Crosstown Boulevard
Concept Study Report

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Summary of Findings

On May 1, 2002, the Federal Highway Administration (FHWA) issued a Record of Decision (ROD) for the *Interstate 40 - Crosstown Expressway from I-235 to Meridian Avenue Oklahoma City, Oklahoma FHWA-OK-EIS-01-(1)*-F project. The ROD documented FHWA's decision to select the preferred alternative, Alternative D, as described in the Final Environmental Impact Statement (FEIS) for the Crosstown and its related improvements. The selected alternative involved reconstructing I-40 in Oklahoma City from the I-235/I-35 interchange westward approximately four miles on an alignment south of the existing structure. The selected alternative provided a ten-lane interstate facility including express lanes on new alignment approximately 2,200 feet south of the existing I-40 facility. In addition, as part of the relocation of I-40, the ROD identified that the existing I-40 right-of-way would be converted to a six-lane at-grade boulevard from east of the Union Pacific tracks at the I-235 interchange to west of Walker Avenue. From Western to Agnew Avenues, the existing I-40 right-of-way would be converted to a divided boulevard. The utilization of the old I-40 right-of-way as a boulevard was part a critical component of the selected alternative and developed to provide needed capacity on the new I-40 mainline.

Because of the time elapsed since the ROD's approval in 2002, recent downtown development in Oklahoma City, and changing City priorities with respect to downtown transit, pedestrian, and cyclist options, the Oklahoma Department of Transportation (ODOT) and FHWA decided to reevaluate the original six-lane boulevard concept proposed in the ROD. This evaluation would examine alternatives to the original boulevard concept, identify their potential social, economic, and environmental impacts, and provide for consistency with the most current planning priorities of Oklahoma City and current plus future traffic needs. The evaluation would take into account input from the public and various Oklahoma City and regional stakeholders. After initial public involvement undertaken by the City of Oklahoma City, FHWA determined that the reevaluation of the ROD would best be accomplished by preparation of a new Environmental Assessment (EA) addressing various reasonable alternatives for the proposed boulevard, including one that restored as much as feasible the original street grid.

As discussed in this report, the original six-lane alternative and three other build alternatives were analyzed using seven project evaluation criteria: estimated construction costs, traffic functionality, impacts to right-of-way, constructability, construction impacts to traffic, stakeholder objectives, and environmental impacts.

After reviewing the seven criteria and placing them into a decision matrix, Alternative C best meets the project purpose and need, as well as the engineering and design standards for ODOT and Oklahoma City.

1.0 Introduction

Interstate (I)-40 plays a critical role not only as a transportation corridor within Oklahoma City and the state, but also as a primary freight corridor carrying goods east and west. It falls on the National Highway System (NHS) which consists of roadways important to the nation's economy, defense, and mobility. The National Highway System (NHS) includes the Eisenhower Interstate System of highways, among others. On May 1, 2002, the Federal Highway Administration (FHWA) issued a Record of Decision (ROD) for the *Interstate 40 - Crosstown Expressway from I-235 to Meridian Avenue Oklahoma City, Oklahoma FHWA-OK-EIS-01-(1)*-F project. The ROD documented FHWA's decision to select the preferred alternative, Alternative D, as described in the Final Environmental Impact Statement (FEIS) for the Crosstown and its related improvements. The selected alternative involved reconstructing I-40 in Oklahoma City from the I-235/I-35 interchange westward approximately four miles on an alignment south of the existing structure. The selected alternative provided a ten-lane interstate facility including express lanes on new alignment approximately 2,200 feet south of the existing I-40 facility.

In addition, as part of the relocation of I-40, the ROD identified that the existing I-40 right-of-way would be converted to a six-lane at-grade boulevard from east of the Union Pacific tracks at the I-235 interchange to west of Walker Avenue. From Western to Agnew Avenues, the existing I-40 right-of-way would be converted to a divided boulevard. The utilization of the old I-40 right-of-way as a boulevard was part a critical component of the selected alternative and developed to provide needed capacity on the new I-40 mainline.

Following issuance of the ROD and subsequent design and construction, ODOT opened the new Crosstown Expressway to traffic in 2012. The new Crosstown Expressway is a 10-lane interstate stretching four and a half miles from May Avenue to I-235/I-35.

