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I. INTRODUCTION

The purpose of this Design Analysis Report is to describe proposed improvements for Eubank Boulevard from San Antonio Drive to Paseo del Norte, convey the results of engineering analysis performed to-date, and document engineering criteria and methodology to be used for design. A summary of design coordination issues that have been identified is also provided.

II. PROJECT BACKGROUND

This project involves improvements to Eubank Boulevard from San Antonio Drive to Paseo del Norte in Bernalillo County, NM. The project area is shown on the vicinity map in Figure 1 (page 2). The portion of the project south of San Francisco Avenue and west of Eubank resides within City of Albuquerque limits, the remaining portion to the north and east is in Bernalillo County. Proposed improvements include widening Eubank Boulevard to two-lanes in each direction with bike lanes and a divided median. The project also includes construction of pedestrian facilities and drainage improvements. Funding for the project has been secured from County, State, and Federal sources.

Updated Design Concept

Bernalillo County prepared an Environmental Assessment (EA) for Eubank Boulevard from San Antonio to Paseo del Norte in March 2000, which included a Preferred Alternative for recommended improvements (Build Alternative 1). Due to amount of time elapsed since the preparation of the EA, the County determined that it would be prudent to review the Preferred Alternative and consider refinements. Representatives of Bernalillo County and the design team (Parsons Brinckerhoff, Vector Engineering, and D. Pennington & Associates) met in December 2008/January 2009 for a Design Optimization Workshop. A summary of the discussions is provided in Appendix F.

The proposed design as described in this report, and shown in Appendix B, was prepared based on refinements and concepts discussed at the design workshop meetings. The primary goal of the changes was to provide more efficient access to Eubank Boulevard compared to Build Alternative 1, based on a current understanding and analysis of the transportation needs within the corridor. A project information meeting was held on March 3rd 2009, at which the updated concept was presented to the public. While comments are still being received, initial public response indicates support for the new concept.

Environmental Reevaluation

Based on the updated design concept, the County will conduct a reevaluation of project impacts. Upon completion, expected in May 2009, the Environmental Reevaluation will be submitted to the Federal Highway Administration (FHWA).

Project Schedule

Parsons Brinckerhoff is scheduled to complete design of Eubank Boulevard in December 2009. Construction for the project, currently estimated at $11 million, is expected to begin Spring 2010 with a duration of 12 to 18 months.

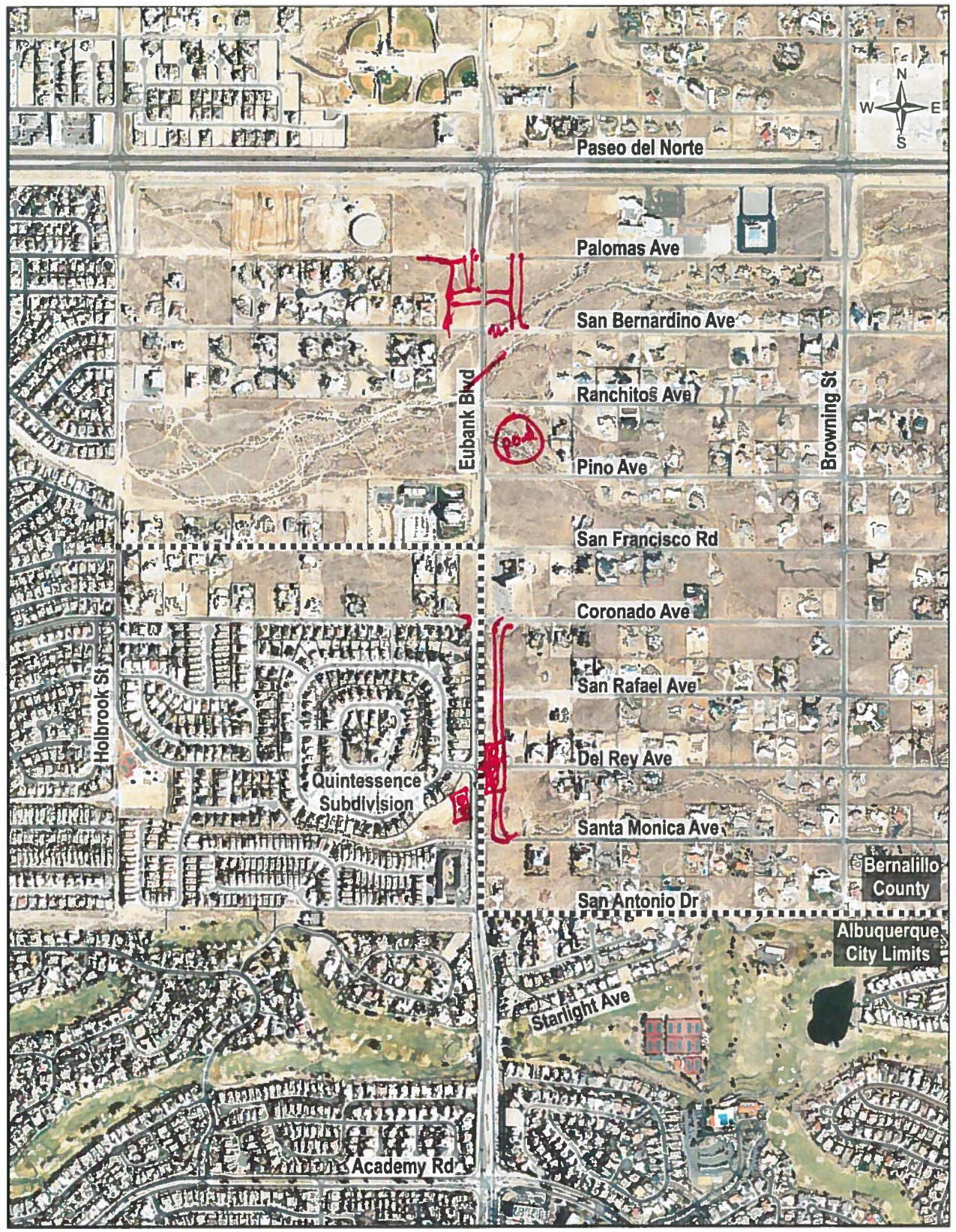


Figure 1: Vicinity Map

III. PROPOSED IMPROVEMENTS

This section briefly describes the proposed improvements for the project. Refer to Appendix A for Existing Conditions and Appendix B for proposed typical sections, preliminary plan and profile sheets, and right-of-way requirements.

A. Typical Section

Key elements of the proposed typical section include:

- *Two 12' driving lanes in each direction*
- *30' divided median* - The wide median will allow for passenger vehicles to make two-stage turning movements across Eubank at unsignalized intersections.
- *7' wide on-street bicycle lanes in each direction*
- *City Standard curb and gutter*
- *2% Cross Slope (east to west)* - The design team proposes to construct Eubank Boulevard maintaining a 2% cross slope across the entire typical section, rather than using normal crown. This section matches the natural terrain in the area, which slopes from east to west, and will help to reduce utility impacts and the overall height of cut/fill slopes or retaining walls.
- *6' wide sidewalk on one side of the road (with a 6' buffer from back of curb)*
- *10' wide multi-use trail on one side of the road*

Facilities that are not currently proposed as part of the project:

- Bus bays will not be provided as this portion of Eubank is not along a designated bus route.
- An equestrian trail was considered in the Environmental Assessment, but this is planned to be eliminated from the project since there are no existing or planned equestrian trails with which to connect.

B. Intersections

One new signalized intersection is proposed for the project at Eubank and Quintessence / Del Rey. All other intersections will be unsignalized. See Appendix C and D for details regarding traffic signal warrants and traffic analysis conducted.

C. Retaining Walls

Based on preliminary engineering, retaining walls are anticipated at Del Rey Avenue east of Eubank to accommodate proper intersection geometry. See Appendix B sheet 5 for approximate location. Additional needs for retaining walls will be evaluated as design progresses.

D. Drainage

PB will prepare a Drainage Report for the project. Details of existing drainage facilities, proposed drainage improvements, and drainage analysis will be provided in the report. A summary of proposed drainage improvements planned for the corridor includes:

- Curb and gutter with drainage inlets along the roadway (median and outside shoulder)
- A parallel storm drain system that connects to existing / proposed facilities
- An interim detention pond east of Eubank between Pino Ave. and Ranchitos Ave.
- A drainage structure to cross flows from the South Domingo Baca Arroyo under Eubank near Ranchitos Ave.

E. Right-of-Way and Access Control

The proposed right-of-way width along Eubank Boulevard within project area varies from 195 feet to 495 feet. This meets minimum street standard requirements for Bernalillo County and the City. Refer to Appendix B for a depiction of lots that are planned to be acquired for the project.

Access to Eubank Boulevard will be modified from existing conditions as follows:

- A frontage road east of Eubank will collect traffic from Santa Monica, Del Rey, San Rafael, and Coronado. The proposed frontage road will connect to Eubank at a signalized intersection at Quintessence / Del Rey.
- Coronado Ave. west of Eubank will not have direct access to Eubank Boulevard. The City is currently planning to construct a cul-de-sac at this location.
- Frontage roads east/west of Eubank will collect traffic from San Bernadino, Palomas, and the Paseo del Norte Frontage Road. The proposed frontage roads will connect to Eubank at an unsignalized intersection between San Bernadino and Palomas.

F. Utilities

While the project will be designed so as to avoid or reduce utility relocations to the extent possible, some existing utility conflicts are anticipated for the project. In particular, the overhead electric, underground telecommunications, and a waterline along the east side of Eubank may require relocation. Relocation work will be coordinated with respective utility owners once utility investigations have been completed and conflicts identified.

In addition, ABCWUA (Albuquerque Bernalillo County Water Utility Authority) is planning for future water and sewer line extensions into areas of North Albuquerque Acres that are not currently served. As part of this project, we recommend installing utility sleeves under Eubank Boulevard to accommodate crossings and avoid future disruption of the roadway.

IV. Design Coordination Issues

Based on the preliminary work prepared, the following issues have been identified that require coordination with project stakeholders.

- **Alignment Considerations**
  Two basic horizontal alignments options are being considered:

  - *Option A: East Alignment*
    Under this alignment, Eubank is shifted east at the north end of the project between San Francisco Avenue and Paseo del Norte. This is the alternative shown in Appendix B on the plan and profile sheets. This alternative is recommended by the design team, as it provides the following advantages:

    i. It provides a larger buffer between Eubank Boulevard and the East/West Frontage Roads. This added room allows for more vehicle queuing capacity at the frontage road intersection with Eubank. The additional buffer also provides the ability to design flatter slopes between Eubank and the Frontage Roads.

    ii. It provides improved horizontal geometry for Eubank (ability to design curves with larger radii). The alignment also matches well with the existing intersection at Eubank and Paseo del Norte - which is also shifted toward the east.

    iii. Under this alternative, the West Frontage Road can be constructed in a linear manner without the need for curvature (see Option B).

  - *Option B: West Alignment*
    Under this alignment (See Figure 2 page 6), Eubank is shifted west at the north end of the project between Pino Avenue and Paseo del Norte. This alternative creates tighter geometry for Eubank and the adjacent frontage roads, but has potential cost savings associated with fewer right-of-way impacts.

- **Right-of-Way and Maintenance - East Frontage Road A**
  East Frontage Road A (see plan and profile sheets – Appendix B) connects Santa Monica, Del Rey, San Rafael, and Coronado Avenue east of Eubank. Eubank Boulevard in this section of the project resides within the City, property east of the existing Right-of-Way is in Bernalillo County.

  Additional Right-of-Way will be required in this area in order to accommodate the frontage road. Discussions with the City are needed to agree upon jurisdiction and maintenance responsibilities for the frontage road within the newly acquired portion.

