011042	PIPE, REINFORCED CONCRETE 36"	L.FT.	4,709	\$85.00	\$400,265
5011052	PIPE, REINFORCED CONCRETE 48"	L.FT.	855	\$120.00	\$102,600
5012524	STORM DRAIN PIPE, 24"	L FT	3,414	\$55.00	\$187,770
5030106	RCBC WINGWALLS (INLET)	EACH	13	\$15,000.00	\$195,000
5030141	GRATED CATCH BASINS	EACH	3	\$3,500.00	\$10,500
5030141	CATCH BASIN, AREA INLET	EA	1	\$3,500.00	\$3,500
5030142	CATCH BASIN, MEDIAN SCUPPER	EA	2	\$1,000.00	\$2,000
5030166	RCBC WINGWALLS (OUTLET)	EACH	13	\$15,000.00	\$195,000
5030603	CATCH BASIN (4' WING)	EA	4	\$3,200.00	\$12,800
5030604	CATCH BASIN (DOUBLE 4' WING)	EA	1	\$5,500.00	\$5,500
5030605	CATCH BASIN (8' WING)	EA	18	\$4,000.00	\$72,000
5030606	CATCH BASIN (DOUBLE 8' WING)	EA	7	\$5,000.00	\$35,000
5030607	CATCH BASIN (12' WING)	EA	15	\$4,200.00	\$63,000
5030608	CATCH BASIN (DOUBLE 12' WING)	EA	3	\$5,500.00	\$16,500
5030609	CATCH BASIN (16' WING)	EA	5	\$4,500.00	\$22,500

continued			TOTAL		
			INA TO DEL CERRO		
ITEM No.	ITEM DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
5030613	CATCH BASIN, W/ SPILLWAY SCUPPER (4' WING)	EA	2	\$3,500.00	\$7,000
5030614	CATCH BASIN W/ SPILLWAY SCUPPER (DOUBLE 8' WING)	EA	2	\$4,500.00	\$9,000
5030615	CATCH BASIN W/ SPILLWAY SCUPPER (8' WING)	EA	8	\$4,000.00	\$32,000
5030616	CATCH BASIN W/ SPILLWAY SCUPPER (DOUBLE 12' WING)	EA	1	\$6,000.00	\$6,000
5030617	CATCH BASIN W/ SPILLWAY SCUPPER (12' WING)	EA	9	\$5,000.00	\$45,000
5030619	CATCH BASIN W/ SPILLWAY SCUPPER (16' WING)	EA	1	\$6,000.00	\$6,000
5050021	MANHOLE, CONNECT TO EXISTING STORM DRAIN MANHOLE	EA	3	\$2,000.00	\$6,000
5050089	MANHOLE, STORM DRAIN	EA	8	\$3,500.00	\$28,000
5050090	STORM DRAIN PIPE END SECTIONS	EA	10	\$250.00	\$2,500
5090600	SEWER MISC WORK	L SUM	1	\$25,000.00	\$25,000
5107005	POTABLE WATER, CORROSION RPT	L SUM	1	\$5,000.00	\$5,000
5110001	MISC WATER ADJUSTMENTS	L SUM	1	\$500,000.00	\$500,000
6010001	REINFORCED CONCRETE BOX CULVERT (1-10' X 4')	L.FT.	333	\$900.00	\$299,700
6010002	REINFORCED CONCRETE BOX CULVERT (1-10' X 6')	L.FT.	450	\$1,000.00	\$450,000
6010003	REINFORCED CONCRETE BOX CULVERT (2-8' X 4')	L.FT.	205	\$1,000.00	\$205,000
6010004	REINFORCED CONCRETE BOX CULVERT (2-10' X 4')	L.FT.	272	\$1,100.00	\$299,200
6010005	REINFORCED CONCRETE BOX CULVERT (2-10' X 5')	L.FT.	40	\$1,200.00	\$48,000
6010006	REINFORCED CONCRETE BOX CULVERT (3-10' X 5')	L.FT.	133	\$2,000.00	\$266,000
6010007	REINFORCED CONCRETE BOX CULVERT (4-12' X 8')	L.FT.	128	\$3,000.00	\$384,000
6010008	REINFORCED CONCRETE BOX CULVERT (5-10' X 5')	L.FT.	139	\$3,200.00	\$444,800
6010009	REINFORCED CONCRETE BOX CULVERT (5-12' X 8')	L.FT.	59	\$3,500.00	\$206,500
6010010	REINFORCED CONCRETE BOX CULVERT (6-10' X 5')	L.FT.	135	\$5,000.00	\$675,000
6010011	REINFORCED CONCRETE BOX CULVERT (6-10' X 6')	L.FT.	65	\$5,100.00	\$331,500
6010012	REINFORCED CONCRETE BOX CULVERT (6-12' X 8')	L.FT.	147	\$6,000.00	\$882,000