Since the ROD's approval, numerous transportation-related laws and plans have been developed, including the following:

Encompass 2035—This long-range transportation plan was adopted by the Intermodal Transportation Policy Committee and endorsed by the Board of Directors of the Association of Central Oklahoma Governments (AACOG) on April 28, 2011. AACOG is the area's metropolitan planning organization responsible for comprehensive, continuing, and cooperative transportation planning in the region. As identified in *Encompass 2035* (AACOG 2012), long-range transportation goals and strategies for the region are centered on community, connectivity, livability, maintenance, operations, and performance.

Statewide Transportation Improvement Program Fiscal Year 2013–2016 (ODOT 2012)—The Statewide Transportation Improvement Program (STIP), which incorporates the Transportation Improvement Program (TIP) for the Oklahoma City Area Regional Transportation Study area, was approved by FHWA and the Federal Transit Administration on November 30, 2012. A TIP is a programming document that shows the transportation projects using federal dollars that will be developed and/or constructed in the upcoming four years. It shows the funding sources, the implementing agency, and the phase of development in which the project falls. One of the goals of the STIP is to identify and implement transportation improvements that will reduce congestion, increase mobility and safety, and enhance the region's air quality.

Metropolitan Area Projects (MAPS) 3 – MAPS 3 (Oklahoma City, 2013a) is a 10-year construction program intended to improve the quality of life in Oklahoma City. It is funded by a one-cent sales that began in April 2010 and ends in December 2017. The initiative funds eight projects and is expected to raise approximately $780 million. Several of the projects in MAPS 3 lie in the vicinity of the old I-40 ROW.

The Downtown Strategic Initiative identifies efforts to redevelop the downtown core and surrounding neighborhoods (Oklahoma City, 2013b). It considers how transportation connects areas in downtown. Plans show the future boulevard linking a corridor of existing parks and the future Downtown Public Park, Myriad Botanical Gardens, Bricktown River Walk Park, and Regatta Park. The ODOT *2005–2030 Oklahoma Statewide Intermodal Transportation Plan* (ODOT 2005) recommends improvements to transportation projects to assist with intermodal transportation in the area.

The Core to Shore Plan (Oklahoma City, 2008) focuses on redevelopment opportunities resulting from relocating the Crosstown Expressway. Phase I of the plan includes new local access provided on the old I-40 ROW. Based upon the plan, the new access should complement downtown land use and redevelopment plans. The plan also indicates that transportation alternatives on the old I-40 ROW should be comfortable for pedestrians, meet "complete street" policies that will be identified in the new comprehensive plan, *planOKC* (Oklahoma City, 2013c), provide land use connections between downtown and the river, and support mixed-use development. As a result, the plan's overall purpose is to create a compelling redevelopment vision for the Core to Shore district and provide a framework that guides public- and private-sector action toward implementation. This would be accomplished by providing transportation improvements that meet these two objectives:

- Developing a downtown boulevard, along the old I-40 alignment between Oklahoma and Walker Avenues
- Connecting the downtown core with the Oklahoma River shore using multiple modes of urban transit, including pedestrian and bicycle transportation, buses, and future fixed guideway transit

As a result, Downtown Oklahoma City has experienced much redevelopment. This includes facilities such as the Chesapeake Energy Arena, Myriad Botanical Gardens and other city parks, the Devon Tower office building, the Bricktown entertainment district, the Amtrak station, and local government building.

In addition, several planned facilities will be located in the area of the proposed Crosstown Boulevard. These include the new convention center and retail area between Hudson and Robinson Avenues with the Crosstown Boulevard as the southern boundary. Also included is the Downtown Public Park project. This park will be located between Hudson and Broadway Avenues with the Crosstown Boulevard as the northern boundary. Other area projects that will work with the Crosstown Boulevard are the planned streetcar system and the Oklahoma City Intermodal Hub.

Because of the time elapsed since the ROD's approval in 2002, recent downtown development in Oklahoma City, and changing City priorities with respect to downtown transit, pedestrian, and cyclist options, the Oklahoma Department of Transportation (ODOT) and FHWA decided to reevaluate the original six-lane boulevard concept proposed in the ROD. This evaluation would examine alternatives to the original boulevard concept, identify their potential social, economic, and environmental impacts, and provide for consistency with the most current planning priorities of Oklahoma City and current plus future traffic needs. The evaluation would take into account input from the public and various Oklahoma City and regional stakeholders. After initial public involvement undertaken by the City of Oklahoma City, FHWA determined that the reevaluation of the ROD would best be accomplished by preparation of a new Environmental Assessment (EA) addressing various reasonable alternatives for the proposed boulevard, including one that restored as much as feasible the original street grid.