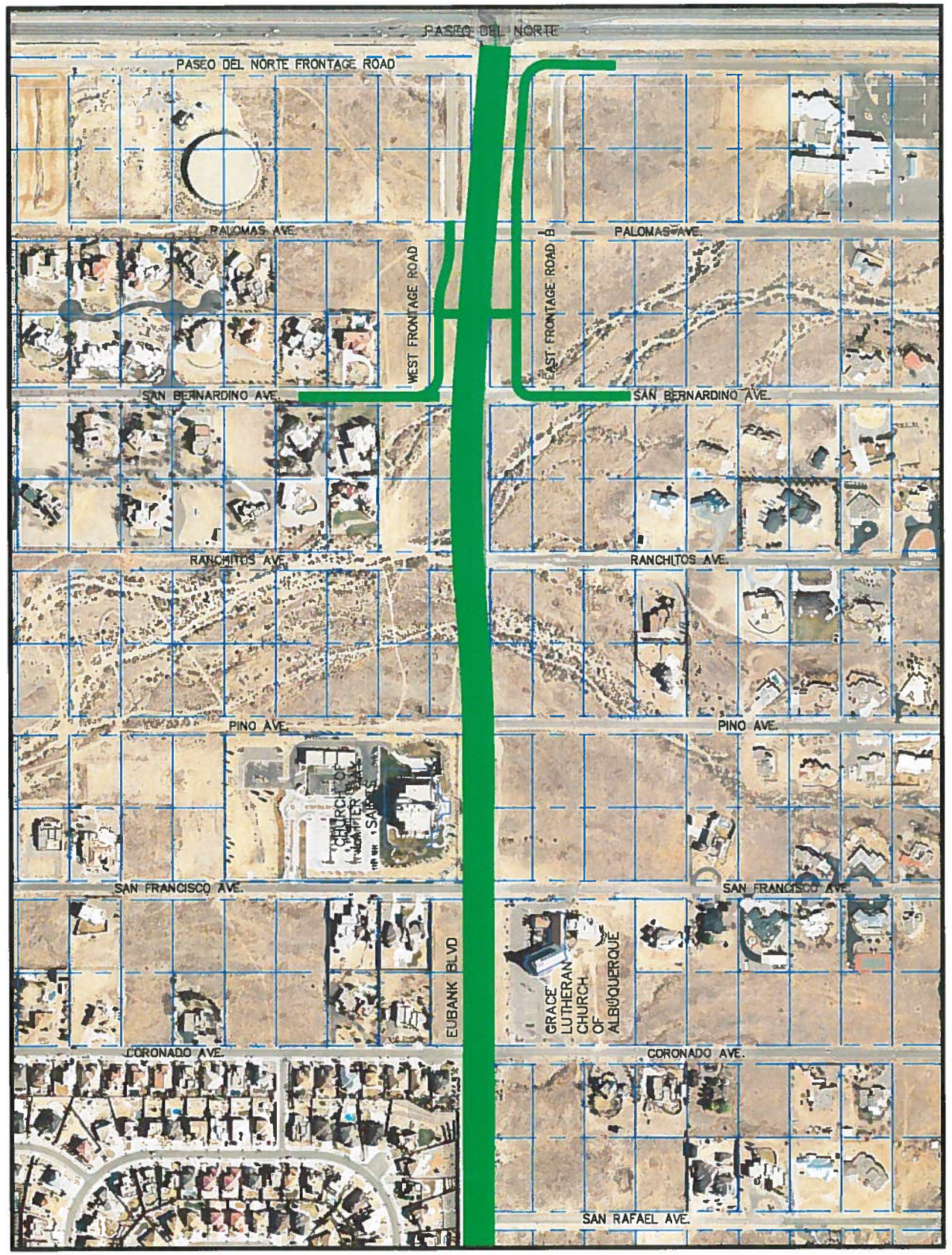


Figure 2: Eubank Boulevard – West Alignment Option

- **South Terminus Details (City of Albuquerque portion)**
  A determination of the existing pavement condition should be made at the south end of the Eubank (between Academy and San Antonio). The area will require restriping to match the proposed four-lane section continuing north on Eubank. Depending on pavement needs, potential options include:
    a. Mill and overlay with new striping
    b. Remove existing striping and restripe

- **OGFC (Open Graded Friction Course)**
  OGFC is generally not required for urban arterials. The County is not planning to include OGFC in the proposed pavement section for the project.

- **Signal Interconnect / ITS**
  Coordination with the City and County is required to determine potential needs for signal interconnect. Both the Eubank/Academy and Eubank/Paseo del Norte intersections are currently interconnected to their respective east-west arterials.

  Additionally, the Albuquerque Metropolitan Planning Area (AMPA) Regional ITS Architecture indicates Intelligent Transportation System (ITS) elements within the Eubank Boulevard project limits. The design team will coordinate with the Mid-Region Council of Governments (MRCOG) during development of the project to determine needs for the corridor. Provisions for the project may include installing conduit for future use.

- **Lighting**
  Lighting for the project is planned at the intersections only. Refer to Appendix E for lighting design and analysis discussion. Coordination with the City is needed to confirm details of the proposed lighting design.

- **Utility Sleeves**
  As noted previously, the project team recommends installing utility sleeves under Eubank Boulevard to accommodate future water and sewer line crossings. Coordination with the Albuquerque Bernalillo County Water Utility Authority will be necessary to determine appropriate locations for these sleeves.

- **Coronado Avenue cul-de-sac (west of Eubank)**
  The City has near-term plans to construct a cul-de-sac at the west end of Coronado Avenue adjacent to Eubank. This will eliminate direct access to Eubank Boulevard at this location. This portion of the project is within City Limits, therefore these improvements are currently planned to be incorporated into the proposed build condition for the project.

V. ENGINEERING CRITERIA AND METHODOLOGY

This section describes the engineering criteria and methodologies that will be used in the design of the project.

A. Roadway Design Criteria

The design for Eubank Boulevard will be based on the City of Albuquerque's *Development Process Manual (DPM)* and the 2004 edition of the American Association of State Highway and Transportation Officials' (AASHTO's) *A Policy on Geometric Design of Highways and Streets*. Although the two standards provide similar guidance and intent, the City *DPM* contains particular criteria that are used throughout the metropolitan area. It should be noted that the two standards are not mutually exclusive; the *DPM* refers to AASHTO in many instances.

For the portion of the project within City of Albuquerque limits, the criteria established in the DPM will be utilized. For the portion of the project within Bernalillo County limits, criteria established in either the DPM or AASHTO could be utilized. However, where feasible, an attempt be made to adhere to the more stringent standard throughout the corridor.

The primary factor that determines the engineering design criteria to be used is the functional classification of the roadway. Eubank Boulevard is classified as a **principal arterial** according to the Albuquerque Metropolitan Planning Area Long Range Roadway System map. The criteria in Table 1 (page 9) are based upon this classification.

1. Design Speed

The design speed that will be used for Eubank Boulevard is **50 mph**, per *DPM* Table 23.3.1. The posted speed limit along the project is expected to remain 40 mph.

2. Design Vehicle

Since the project area is predominantly residential, the design vehicle for the project is a passenger car (**P**).

3. Intersections

Intersection design will be based on criteria established in the City's DPM and AASHTO's *A Policy on Geometric Design of Highways and Streets*. Intersection sight distance will be evaluated to develop proper intersection geometry.

4. Driveways

Driveway widths, grades, and details will be deigned per the County's local policy.

5. Bicycle Facilities

Eubank Boulevard is designated as a bicycle route on the *Long Range Bikeway System* for the Albuquerque Urban Area. The facility will include on-street bike lanes (7 feet wide) in each direction.

6. ADA Compliance

The project design will be consistent with the provisions of the Americans with Disabilities Act. This includes consideration of sidewalk grades and clearance from utility appurtenances. The design team will also evaluate a means of providing ADA accessible access to pedestrian facilities along Eubank from adjacent side streets and frontage roads.

Table 1. Roadway Design Criteria

Roadway Design Criteria			
Eubank Boulevard			
Description	*Criteria (City DPM)*	*Criteria (AASHTO 2004)*	*Comments / Reference*
Design Speed (Principal Arterial)	50 mph	50 mph	
Design Vehicle	P	P	Passenger Car
Maximum Superelevation	4.0%	4.0%	
Curve Radii	Per Table 23.3.1	Per Exhibit 3-25	
Minimum Radius (w/ 4% Superelevation)	1000 ft	926 ft	
Minimum Radius (w/ 2% Cross Slope)	5000 ft	4940 ft	
Maximum Grade	6.0%	6.0%	
Minimum Grade	0.5%	0.5%	
Minimum K (sag) [SSD]	110	96	
Minimum K (crest) [SSD]	160	84	
Minimum Length of Vertical Curve	150 ft	-	
Max Grade Change Without Vertical Curve	0.40%	-	
Stopping Sight Distance (SSD)		425 ft	
Intersection Sight Distance (ISD)		480 ft	Passenger Car Design Vehicle
Normal Crown / Cross Slope	2.0%	2.0%	2% Cross Slope East to West
Frontage Roads			
Description	*Criteria (AASHTO 2004)*		*Comments / Reference*
Design Speed	25 mph		
Design Vehicle	P		Passenger Car
Maximum Superelevation	4.0%		
Curve Radii	Per Exhibit 3-25		
Minimum Radius (w/ 4% Superelevation)	154 ft		Design Exceptions likely required to minimize Right-of-Way impacts
Minimum Radius (w/ 2% Cross Slope)	1340 ft		
Maximum Grade	6.0%		
Minimum Grade	0.5%		
Minimum K (sag) [SSD]	26		Exhibit 3-75
Minimum K (crest) [SSD]	12		Exhibit 3-72
Minimum Length of Vertical Curve	-		
Max Grade Change Without Vertical Curve	-		
Stopping Sight Distance (SSD)	155 ft		
Intersection Sight Distance (ISD)			
Normal Crown / Cross Slope	2.0%		
ADDITIONAL DESIGN DETAILS			
Cut / Fill Slopes	3:1 (Typical)		
Lane Width	12 ft		
Shoulder Width	N/A		
Median Width	30 ft		
Bike Lane	7 ft		(Per DPM for Posted Speed 40mph or greater)
Sidewalk Width	6 ft (w/ 6 ft buffer from back of curb)		(Per DPM for Principal Arterial)
Multi-Use Trail	10 ft		

B. Hydrology and Hydraulics

PB's proposed drainage analysis and design will be performed in accordance with the current Bernalillo County Code and the *DPM*. Utilizing the *DPM* will provide consistency of analysis and design procedures with adjacent City and County projects. The basis for the analysis will be the North Albuquerque Acres Master Drainage Plan.

Not in that report

Some of the key design criteria are summarized below:

- Hydrologic data used for hydraulic design will be based on developed conditions as agreed upon by the PB and the County. and City
- Design storm: 100-year 24 hr for off-site and 10-year 6 hr for on-site. ?
- Detention pond design: in accordance with the New Mexico Office of the State Engineer (NMSEO) and Bernalillo County ordinance ?
- Storm Water Quality Pond(s): Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) criteria.
- Allowable street flow extent: limited to within right-of-way limits during the 100-year event
- Allowable street flow spread: a 12' driving lane must be clear in each direction during the 10-year storm
- Gutter: 24" pan, 8" curb height, n=0.017
- Storm drain criteria:
  - Inlets: City of Albuquerque type "A" inlets (see Standard Drawing 2201).
  - Minimum diameter: 18" for laterals and 24" for trunk lines.
  - Material will be smooth wall pipe, n=0.013. Reinforced concrete pipe is required within the Albuquerque City limits. ? discuss

C. Traffic

1. Design Year Traffic Forecasts

The design year (year 2030) traffic forecasts were produced using a transportation forecasting model for the Albuquerque metro area based on the current Metropolitan Transportation Plan (MTP) 2030 socioeconomic dataset and network assumptions. These assumptions include a four-lane section on Eubank Boulevard between Academy Boulevard and Paseo del Norte, an improved two-lane section on Eubank Boulevard north of Paseo del Norte to Alameda Boulevard, and an improved two-lane section on Alameda Boulevard from Eubank Boulevard west to Ventura Boulevard.

2. Intersection Analysis

The Synchro traffic analysis software will be used to evaluate design-year traffic operations of the Eubank Boulevard intersections. Signal warrants from the 2003 Manual on Uniform Traffic Control Devices (MUTCD) will be analyzed to determine which, if any, intersections may warrant the installation of a traffic signal as part of the reconstruction project. The AM and PM peak-hour analysis results will be used to identify the required lane configurations to achieve the design level of service. Vehicle queue storage needs will be estimated based on the Synchro analysis results and by using manual methods.

3. Pavement Marking and Signing

Pavement markings and signing for improvements to Eubank Boulevard will comply with the MUTCD. Concurrence with the permanent signing and striping plans will be obtained from both Bernalillo County and the City of Albuquerque prior to completion of the final design plans. Use of special signs and markings is not anticipated for this project. Bike lane signing will be provided.

D. Street Lighting

Street lighting design for corridors is guided by the American National Standard Practice for Roadway Lighting as described in the Illuminating Engineering Society of North America (IESNA) document RP-8-00, Roadway Lighting (RP-8). Alternatively, Bernalillo County has a standard practice in the North Albuquerque Acres area of placing street lighting on arterials only at intersections. Both methods will be considered in the design of lighting for the Eubank Boulevard project.

E. Geotechnical Analysis

Geotechnical investigation and pavement design will be performed per New Mexico Department of Transportation (NMDOT) standards.

F. ABCWUA Utilities

Designs required for Albuquerque Bernalillo County Water Utility Authority (ABCWUA) facilities (water / sanitary sewer) will be based on the criteria established in the City of Albuquerque *Development Process Manual (DPM)*. Materials and details will adhere to the *City of Albuquerque Standard Specifications for Public Works Construction.*

APPENDIX A

EXISTING CONDITIONS

A. Typical Section

Eubank Boulevard is currently a two-lane roadway consisting of two 12' driving lanes, one lane in each direction (see Figure A1). The facility generally does not include a paved shoulder. South of Coronado the road is shifted to west side of the existing right-of-way. North of Coronado the roadway is roughly centered within the existing 60' right-of-way. Existing terrain within the project limits is rolling with cross slopes from east to west.