continued			TOTAL		
			INA TO DEL CERRO		
ITEM No.	ITEM DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
6010902	BRIDGE	SQ. FT.	13,200	\$100.00	\$1,320,000
6016087	PIPE HEADWALLS	EACH	8	\$5,500.00	\$44,000
6080000	SIGNING	L SUM	1	\$135,000.00	\$135,000
6200001	SOIL NAILING (CUT WALLS)	S.F.	22,180	\$45.00	\$998,100
6200002	SOIL NAILING, ARCHITECTURAL FACE	S.F.	22,180	\$30.00	\$665,400
6200003	SOIL NAILING, DRAINAGE SWALE	L.F.	2,410	\$15.00	\$36,150
7040000	PAVEMENT MARKINGS	L SUM	1	\$100,000.00	\$100,000
7320085	FIBER OPTIC COMMUNICATIONS CONDUIT	LSUM	1	\$330,000.00	\$330,000
7360010	STREET LIGHTING (GORET TO GRANT)	LSUM	1	\$0.00	\$0
7370000	TRAFFIC SIGNAL (DEL CERRO)	L SUM	1	\$300,000.00	\$300,000
7370001	TRAFFIC SIGNAL (SWEETWATER)	L SUM	1	\$250,000.00	\$250,000
7370002	TRAFFIC SIGNAL (GORET)	L SUM	1	\$250,000.00	\$250,000
7370003	TRAFFIC SIGNAL (GRANT)	L SUM	1	\$200,000.00	\$200,000
8070000	LANDSCAPING	L SUM	1	\$1,500,000.00	\$1,500,000
8070000	IRRIGATION	L SUM	1	\$400,000.00	\$400,000
9050001	GUARDRAIL, W-BEAN, SINGLE FACE	L FT	140	\$30.00	\$4,200
9080001	CONCRETE CURB	L FT	79,543	\$9.00	\$715,887
9080201	CONCRETE SIDEWALK	SQ FT	48,541	\$3.00	\$145,623
9080202	ASPHALT MULTI-USE PATH	SQ FT	165,175	\$3.00	\$495,525
9080280	CURB ACCESS RAMP	EA	70	\$1,000.00	\$70,000
9080287	CURB ACCESS RAMP, MULTI-USE PATH	EA	25	\$1,200.00	\$30,000
9080303	CONCRETE DRIVEWAY	SQ FT	8,565	\$5.00	\$42,825
9090002	SURVEY MONUMENT	EA	20	\$300.00	\$6,000
9130001	DUMPED RIPRAP	CU. YD.	260	\$100.00	\$26,000
9130005	GABION LINED OUTLET	CU. YD.	441	\$150.00	\$66,150
9140110	WALL(BLOCK)	L FT	380	\$30.00	\$11,400
9201000	CONCRETE CHANNEL LINING	SQ. YD.	9,269	\$80.00	\$741,520
9300110	MISC UTILITY RELOCATIONS	L SUM	1	\$200,000.00	\$200,000
9320001	CONCRETE UNIT PAVERS (MEDIAN NOSES)	SQ FT	55,062	\$7.00	\$385,434
9330001	METAL HANDRAIL	L FT	356	\$21.00	\$7,476
INTERMEDIATE CONSTRUCTION SUBTOTAL			\$23,313,568		
CONTINGENCIES			20.0%		\$4,662,714
INTERMEDIATE CONSTRUCTION SUBTOTAL			\$27,976,281		
ERROSION CONTROL AND POLLUTION PROVENTION (AZPDES)			4.0%		\$1,119,051
CONTRACTOR QUALITY CONTROL			3.0%		\$839,288
SURVEY AND CONSTRUCTION LAYOUT			3.0%		\$839,288

ENGINEERS FIELD OFFICE		1.0%		\$279,763
MAINTENANCE AND PROTECTION OF TRAFFIC		5.0%		\$1,398,814
INTERMEDIATE CONSTRUCTION SUBTOTAL			\$32,452,486	
MOBILIZATION		8.0%		\$2,596,199
CONSTRUCTION SUBTOTAL			\$35,048,685	
CONSTRUCTION ENGINEERING/ADMIN		12.0%		\$4,205,842
CONSTRUCTION TOTAL			\$39,254,527	
FINAL DESIGN		10.0%		\$3,504,868
INDIVIDUAL 401/404 PERMITS				\$250,000
ARCHAEOLOGICAL CLEARANCE				\$4,000,000
RIGHT OF WAY/EASEMENT ACQUISITION				\$750,000
PROJECT TOTAL			\$47,759,396	