1.1 Project Purpose and Need Summary

The purpose of the boulevard project being evaluated with this EA is to complete the I-40 relocation project in a manner that is broadly consistent with the 2002 ROD. A major purpose of the proposed action is to help balance interchange capacity on the new I-40 and local road access points by restoring connectivity between I-40 and downtown that was lost when I-40 was relocated. Prior to the relocation of the I-40 Crosstown, traffic into Downtown Oklahoma City had five points of access and bidirectional traffic was distributed rather evenly. When the new I-40 Crosstown was opened in 2012, local traffic entering the downtown street network was limited to four locations. To improve interstate access to Oklahoma City and separate through and local traffic movements on I-40, additional access points into downtown need to be provided, as identified in the ROD. Since approval of the ROD, Oklahoma City and various private entities have completed or are developing further commercial, recreational, and entertainment destinations that are expected to result in additional demand for fast and efficient access to the downtown business district from the I-40 mainline.

The purpose of the project is based on three need elements:

- Balance interchange capacity on the new I-40 Crosstown
- Restore lost vehicular access to Downtown Oklahoma City
- Provide pedestrian and bicyclist accessibility

The complete Purpose and Need Statement (Parsons Brinckerhoff 2014) is included as part of the EA.

1.2 Purpose of Report

The purpose of this report is as follows:

- Outline the process used for identifying and evaluating alternatives developed for the Crosstown Boulevard project
- Review the six-lane boulevard with three other build alternatives identified for detailed study in the EA
- Summarize the screening process of each build alternative
- Identify the alternative that best meets the project purpose and need, and engineering and design standards for ODOT and Oklahoma City

2.0 Alternatives

The alternatives were developed in coordination with the City of Oklahoma City and a public involvement process. This chapter describes the alternatives in detail, as well as the study area and connections to the Crosstown Expressway.

2.1 Study Area

The study area extends from Pennsylvania Avenue to Lincoln Boulevard/Byers Avenue to account for any potential impacts beyond the proposed project right-of-way, which is predominately the former I-40 ROW. The study area covers about 463 acres (Association of Central Oklahoma Governments 2010) within and near the central business district of Oklahoma City. The primary land use is made up of commercial uses (approximately 189 acres), defined in four distinct areas with unique needs and characteristics in each:

2.1.1 West Connection—Pennsylvania Avenue to Western Avenue

The West Connection portion of the study area is identified in the *OKC Plan 2000-2020* (Oklahoma City 2000) as within a Traditional Neighborhood area, which are defined as areas of mature neighborhood and commercial buildings. The zoning of the West Connection is primarily Moderate Industrial (I-2) and Heavy Industrial (I-3), with very small pockets of Medium Density Residential (R-3) near Western Avenue. Existing land uses in the West Connection area are primarily industrial, consistent with the zoning designations. Farther north and south of the I-40 ROW, land is zoned and used for more residential uses.

2.1.2 Transition (Bridge) Section—Western Avenue to Dewey Avenue

The Transition Section extends through a mixed-use area of downtown. Buildings in this area include a wide range of types and purposes, including restaurants, retail, civic (county and municipal), as well as small commercial operations. Large manufacturing in the area is being converted and repurposed. The area also borders "Film Row," an area composed of small, individual professional buildings. This area's transportation needs include access to the core of downtown, commuter access, and interstate access for business interaction.

2.1.3 Core Section—Dewey Avenue to E. K. Gaylord Boulevard

The Core Section of the study area is undergoing development. Major focal points in this area include a proposed large city park south of the former I-40 right of way and the proposed convention center to the north. Existing facilities, such as the Chesapeake Energy Arena and the Myriad Botanical Gardens, have operational characteristics that would affect the former right of way. This area's transportation needs continue to evolve but do have several governing factors, including the following:

- Redistribution of traffic to the existing street grid
- Public transit (modern streetcar)
- Pedestrian access in and out of public venues

- Bicycle access
- Truck access to the convention center and arena
- Redevelopment opportunities to create sustainable retail and residential components

2.1.4 East Connection—E. K. Gaylord Boulevard to Byers Avenue

The East Connection borders Bricktown, which serves several downtown areas and has been successful in creating a small residential enclave. This area's transportation needs are primarily focused on easy access to the interstate system. Long term, the need exists to create a slower, pedestrian-friendly environment to encourage development south of the boulevard.