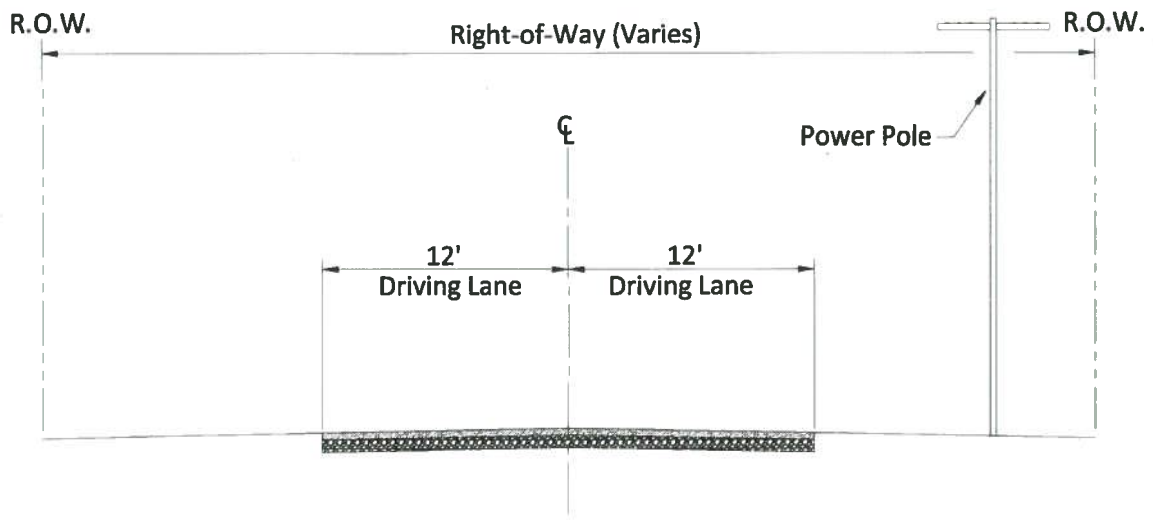


Figure A1 – Existing Eubank Typical Section

B. Right-of-Way / Access Control

The existing right-of-way width along Eubank within the project limits varies from 60 feet (north of Coronado Avenue) to 108 feet (south of Coronado Avenue). Current access to Eubank Boulevard is provided at each cross street within the corridor.

C. Posted Speed Limit

The current posted speed limit along Eubank Boulevard within the project limits is 40 mph.

D. Existing Utilities

There are several utilities located within the corridor. Existing utilities were researched by contacting utility companies. Known utilities include:

- Water
- Sanitary Sewer
- Storm Sewer
- Gas
- Telecommunications / Fiber Optic
- Overhead Electric

PB will prepare detailed maps of existing utilities within the corridor as part of the Subsurface Utility Engineering (S.U.E.) effort. Utilities that may be in conflict with the proposed design will be located horizontally and vertically.

E. Street Lighting

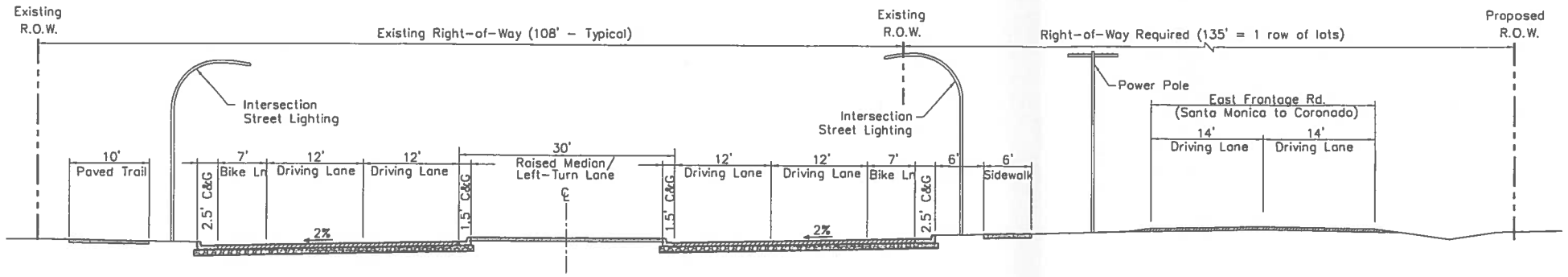
Street lights are located on Eubank Boulevard from just north of Academy Boulevard to just south of the project area. These street lights are single-arm Type V pole with a 400-Watt high-pressure sodium lamp mounted at a 40-foot height. The poles are mounted on the sides of the street in a staggered arrangement with a spacing of approximately 235 feet between poles on each side of the road. The last pole on the east side is located at the northeast corner of Eubank/Starlight; the last pole on the west side is located just north of the Tanoan subdivision. These lights are maintained by the City of Albuquerque.

One street light is located within the project area; it is a single-arm Type V pole with a 100-Watt high-pressure sodium lamp mounted at a 27-foot height at the northwest corner of Eubank/Quintessence. This light is also maintained by the City of Albuquerque.

At the north end of the project street lighting currently exists at and on the approaches to the Eubank/Paseo del Norte intersection. Two street lights are located on the east side of Eubank on its approach to Paseo del Norte; one street light is located on the west side of Eubank on the departure side of the intersection. The lights are 250-Watt high-pressure sodium lamps mounted on a 30-foot height, and are maintained by Bernalillo County.

APPENDIX B

PROPOSED TYPICAL SECTIONS, PRELIMINARY PLAN AND PROFILE SHEETS, RIGHT-OF-WAY REQUIREMENTS



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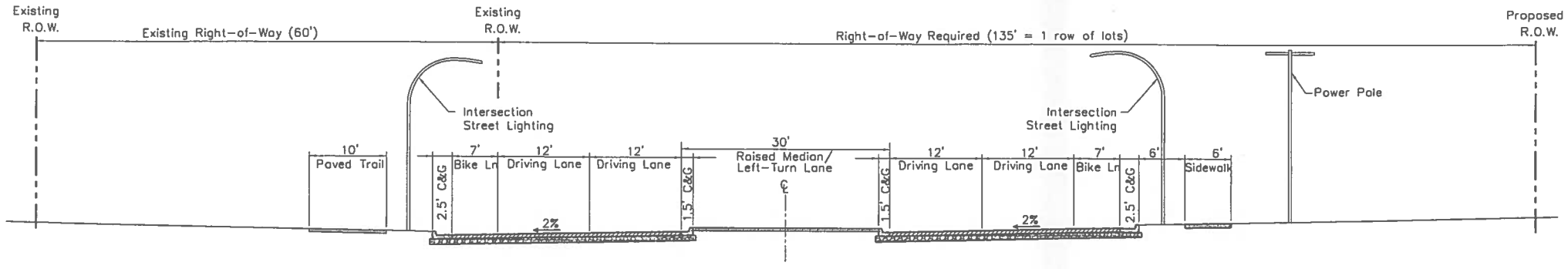
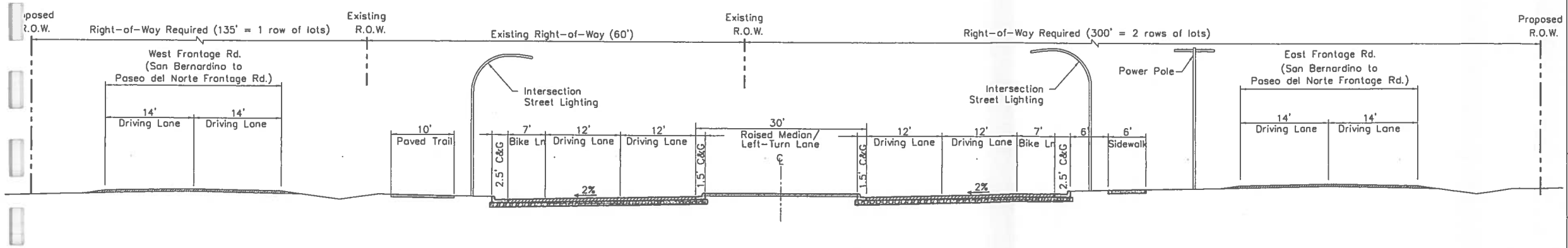
PROPOSED TYPICAL SECTION (SAN ANTONIO AVE. TO CORONADO AVE.)



EUBANK BOULEVARD
PROPOSED TYPICAL SECTION (CORONADO AVE. TO SAN BERNARDINO AVE.)



EUBANK BOULEVARD
PROPOSED TYPICAL SECTION (SAN BERNARDINO AVE. TO PASEO DEL NORTE)

SURVEY INFORMATION
FIELD NOTES

NO.	BY	DATE

BENCH MARKS

AS BUILT INFORMATION
CONTRACTOR
WORK STARTED BY — DATE
INSPECTOR'S ACCEPTANCE BY — DATE
FIELD VERIFICATION BY — DATE
DRAWINGS CORRECTED BY — DATE

MICRO-FILM INFORMATION
RECORDED BY — DATE
NO.

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

DESIGN

DESIGNED BY	JB	03/09
DRAWN BY	RM	03/09
CHECKED BY	SH	03/09

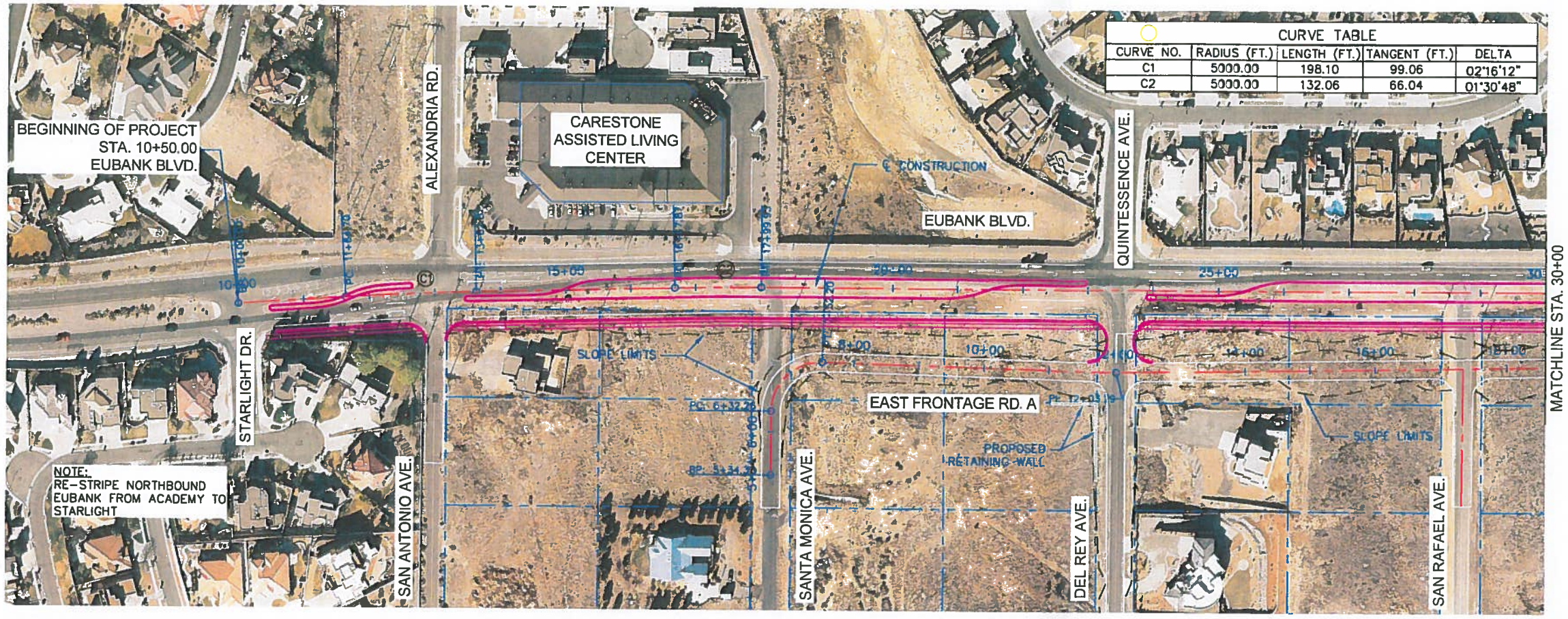
PB Parsons Brinckerhoff

COUNTY OF BERNALILLO
PUBLIC WORKS DIVISION
TECHNICAL SERVICES DEPARTMENT

EUBANK BOULEVARD
PROPOSED TYPICAL SECTIONS

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL		MO./DAY/YR.	MO./DAY/YR.

City Project No.	Zone Map No.	Sheet	Of
	D-21	1	9



CURVE TABLE				
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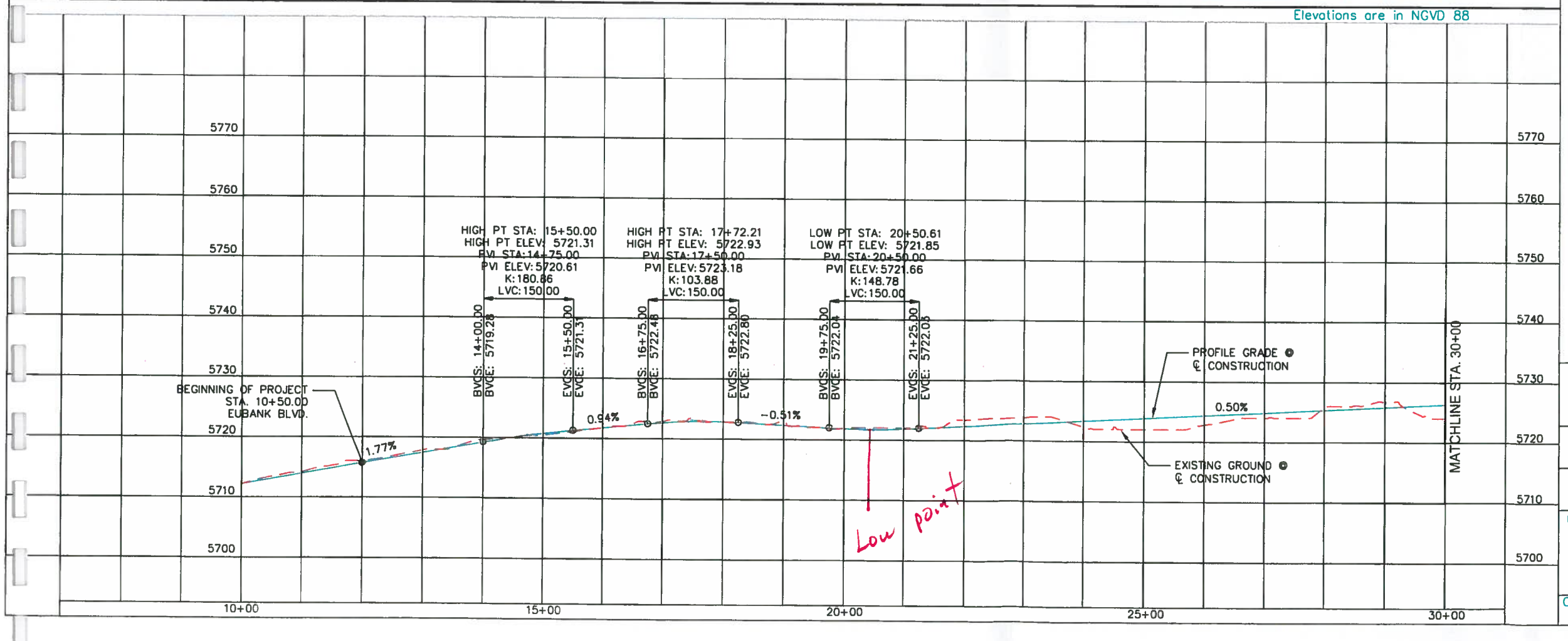
Elevations are in NGVD 88



GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.
1 inch = 100 ft. (HORIZ)
1 inch = 10 ft. (VERT)

PB Parsons Brinckerhoff

AS BUILT INFORMATION
CONTRACTOR
WORK STARTED ON DATE
WORK COMPLETED ON DATE
ACCEPTANCE BY DATE
FIELD VERIFICATION BY DATE
DRAWINGS CORRECTED BY DATE
MICRO-FILM INFORMATION
RECORDED BY DATE
NO.

BENCH MARKS

SURVEY INFORMATION
FIELD NOTES
NO. BY DATE

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

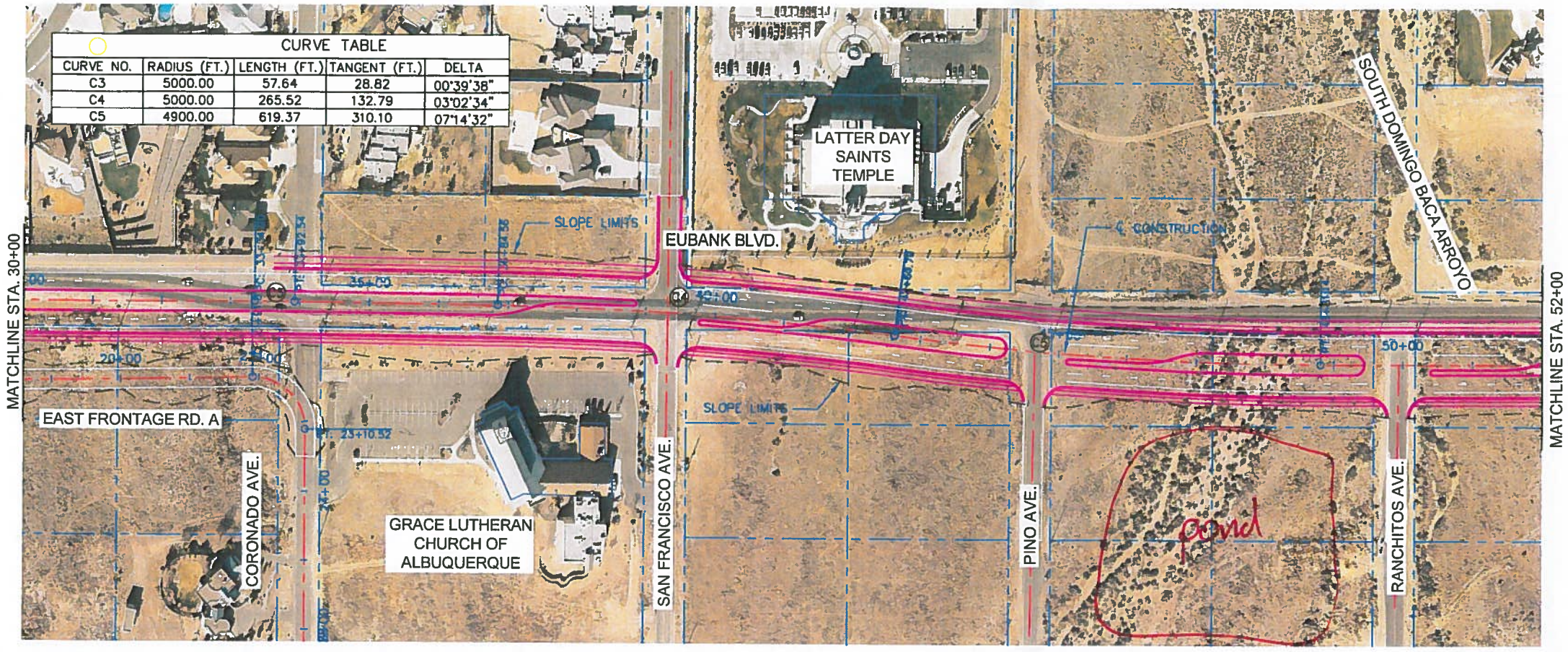
DESIGN
DESIGNED BY JB DATE 03/09
DRAWN BY RM DATE 03/09
CHECKED BY SH DATE 03/09

COUNTY OF BERNALILLO
PUBLIC WORKS DIVISION
TECHNICAL SERVICES DEPARTMENT

EUBANK BOULEVARD
CONCEPTUAL PLAN & PROFILE

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL		MO./DAY/YR.	MO./DAY/YR.

City Project No. | Zone Map No. D21 | Sheet 2 Of 9



AS BUILT INFORMATION

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INSPECTOR'S SIGNATURE — DATE
ACCEPTANCE BY — DATE
VERIFICATION BY — DATE
DRAWINGS CORRECTED BY — DATE

MICRO-FILM INFORMATION
RECORDED BY — DATE
NO.

BENCH MARKS

SURVEY INFORMATION
FIELD NOTES

NO.	BY	DATE

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

DESIGN
DESIGNED BY JB — DATE 03/09
DRAWN BY RM — DATE 03/09
CHECKED BY SH — DATE 03/09

GRAPHIC SCALE
(IN FEET)
1 inch = 100 ft.
1 inch = 100 ft. (HORIZ)
1 inch = 10 ft. (VERT)

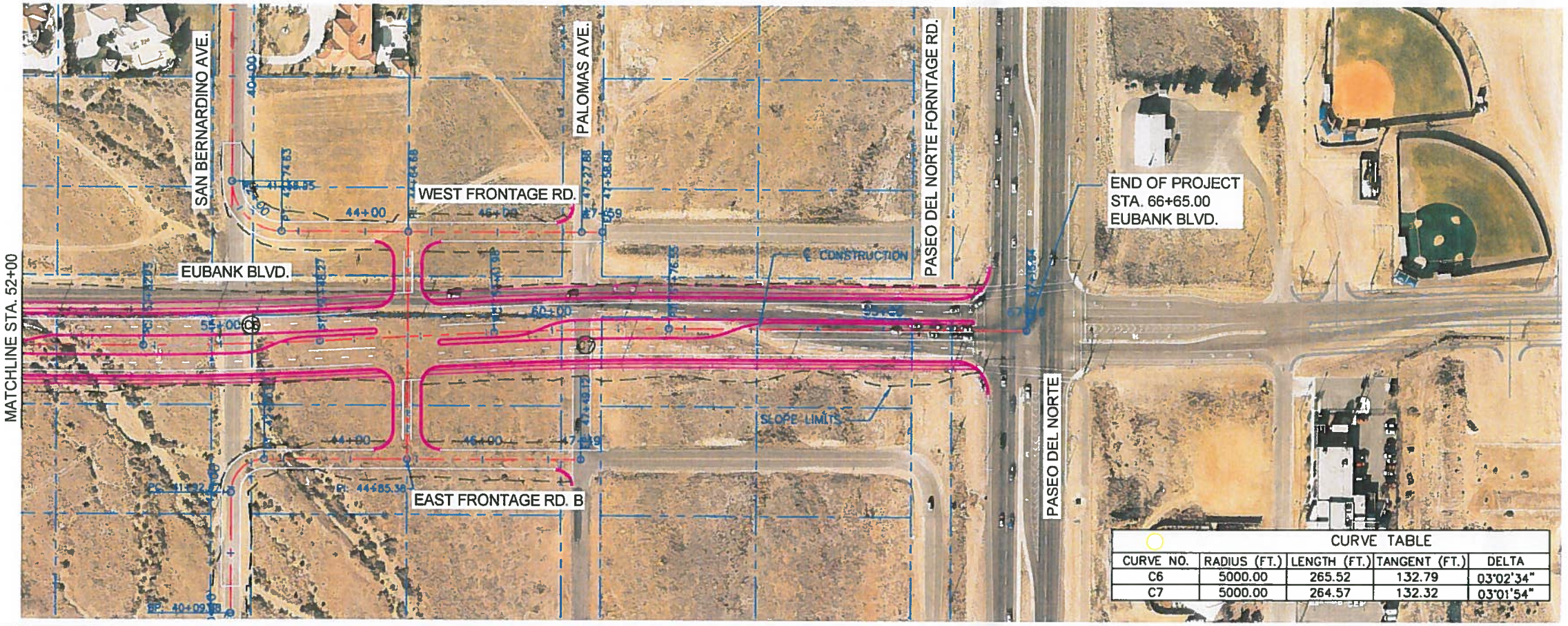
PB Parsons Brinckerhoff

COUNTY OF BERNALILLO
PUBLIC WORKS DIVISION
TECHNICAL SERVICES DEPARTMENT

EUBANK BOULEVARD
CONCEPTUAL PLAN & PROFILE

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL		MO./DAY/YR.	MO./DAY/YR.

City Project No. | Zone Map No. D21 | Sheet 3 Of 9



CURVE TABLE				
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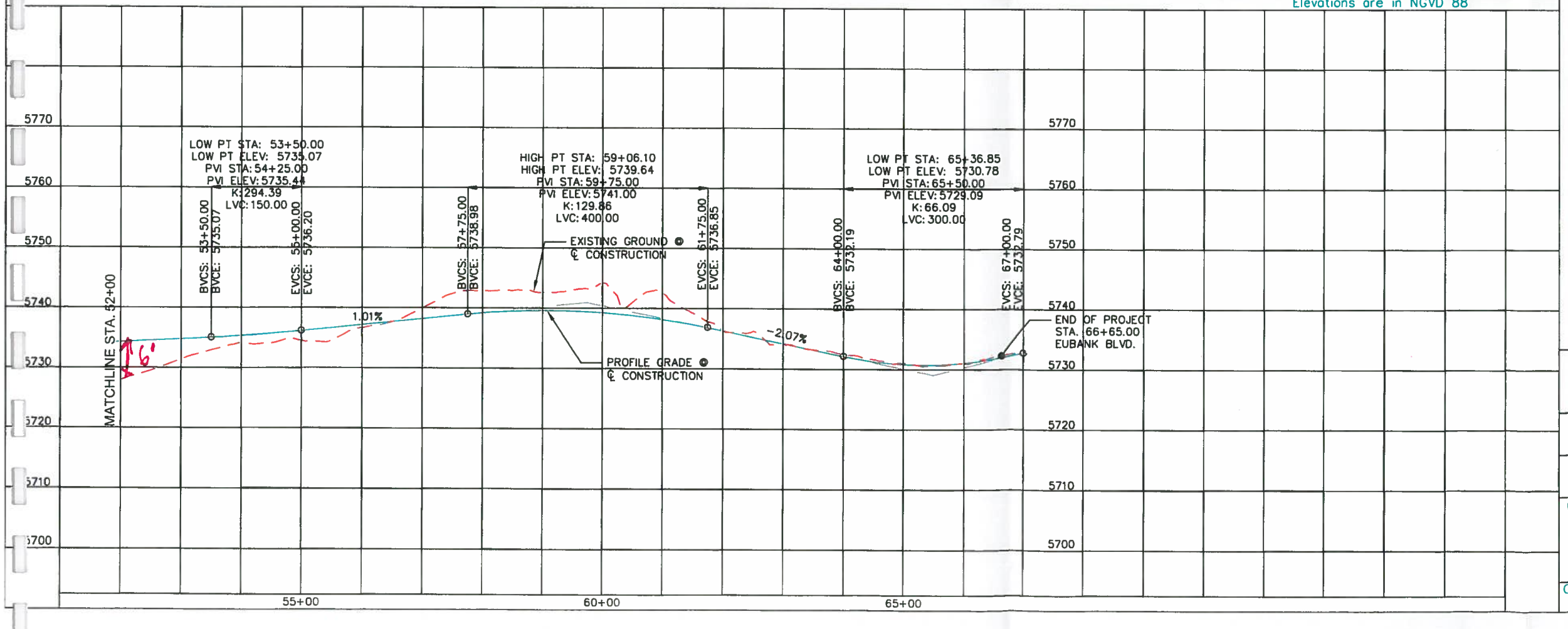
Elevations are in NGVD 88



AS BUILT INFORMATION

CONTRACTOR
WORK STARTED BY — DATE
INSPECTOR'S ACCEPTANCE BY — DATE
FIELD VERIFICATION BY — DATE
DRAWING CORRECTED BY — DATE

MICRO-FILM INFORMATION
RECORDED BY — DATE
NO.

BENCH MARKS

SURVEY INFORMATION
FIELD NOTES
NO. | BY | DATE

ENGINEER'S SEAL

REMARKS | NO. | DATE | BY

DESIGN
DESIGNED BY — JB — DATE 03/09
DRAWN BY — RM — DATE 03/09
CHECKED BY — SH — DATE 03/09

GRAPHIC SCALE
100 0 50 100 200
(IN FEET)
1 inch = 100 ft.
1 inch = 100 ft. (HORIZ)
1 inch = 10 ft. (VERT)

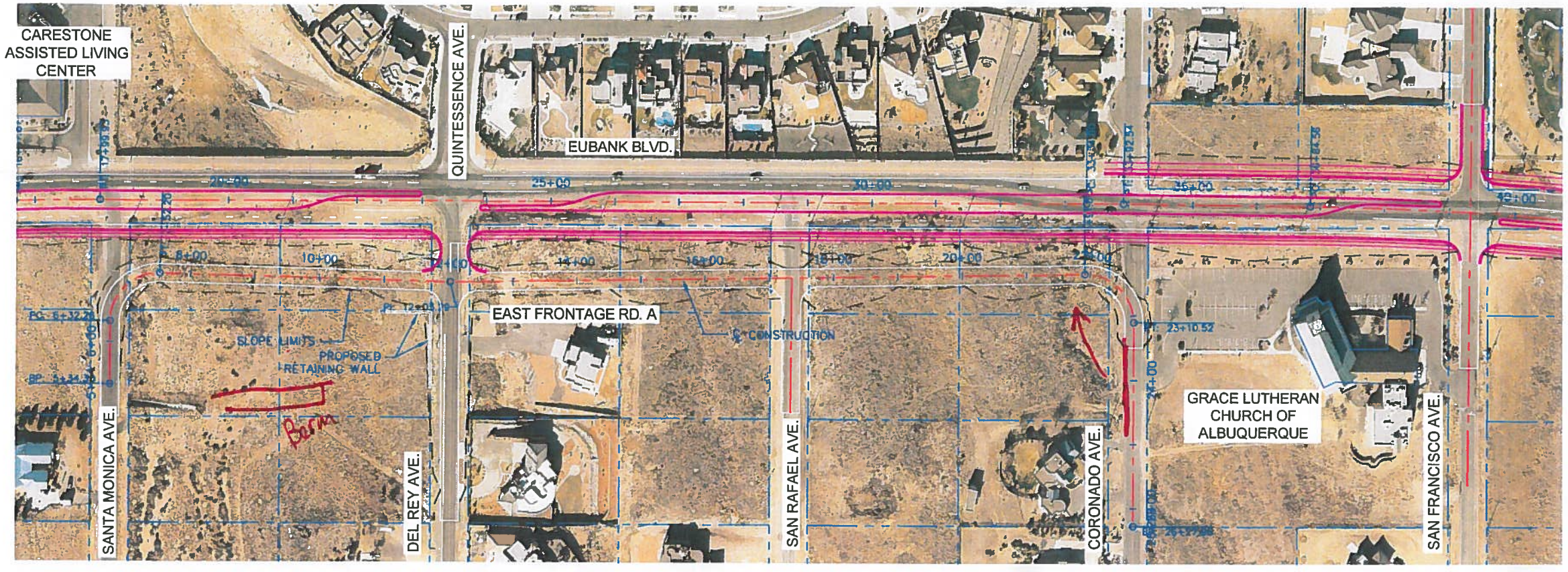
PB Parsons Brinckerhoff

COUNTY OF BERNALILLO
PUBLIC WORKS DIVISION
TECHNICAL SERVICES DEPARTMENT

EUBANK BOULEVARD
CONCEPTUAL PLAN & PROFILE

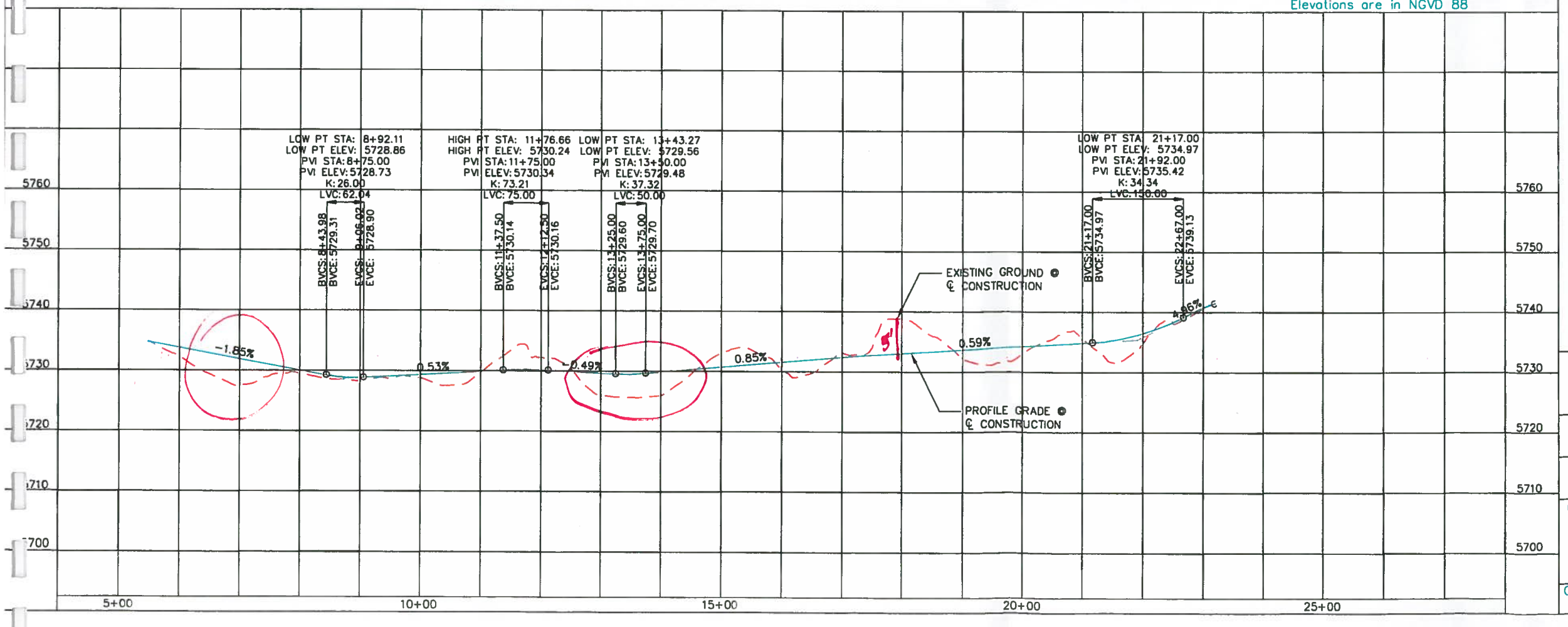
DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL		MO./DAY/YR.	MO./DAY/YR.

City Project No.	Zone Map No.	Sheet	Of
	D21	4	9



EAST FRONTAGE RD. A

Elevations are in NGVD 88



GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.
1 inch = 100 ft. (HORIZ)
1 inch = 10 ft. (VERT)

PB Parsons Brinckerhoff

COUNTY OF BERNALILLO
PUBLIC WORKS DIVISION
TECHNICAL SERVICES DEPARTMENT

FRONTAGE ROADS
CONCEPTUAL PLAN & PROFILE

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL		MO./DAY/YR.	MO./DAY/YR.

City Project No.	Zone Map No.	Sheet	Of
	D21	5	9

AS BUILT INFORMATION
CONTRACTOR
WORK STARTED BY DATE
INSPECTOR'S ACCEPTANCE BY DATE
FIELD VERIFICATION BY DATE
CORRECTED BY DATE
MICRO-FILM INFORMATION
RECORDED BY DATE
NO.

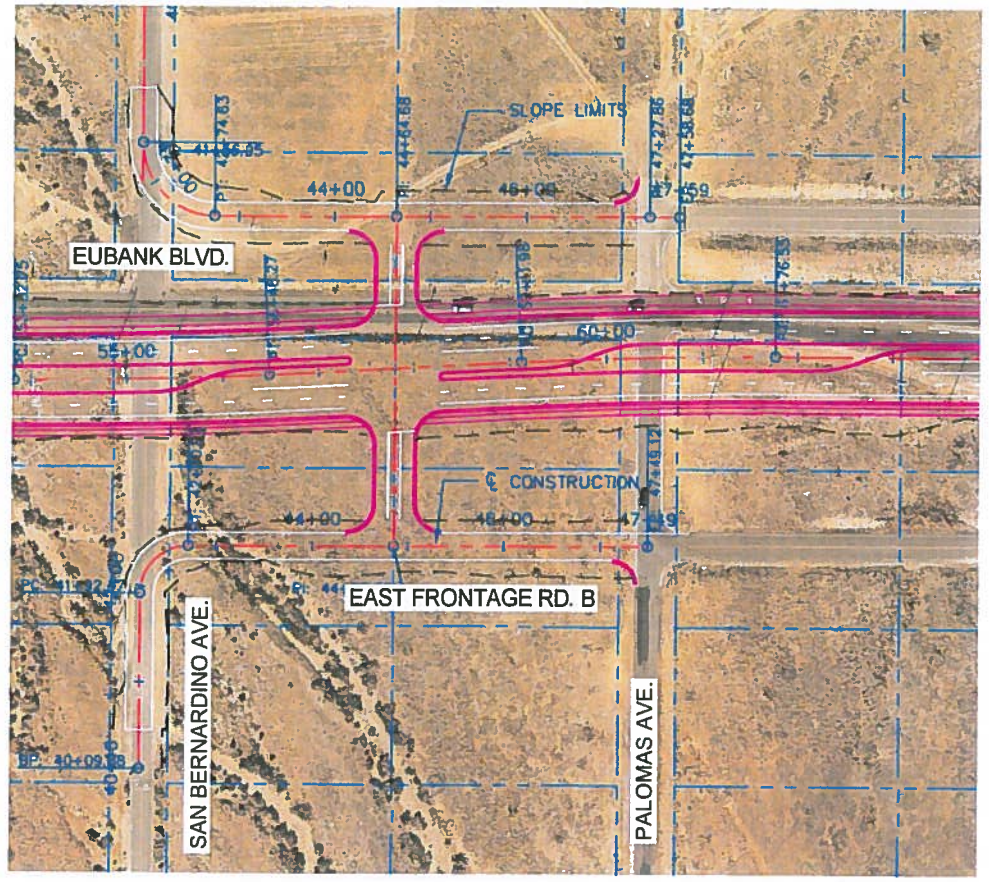
BENCH MARKS

SURVEY INFORMATION
FIELD NOTES
NO. BY DATE

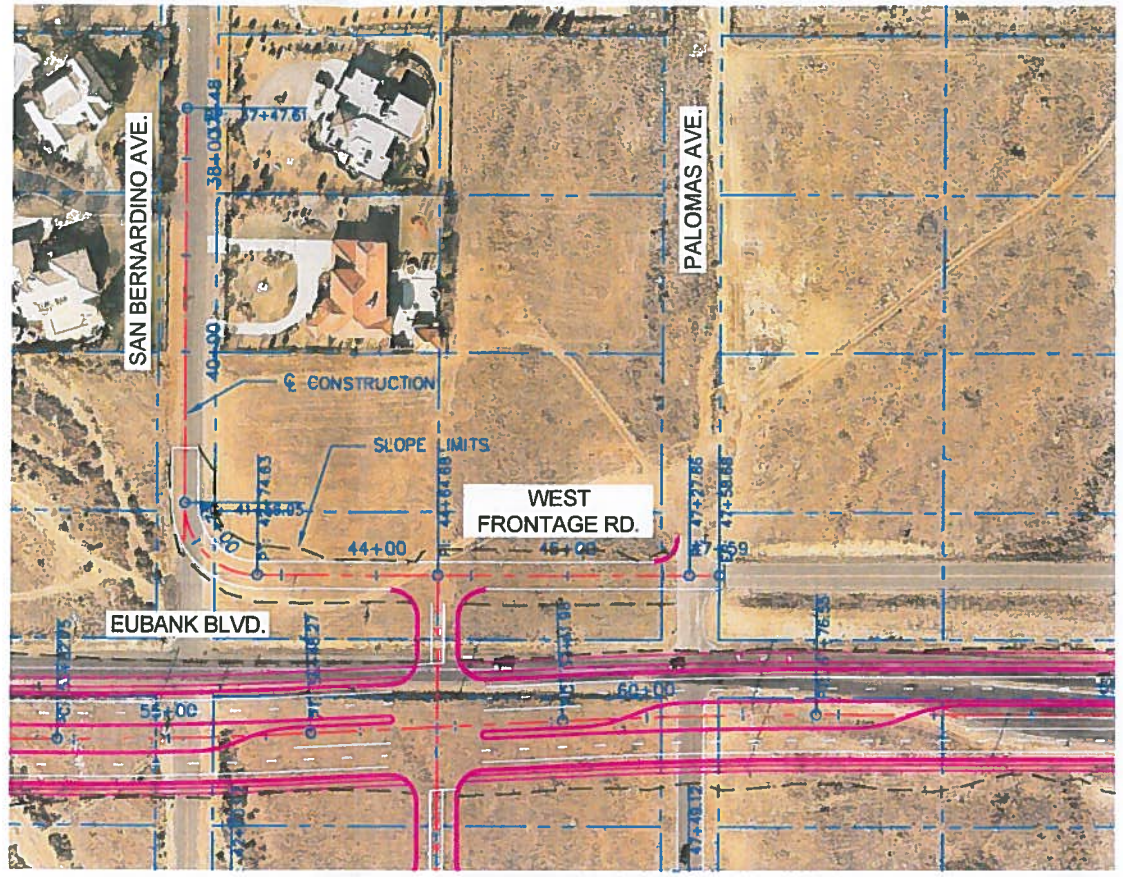
ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

DESIGN
DESIGNED BY JB DATE 03/09
DRAWN BY RM DATE 03/09
CHECKED BY SH DATE 03/09

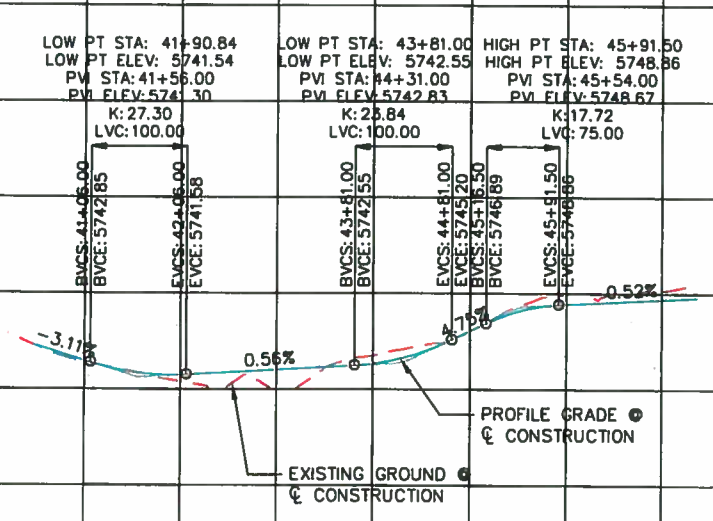


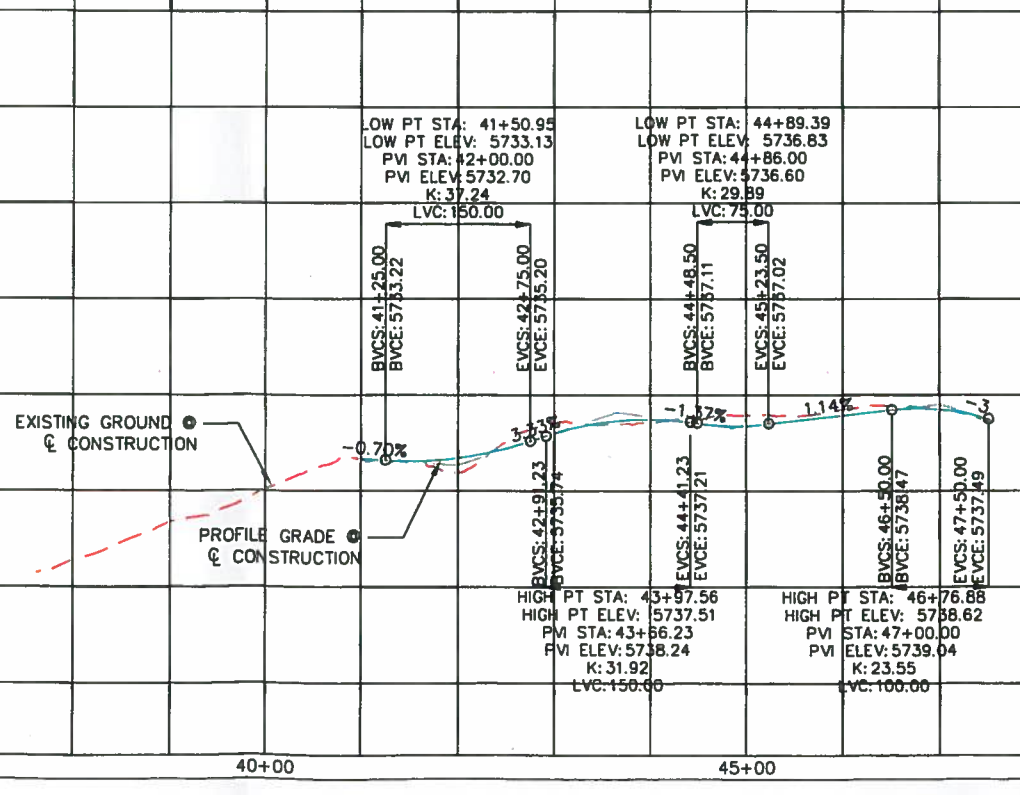
EAST FRONTAGE RD. B



WEST FRONTAGE RD.

Elevations are in NGVD 88





AS BUILT INFORMATION

CONTRACTOR

WORK STAKED BY — DATE

INSPECTOR'S ACCEPTANCE BY — DATE

FIELD VERIFICATION BY — DATE

MARKINGS CORRECTED BY — DATE

MICRO-FILM INFORMATION

RECORDED BY — DATE

NO.

BENCH MARKS

SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

DESIGN

DESIGNED BY	JB	DATE 03/09
DRAWN BY	RM	DATE 03/09
CHECKED BY	SH	DATE 03/09

GRAPHIC SCALE

100 0 50 100 200

(IN FEET)
1 inch = 100 ft.
1 inch = 100 ft. (HORIZ)
1 inch = 10 ft. (VERT)

PB Parsons Brinckerhoff

COUNTY OF BERNALILLO
PUBLIC WORKS DIVISION
TECHNICAL SERVICES DEPARTMENT

FRONTAGE ROADS
CONCEPTUAL PLAN & PROFILE

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL		MO./DAY/YR.	MO./DAY/YR.

City Project No. | Zone Map No. D21 | Sheet 6 Of 9

LEGEND

- RIGHT OF WAY CURRENTLY ACQUIRED FOR THE PROJECT
- ADDITIONAL RIGHT OF WAY REQUIRED FOR THE PROJECT
- RIGHT OF WAY ORIGINALLY PLANNED FOR ACQUISITION THAT IS NO LONGER REQUIRED

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.
1 inch = 100 ft. (HORIZ)

PB Parsons Brinckerhoff

AS BUILT INFORMATION
CONTRACTOR
WORK STARTED BY DATE
INSPECTIONS DATE
AS-BUILTS BY DATE
FIELD VERIFICATION BY DATE
DRAWING CORRECTED BY DATE

MICRO-FILM INFORMATION
RECORDED BY DATE
NO.

BENCH MARKS

SURVEY INFORMATION
FIELD NOTES
NO. BY DATE

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY

DESIGN

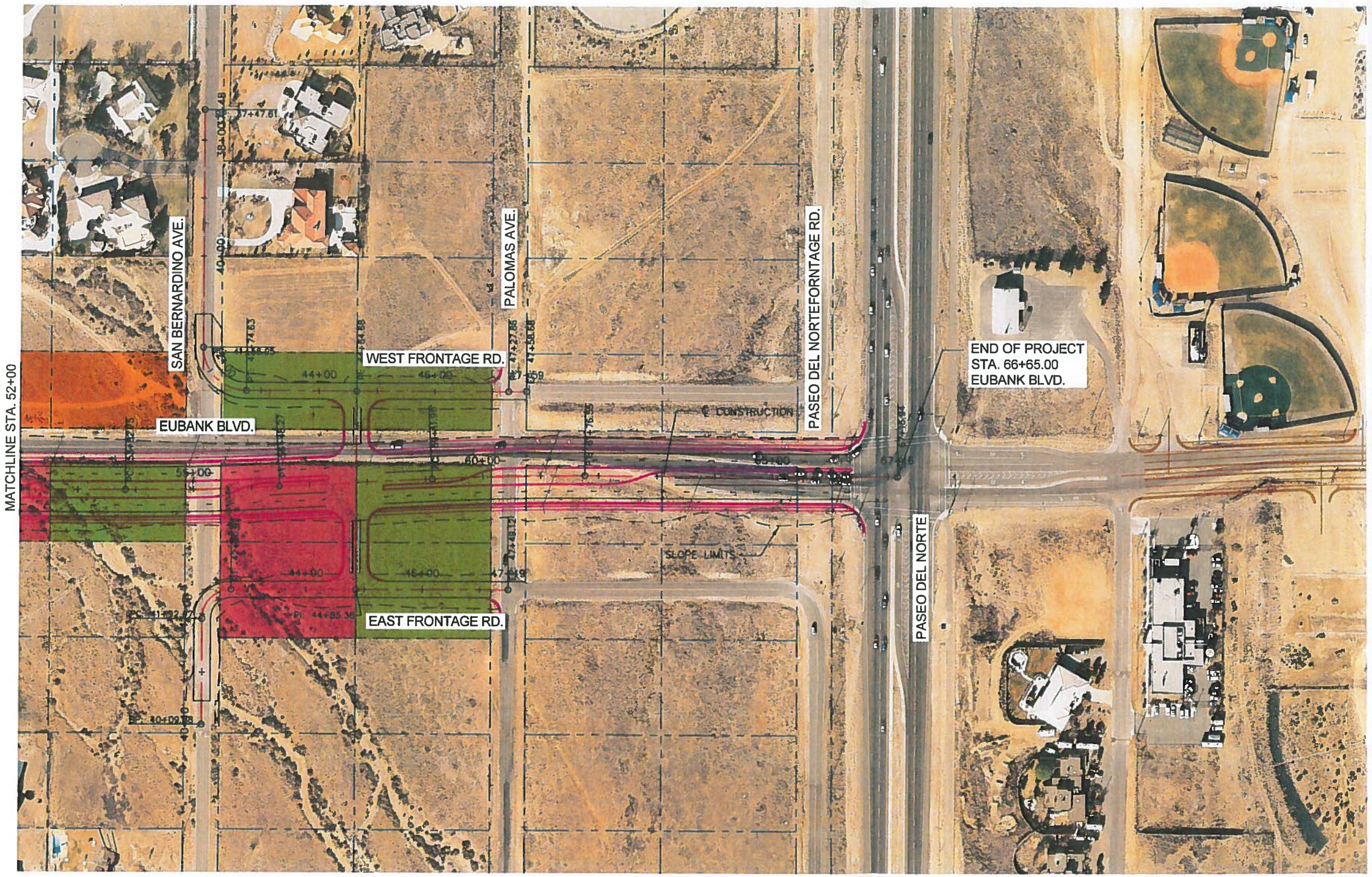
DESIGNED BY	JB	03/09
DRAWN BY	RM	03/09
CHECKED BY	SH	03/09

COUNTY OF BERNALILLO
PUBLIC WORKS DIVISION
TECHNICAL SERVICES DEPARTMENT

EUBANK BOULEVARD
CONCEPTUAL PLAN – RIGHT OF WAY

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	MO./DAY/YR.	MO./DAY/YR.

City Project No.	Zone Map No.	Sheet	Of
	D-21	7	9



LEGEND

- RIGHT OF WAY CURRENTLY ACQUIRED FOR THE PROJECT
- ADDITIONAL RIGHT OF WAY REQUIRED FOR THE PROJECT
- RIGHT OF WAY ORIGINALLY PLANNED FOR ACQUISITION THAT IS NO LONGER REQUIRED

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.
1 inch = 100 ft. (HORIZ)

PB Parsons Brinckerhoff

AS BUILT INFORMATION
CONTRACTOR
WORK STAKED BY — DATE
INSPECTOR'S NOTES/PUNCH LIST BY — DATE
FIELD VERIFICATION BY — DATE
DRAWING CORRECTED BY
MICRO-FILM INFORMATION
RECORDED BY — DATE
NO.

BENCH MARKS

SURVEY INFORMATION
FIELD NOTES
NO. | BY | DATE

ENGINEER'S SEAL

REMARKS

DESIGN
DESIGNED BY JB DATE 03/09
DRAWN BY RM DATE 03/09
CHECKED BY SH DATE 03/09

NO. | DATE | BY

COUNTY OF BERNALILLO
PUBLIC WORKS DIVISION
TECHNICAL SERVICES DEPARTMENT

EUBANK BOULEVARD
CONCEPTUAL PLAN – RIGHT OF WAY

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL		MO./DAY/YR.	MO./DAY/YR.

City Project No.	Zone Map No.	Sheet	Of
	D-21	9	9

APPENDIX C

TRAFFIC ENGINEERING ANALYSIS

1. Traffic Volumes

Existing traffic flows on Eubank Boulevard range from 15,900 vehicles per day (vpd) near Paseo del Norte to 19,100 vpd north of Academy Boulevard. The 2030 design-year traffic forecasts indicate that average daily traffic flows on this roadway will increase to approximately 21,100 vpd at the north end of the project and 23,100 vpd farther south near Academy Boulevard. The projected design-year build condition turning movement volumes for the intersections within the Eubank Boulevard project are shown in Figure C1.

2. Traffic Signals

The need for traffic signals was determined at each intersection using the warrants presented in the MUTCD. The intersections studied were

- Eubank Boulevard/San Antonio Drive
- Eubank Boulevard/Quintessence Avenue-Del Rey Avenue
- Eubank Boulevard/San Francisco Avenue
- Eubank Boulevard/San Bernardino Avenue-Palomas Avenue frontage road

The warrant analysis used eight-hour turning movement counts collected on Wednesday, January 14, Thursday, January 15, and Tuesday, January 20, 2009. To represent traffic conditions in the proposed reconstructed scenario, some existing traffic volumes were redistributed. The traffic volumes at Coronado, San Rafael and Santa Monica avenues were combined with those at Del Rey Avenue. In addition, the Palomas and San Bernardino avenues volumes were combined at a new intersection located midway between the two existing streets.

The result of the signal warrant analyses was that only one of the intersections studied met one of the MUTCD warrants. The intersection of Eubank Boulevard/Quintessence Avenue-Del Rey Avenue met the peak hour volume warrant (MUTCD warrant 3B) using the 70 percent criteria, which can be used when the 85th percentile speed is expected to be over 40 miles per hour.

It is possible that other intersections could meet signal warrants in the future, but this would be dependent on either 1) residential development with a density much greater than the existing one residence per acre or 2) construction of a high-volume non-residential traffic generator serving Eubank. Neither of these is currently anticipated in the area except possibly in the north part of the project area near Paseo del Norte. For that reason, the construction of underground conduit for the possible future installation of a traffic signal at the Eubank/San Bernardino-Palomas frontage road intersection should be considered as part of the construction plans.

The City of Albuquerque operates and maintains the signalized intersection at Eubank Boulevard/Academy Boulevard. Bernalillo County operates and maintains the signalized intersection of Eubank Boulevard/Paseo del Norte, and will operate and maintain the new signalized intersection that is proposed at Eubank Boulevard/Quintessence Avenue-Del Rey Avenue. These two signals are interconnected to other signals along their respective east-west arterials. The need for coordination between the new signal at Quintessence-Del Rey and the two existing signals to the north and south will be considered as part of the Eubank reconstruction project.

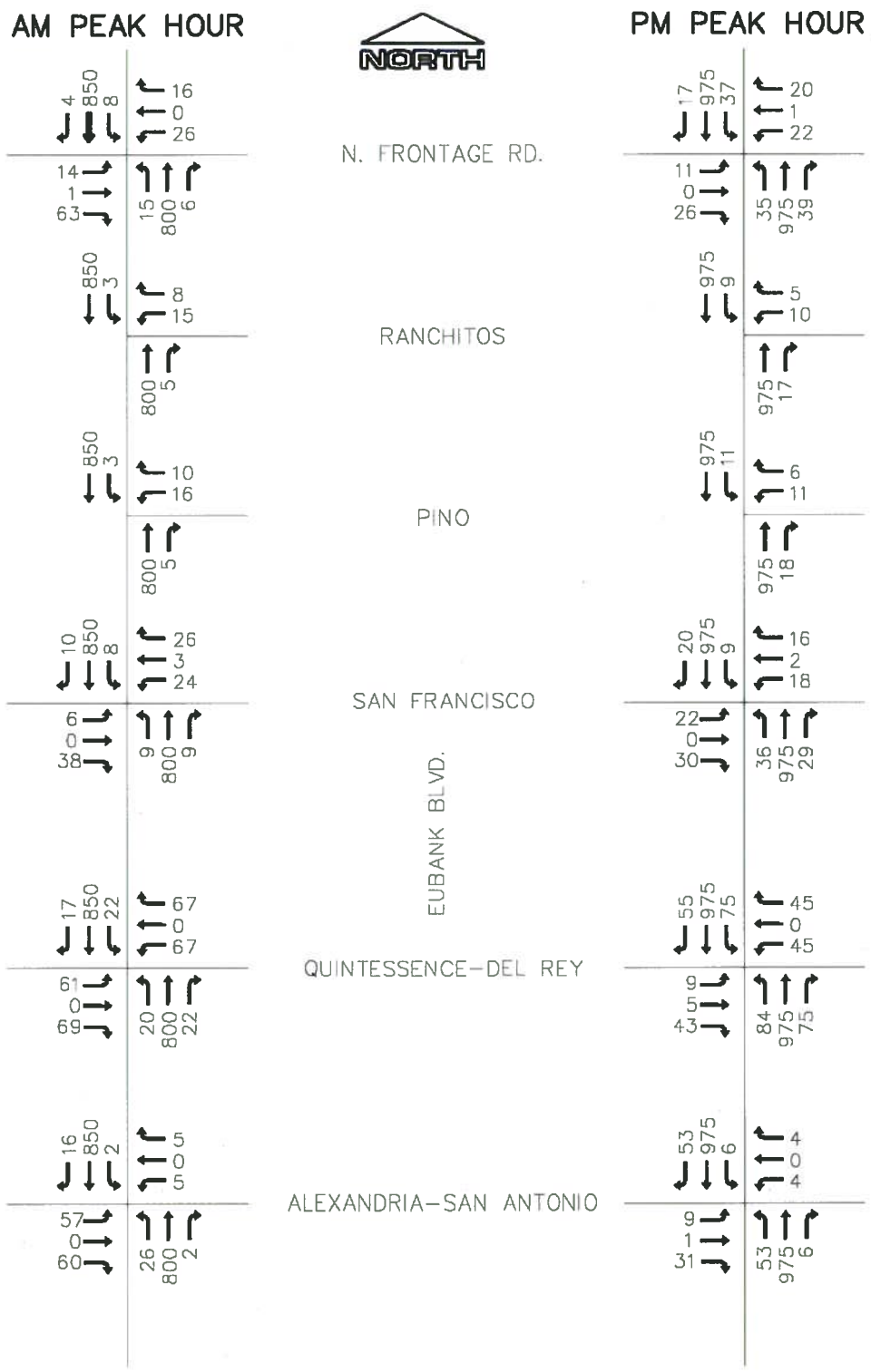


Figure C1. Design Year (2030) Turning Movement Volumes

The Albuquerque Metropolitan Planning Area (AMPA) Regional ITS Architecture shows the inclusion of Intelligent Transportation System (ITS) elements within the Eubank Boulevard project limits. During the design process, we will coordinate with the Mid-Region Council of Governments (MRCOG), who administers this plan, to ensure that the required elements are part of the construction documents.

3. Design-Year Intersection Levels of Service

Level of service (LOS) is expressed as A to F, with LOS A representing the best operating conditions and LOS F the worst. Generally, a level of service of D or better is desired for urban arterial streets. Thus, for the purposes of this project, "acceptable level of service" for an intersection is defined as LOS D or better. "Unacceptable levels of service" are defined as LOS E and F.

The operational analyses of the Eubank Boulevard intersections were performed using the Synchro Version 7 traffic analysis software, using the proposed lane geometrics. The traffic operations analyses results for design-year conditions are summarized in Table C1. The analyses indicate that traffic is expected to operate at acceptable conditions during the peak hours in the design year 2030. Detailed operational analysis output reports are included in Appendix D.

Table C1. Design Year 2030 Level of Performance at Eubank Boulevard Intersections

Intersection	Cycle Length (sec)	NB Left LOS	SB Left LOS	EB Approach LOS	WB Approach LOS
AM PEAK HOUR					
Eubank/Alexandria-San Antonio	unsig.	B	A	D	C
Eubank/Quintessence-Del Rey	40 sec	A*	A*	B	B
Eubank/San Francisco	unsig.	B	A	B	C
Eubank/Pino	unsig.	n/a	A	n/a	C
Eubank/Ranchitos	unsig.	n/a	A	n/a	C
Eubank/San Bernardino-Palomas	unsig.	B	A	C	C
PM PEAK HOUR					
Eubank/Alexandria-San Antonio	unsig.	B	B	C	C
Eubank/Quintessence-Del Rey	60 sec	A*	A*	B	B
Eubank/San Francisco	unsig.	B	B	D	D
Eubank/Pino	unsig.	n/a	B	n/a	C
Eubank/Ranchitos	unsig.	n/a	B	n/a	C
Eubank/San Bernardino-Palomas	unsig.	B	B	C	D

*At the signalized intersection of Eubank/Quintessence-Del Rey, this level of service applies to the whole approach and not just to the left turn movements.

4. Vehicle Queuing Considerations

Vehicle queue lengths were estimated to verify the storage lengths incorporated into the design. Queue lengths for left-turning movements off of Eubank were determined based on the City of Albuquerque's guidelines from the Design Process Manual. To determine queue lengths at the signalized intersection of Eubank/Quintessence-Del Rey, two queuing analysis methodologies were used. The first was based on Synchro 95th-percentile queue estimates. The second was based on a 95th percentile Poisson distribution arrival pattern. For the eastbound and westbound approach queue lengths at the frontage road intersections, the Synchro 95th-percentile queue lengths were used. The queuing analysis results are summarized in Table C2 and include recommended storage lengths for final design.

Table C2. Queuing Length Recommendations for Design Year 2030 at Eubank Boulevard Intersections

		AM Peak Hour				PM Peak Hour				
Intersection	Movement	Yr 2030 Volume (vph)	95% Poisson Queue	95% Synchro Queue	CofA DPM Queue	Yr 2030 Volume (vph)	95% Poisson Queue	95% Synchro Queue	CofA DPM Queue	Recommended Length
Eubank/Alexandria-San Antonio	NB Left	26			50'	53			50'	50' + transition
	SB Left	2			100' taper	6			100' taper	50' + transition
Eubank/Quintessence-Del Rey	NB Left	20	25'	25'		84	100'	50'		100'
	SB Left	22	50'	25'		75	100'	50'		100'
	EB Approach	110	100'	50'		57	75'	50'		100' (no change to existing)
	WB Approach	134	100'	50'		90	100'	50'		100'
Eubank/San Francisco	NB Left	9			100' taper	36			50'	50' + transition
	SB Left	19*			50'	9			100' taper	50' + transition
Eubank/Pino	SB Left	3			100' taper	11			100' taper	50' + transition
Eubank/Ranchitos	SB Left	3			100' taper	9			100' taper	50' + transition
Eubank/San Bernardino-Palomas	NB Left	15			50'	35			50'	50' + transition
	SB Left	71*			75'	37			50'	75' + transition
	EB Left	14	25'			11	25'			50'
	WB Left	26	25'			110*	100'			100'

* Volume is experienced during Sunday peak hour

APPENDIX D

SYNCHRO OUTPUT

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↑↑↑			↑↑↑	
Volume (veh/h)	57	0	60	5	0	5	26	800	2	2	850	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	65	0	68	6	0	6	30	909	2	2	966	18
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											1040	
pX, platoon unblocked												
vC, conflicting volume	1499	1950	492	1525	1958	456	984			911		
vC1, stage 1 conf vol	980	980		969	969							
vC2, stage 2 conf vol	519	970		556	989							
vCu, unblocked vol	1499	1950	492	1525	1958	456	984			911		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	66	100	87	97	100	99	96			100		
cM capacity (veh/h)	190	173	522	172	166	552	698			743		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	133	11	30	606	305	2	644	340
Volume Left	65	6	30	0	0	2	0	0
Volume Right	68	6	0	0	2	0	0	18
cSH	282	262	698	1700	1700	743	1700	1700
Volume to Capacity	0.47	0.04	0.04	0.36	0.18	0.00	0.38	0.20
Queue Length 95th (ft)	59	3	3	0	0	0	0	0
Control Delay (s)	28.7	19.4	10.4	0.0	0.0	9.9	0.0	0.0
Lane LOS	D	C	B			A		
Approach Delay (s)	28.7	19.4	0.3			0.0		
Approach LOS	D	C						

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	39.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↰	↑↱		↰	↑↱	
Volume (vph)	61	0	69	67	0	67	20	800	22	22	850	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.93			0.93		1.00	1.00		1.00	1.00	
Flt Protected		0.98			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1690			1695		1770	3525		1770	3529	
Flt Permitted		0.87			0.87		0.27	1.00		0.29	1.00	
Satd. Flow (perm)		1506			1505		505	3525		543	3529	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	69	0	78	76	0	76	23	909	25	25	966	19
RTOR Reduction (vph)	0	35	0	0	44	0	0	3	0	0	2	0
Lane Group Flow (vph)	0	112	0	0	108	0	23	931	0	25	983	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		5.0			5.0		18.4	18.4		18.4	18.4	
Effective Green, g (s)		5.0			5.0		18.4	18.4		18.4	18.4	
Actuated g/C Ratio		0.16			0.16		0.59	0.59		0.59	0.59	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		240			240		296	2066		318	2068	
v/s Ratio Prot								0.26			c0.28	
v/s Ratio Perm	c0.07				0.07		0.05			0.05		
v/c Ratio	0.47				0.45		0.08	0.45		0.08	0.48	
Uniform Delay, d1	12.0				12.0		2.8	3.7		2.8	3.7	
Progression Factor	1.00				1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.4				1.3		0.1	0.2		0.1	0.2	
Delay (s)	13.4				13.3		2.9	3.8		2.9	3.9	
Level of Service	B				B		A	A		A	A	
Approach Delay (s)	13.4				13.3			3.8			3.9	
Approach LOS	B				B			A			A	

Intersection Summary			
HCM Average Control Delay	5.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	31.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	40.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↑↑↱			↑↑↱	
Volume (veh/h)	6	0	38	24	3	26	9	800	9	8	850	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	7	0	43	27	3	30	10	909	10	9	966	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1496	1930	489	1479	1930	460	977			919		
vC1, stage 1 conf vol	990	990		935	935							
vC2, stage 2 conf vol	506	940		544	995							
vCu, unblocked vol	1496	1930	489	1479	1930	460	977			919		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	100	92	86	98	95	99			99		
cM capacity (veh/h)	185	176	525	190	176	548	702			738		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	50	60	10	606	313	9	644	333
Volume Left	7	27	10	0	0	9	0	0
Volume Right	43	30	0	0	10	0	0	11
cSH	420	277	702	1700	1700	738	1700	1700
Volume to Capacity	0.12	0.22	0.01	0.36	0.18	0.01	0.38	0.20
Queue Length 95th (ft)	10	20	1	0	0	1	0	0
Control Delay (s)	14.7	21.5	10.2	0.0	0.0	9.9	0.0	0.0
Lane LOS	B	C	B			A		
Approach Delay (s)	14.7	21.5	0.1			0.1		
Approach LOS	B	C						

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	16	10	800	5	3	850
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	18	11	909	6	3	966
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage veh)			1			1
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1402	457			915	
vC1, stage 1 conf vol	912					
vC2, stage 2 conf vol	490					
vCu, unblocked vol	1402	457			915	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	98			100	
cM capacity (veh/h)	254	550			741	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	30	606	309	3	483	483
Volume Left	18	0	0	3	0	0
Volume Right	11	0	6	0	0	0
cSH	321	1700	1700	741	1700	1700
Volume to Capacity	0.09	0.36	0.18	0.00	0.28	0.28
Queue Length 95th (ft)	8	0	0	0	0	0
Control Delay (s)	17.4	0.0	0.0	9.9	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	17.4	0.0		0.0		
Approach LOS	C					

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	33.5%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	8	800	5	3	850
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	17	9	909	6	3	966
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage veh)			1			1
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1402	457			915	
vC1, stage 1 conf vol	912					
vC2, stage 2 conf vol	490					
vCu, unblocked vol	1402	457			915	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	98			100	
cM capacity (veh/h)	254	550			741	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	26	606	309	3	483	483
Volume Left	17	0	0	3	0	0
Volume Right	9	0	6	0	0	0
cSH	313	1700	1700	741	1700	1700
Volume to Capacity	0.08	0.36	0.18	0.00	0.28	0.28
Queue Length 95th (ft)	7	0	0	0	0	0
Control Delay (s)	17.5	0.0	0.0	9.9	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	17.5	0.0		0.0		
Approach LOS	C					

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	33.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↑↑↱		↰	↑↑↱	
Volume (veh/h)	14	1	63	26	0	16	15	800	6	8	850	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	16	1	72	30	0	18	17	909	7	9	966	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											961	
pX, platoon unblocked												
vC, conflicting volume	1493	1936	485	1520	1935	458	970			916		
vC1, stage 1 conf vol	986	986		947	947							
vC2, stage 2 conf vol	507	950		573	989							
vCu, unblocked vol	1493	1936	485	1520	1935	458	970			916		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	99	86	83	100	97	98			99		
cM capacity (veh/h)	187	174	528	176	172	550	706			740		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	17	72	30	18	17	606	310	9	644	327
Volume Left	16	0	30	0	17	0	0	9	0	0
Volume Right	0	72	0	18	0	0	7	0	0	5
cSH	186	528	176	550	706	1700	1700	740	1700	1700
Volume to Capacity	0.09	0.14	0.17	0.03	0.02	0.36	0.18	0.01	0.38	0.19
Queue Length 95th (ft)	7	12	15	3	2	0	0	1	0	0
Control Delay (s)	26.3	12.9	29.5	11.8	10.2	0.0	0.0	9.9	0.0	0.0
Lane LOS	D	B	D	B	B			A		
Approach Delay (s)	15.5		22.8		0.2			0.1		
Approach LOS	C		C							

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	40.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↑↑			↑↑	
Volume (veh/h)	9	1	31	4	0	4	53	975	6	6	975	53
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	10	1	35	5	0	5	60	1108	7	7	1108	60
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											1040	
pX, platoon unblocked	0.96	0.96	0.96	0.96	0.96		0.96					
vC, conflicting volume	1831	2387	584	1835	2414	557	1168			1115		
vC1, stage 1 conf vol	1152	1152		1232	1232							
vC2, stage 2 conf vol	679	1235		603	1182							
vCu, unblocked vol	1779	2360	478	1784	2388	557	1088			1115		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	99	93	96	100	99	90			99		
cM capacity (veh/h)	145	125	511	124	112	474	610			622		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	47	9	60	739	376	7	739	430
Volume Left	10	5	60	0	0	7	0	0
Volume Right	35	5	0	0	7	0	0	60
cSH	313	196	610	1700	1700	622	1700	1700
Volume to Capacity	0.15	0.05	0.10	0.43	0.22	0.01	0.43	0.25
Queue Length 95th (ft)	13	4	8	0	0	1	0	0
Control Delay (s)	18.5	24.2	11.5	0.0	0.0	10.8	0.0	0.0
Lane LOS	C	C	B			B		
Approach Delay (s)	18.5	24.2	0.6			0.1		
Approach LOS	C	C						

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↑↑↑			↑↑↑	
Volume (vph)	9	5	43	45	0	45	69	975	75	84	975	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.90			0.93		1.00	0.99		1.00	0.99	
Flt Protected		0.99			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1660			1695		1770	3501		1770	3511	
Flt Permitted		0.94			0.81		0.22	1.00		0.21	1.00	
Satd. Flow (perm)		1577			1404		401	3501		389	3511	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	10	6	49	51	0	51	78	1108	85	95	1108	62
RTOR Reduction (vph)	0	42	0	0	44	0	0	7	0	0	5	0
Lane Group Flow (vph)	0	23	0	0	58	0	78	1186	0	95	1165	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		5.9			5.9		29.5	29.5		29.5	29.5	
Effective Green, g (s)		5.9			5.9		29.5	29.5		29.5	29.5	
Actuated g/C Ratio		0.14			0.14		0.68	0.68		0.68	0.68	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		214			191		273	2380		264	2387	
v/s Ratio Prot								c0.34			0.33	
v/s Ratio Perm	0.01			c0.04			0.19			0.24		
v/c Ratio	0.11			0.30			0.29	0.50		0.36	0.49	
Uniform Delay, d1	16.4			16.9			2.8	3.4		2.9	3.3	
Progression Factor	1.00			1.00			1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2			0.9			0.6	0.2		0.8	0.2	
Delay (s)	16.7			17.8			3.3	3.5		3.8	3.5	
Level of Service	B			B			A	A		A	A	
Approach Delay (s)	16.7			17.8				3.5			3.5	
Approach LOS	B			B				A			A	

Intersection Summary			
HCM Average Control Delay	4.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	43.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↑↑↑			↑↑↑	
Volume (veh/h)	22	0	30	18	2	16	36	975	29	9	975	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	25	0	34	20	2	18	41	1108	33	10	1108	23
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1795	2362	565	1815	2357	570	1131			1141		
vC1, stage 1 conf vol	1140	1140		1206	1206							
vC2, stage 2 conf vol	655	1223		609	1151							
vCu, unblocked vol	1795	2362	565	1815	2357	570	1131			1141		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	82	100	93	84	98	96	93			98		
cM capacity (veh/h)	140	126	468	128	120	464	614			608		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	59	41	41	739	402	10	739	392
Volume Left	25	20	41	0	0	10	0	0
Volume Right	34	18	0	0	33	0	0	23
cSH	236	188	614	1700	1700	608	1700	1700
Volume to Capacity	0.25	0.22	0.07	0.43	0.24	0.02	0.43	0.23
Queue Length 95th (ft)	24	20	5	0	0	1	0	0
Control Delay (s)	25.3	29.5	11.3	0.0	0.0	11.0	0.0	0.0
Lane LOS	D	D	B			B		
Approach Delay (s)	25.3	29.5	0.4			0.1		
Approach LOS	D	D						

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	11	6	975	18	11	975
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	12	7	1108	20	12	1108
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage veh)			1			1
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1697	564			1128	
vC1, stage 1 conf vol	1118					
vC2, stage 2 conf vol	579					
vCu, unblocked vol	1697	564			1128	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	99			98	
cM capacity (veh/h)	196	469			615	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	19	739	390	12	554	554
Volume Left	12	0	0	12	0	0
Volume Right	7	0	20	0	0	0
cSH	247	1700	1700	615	1700	1700
Volume to Capacity	0.08	0.43	0.23	0.02	0.33	0.33
Queue Length 95th (ft)	6	0	0	2	0	0
Control Delay (s)	20.8	0.0	0.0	11.0	0.0	0.0
Lane LOS	C			B		
Approach Delay (s)	20.8	0.0		0.1		
Approach LOS	C					

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	37.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	5	975	17	9	975
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	11	6	1108	19	10	1108
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage veh)			1			1
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1692	564			1127	
vC1, stage 1 conf vol	1118					
vC2, stage 2 conf vol	574					
vCu, unblocked vol	1692	564			1127	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	99			98	
cM capacity (veh/h)	197	469			615	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	17	739	389	10	554	554
Volume Left	11	0	0	10	0	0
Volume Right	6	0	19	0	0	0
cSH	244	1700	1700	615	1700	1700
Volume to Capacity	0.07	0.43	0.23	0.02	0.33	0.33
Queue Length 95th (ft)	6	0	0	1	0	0
Control Delay (s)	20.9	0.0	0.0	10.9	0.0	0.0
Lane LOS	C			B		
Approach Delay (s)	20.9	0.0		0.1		
Approach LOS	C					

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	37.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	11	0	26	22	1	20	35	975	39	37	975	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	12	0	30	25	1	23	40	1108	44	42	1108	19
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage veh)								1			1	
Upstream signal (ft)											961	
pX, platoon unblocked												
vC, conflicting volume	1859	2434	564	1877	2421	576	1127			1152		
vC1, stage 1 conf vol	1202	1202		1210	1210							
vC2, stage 2 conf vol	657	1232		668	1211							
vCu, unblocked vol	1859	2434	564	1877	2421	576	1127			1152		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	100	94	79	99	95	94			93		
cM capacity (veh/h)	123	109	469	121	110	460	615			602		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	12	30	26	23	40	739	414	42	739	389
Volume Left	12	0	25	0	40	0	0	42	0	0
Volume Right	0	30	0	23	0	0	44	0	0	19
cSH	123	469	121	460	615	1700	1700	602	1700	1700
Volume to Capacity	0.10	0.06	0.22	0.05	0.06	0.43	0.24	0.07	0.43	0.23
Queue Length 95th (ft)	8	5	19	4	5	0	0	6	0	0
Control Delay (s)	37.6	13.2	42.9	13.2	11.3	0.0	0.0	11.4	0.0	0.0
Lane LOS	E	B	E	B	B			B		
Approach Delay (s)	20.4		29.1		0.4			0.4		
Approach LOS	C		D							

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	45.4%	ICU Level of Service		A
Analysis Period (min)	15			

APPENDIX E

STREET LIGHTING DESIGN & ANALYSIS

Street Lighting Design & Analysis

A preliminary lighting analysis using the IESNA practice indicated that 400-Watt luminaires mounted at a 40-foot height at a staggered spacing of 235 feet on each side would be the desired spacing for corridor lighting for the project. This is what is currently provided south of the project area along Eubank between Academy Boulevard and San Antonio Drive.

In 1997, however, Bernalillo County passed the North Albuquerque Acres-Sandia Heights Light Pollution Ordinance, which is an effort to "enhance the safety, security, and visual aesthetics of North Albuquerque Acres." The ordinance directs that careful consideration must be given to lighting design and preservation of "night sky." Although the ordinance specifically states that federally-funded and state-funded roadway construction projects are exempt from this ordinance, in keeping with the ideals of this ordinance and with the standard practice of the County on Paseo del Norte in the project vicinity, street lighting for the Eubank project will be provided at intersections only. The street lighting will match what is already in place at the Eubank/Paseo del Norte intersection.

Based on the lighting analysis completed, the following is recommended:

- 250-Watt full cut-off luminaires mounted on 30-foot poles.
- Luminaires should be placed on mastarm extensions over Eubank at the Eubank/Quintessence-Del Rey intersection (at the northeast and southwest corners).
- Two luminaires should be placed at each unsignalized intersections along Eubank over the Eubank departure side (at the northeast and southwest corners).

APPENDIX F

SUMMARY OF DESIGN OPTIMIZAITON WORKSHOP MEETINGS

SUMMARY OF DESIGN OPTIMIZATION WORKSHOP MEETINGS

Due to amount of time elapsed since the preparation of original Environmental Assessment, the County determined that it would be prudent to review the Preferred Alternative (Build Alternative 1) and consider refinements. Representatives of Bernalillo County and the design team (Parsons Brinckerhoff, Vector Engineering, and D. Pennington & Associates) met in December 2008/January 2009 for Design Optimization Workshop meetings.

Key aspects of the discussions included:

- During development of the original design (Build Alternative 1), a major concern of residents was "cut-through" traffic. The frontage road concept presented was well-received as it was seen to discourage this behavior, as it would not lend preference to any single street.
- Since the EA was prepared, the County has installed traffic calming devices (speed humps, traffic circles, and chicanes) throughout North Albuquerque Acres. This was done to discourage cut-through traffic and speeding in general.
- In addition, all of the east-west streets in North Albuquerque Acres south of Paseo del Norte have been paved. Therefore, no single east-west street is "preferred" over another.
- Widening of Paseo del Norte between Eubank and Tramway to four lanes has been completed since Build Alternative 1 was presented to the public. While these planned improvements were known to the project team, the actual impacts on local traffic patterns could not be fully anticipated.
- The original design considered three signalized intersections along Eubank:
    1. Quintessence / Del Rey Ave
    2. Near San Bernadino Ave
    3. San Francisco Rd
- Based on current and projected traffic volumes, the only signal currently warranted is at Quintessence Del Rey.
- Queue lengths need to be considered at frontage road intersections, particularly where they will be unsignalized. Where appropriate, it makes sense to eliminate sections of frontage road and provide direct access to Eubank.
- Provided the Eubank median is wide enough (~24-30 ft), vehicles can safely make two-stage left turns at unsignalized intersections onto Eubank.
- An equestrian trail was originally proposed. Since the trail would not connect with an existing or planned network, this feature is no longer recommended.
- The original design concept required acquisition of 31 lots. The updated design (East Alignment Option) requires partial/full acquisition of 28 lots. This provides both a benefit in terms of right-of-way cost, but also in terms of the time and effort necessary to negotiate and purchase properties.