2.2 Connections to the Crosstown Expressway

2.2.1 West Connection

This section of the boulevard must serve as a connection from an access-controlled highway to a limited-access urban arterial. This section was approved in the ROD as an elevated, six-lane facility using the original I-40 roadbed and overpass bridges. This elevated roadway would have then continued into a large elevated bridge structure that would span Western and Reno Avenues, as described for Alternative A below. The existing high-speed exit and entrance ramps would remain in place at Virginia and Klein Avenues; however, the existing ramps at Pennsylvania Avenue would be removed because they would be in conflict with the fly-over ramps from the I-40 Crosstown Expressway.

During one of the first public forums for the Crosstown Boulevard, some citizens expressed opposition to the roadway being left on the elevated fill. They requested that the Crosstown Boulevard be brought down to the same level as other downtown streets, such as Virginia Avenue. This option was considered but dismissed for the following reasons:

- The ramps to the Crosstown Boulevard had to go over the new I-40 and the Union Pacific Railroad. The grade or slope to get the boulevard down from the railroad overpass to the existing Virginia Avenue would exceed the permissible slope under current design standards, making this option too steep for traffic to use it safely.
- Indiana Avenue is the first road in the west connection that could be a street-level intersection because of safe slope requirements. However, this would create several unfavorable conditions for the roadway and surrounding area.
    - The spacing of the ramps from Virginia Avenue from the east onto the Crosstown Boulevard would be very close to the Indiana Avenue intersection. This would create dangerous weaving as merging traffic from the ramp would compete with the right-turning traffic at the Indiana Avenue intersection.
    - Traffic analysis shows that a signalized intersection at the Crosstown Boulevard and Indiana Avenue would operate in a failing condition, causing unacceptable traffic delays as traffic had to wait for several traffic cycles to clear the intersection.

    - Considering the expected number of trucks serving the area's industrial land uses, a stopped condition on the Crosstown Boulevard at Indiana Avenue would create an unsafe stopping condition at the crest of the hill approximately 1,500 feet west of the intersection.
    - A right turn on/ right off intersection at Indiana Avenue would close the intersection to through traffic on Indiana Avenue and change the area's vehicular patterns.
    - California Avenue is parallel to the boulevard on the south and Lindley Avenue is parallel on the north. These roadways are too close to the boulevard for efficient traffic operations through the intersection.
- Considering safety, the allowable maximum slope would not allow the boulevard to pass over Indiana Avenue and be at street level at Blackwelder Avenue.
- A street-level intersection at Blackwelder Avenue would require the same kind of intersection at Indiana Avenue, which has been dismissed for the reasons described above.
- A street-level intersection with Blackwelder Avenue would have the same traffic performance as that described above for Indiana Avenue.
    - California Avenue is parallel to the boulevard on the south. It is too close to the boulevard for efficient traffic operations through the intersection.

After determining this citizens' request could not be met safely and acknowledging that these citizen concerns should be addressed, the city, ODOT, and FHWA developed a compromise alternative. This compromise reused the I-40 Crosstown overpass bridges along the existing right-of-way. The section would stay elevated from the surrounding terrain and have 42-foot-wide grass medians. The roadway comes down to street level after Blackwelder Avenue, just as the original highway did, and continues at street level through Klein Avenue. Exit and entrance ramps would be provided on the west side of Virginia Avenue to replace the ramps lost at Pennsylvania Avenue and thus restore full access to the area. A right on/right off intersection would exist at Klein Avenue. This transitional section would contain four through lanes. One additional acceleration/deceleration lane would be provided in each direction between the ramps. This compromised alternative helps to balance the city's plans and objectives of providing good accessibility and connectivity to the surrounding industrial uses, while keeping the large trucks that serve this area from using neighborhood streets to the north and south.

In an effort to alleviate traffic congestion on some of the new I-40 Crosstown Expressway exit ramps; this section was built under an emergency status prior to the EA. This section of the Crosstown Boulevard was opened to traffic in November 2013. The horizontal alignment for this section of the boulevard was planned during the interchange study for the Crosstown Expressway. Because it was identified in the interchange study, no other horizontal alternate was considered for this section. Due to the above constraints, the West Connection is consistent in all of the alternatives.

2.2.2 East Connection

This section begins at the west side of E. K. Gaylord Boulevard. The boulevard would then extend east, passing under a new bridge for the Burlington Northern Santa Fe Railway and terminate the ramps leading to the new I-40 Crosstown, approximately at Byers Avenue. It would contain three through westbound lanes and two through eastbound lanes and allow left and right turns at E. K. Gaylord Boulevard, and left and right turn access to northbound Oklahoma Avenue. This section of the boulevard was planned during the interchange study for the Crosstown Expressway, when other options also were considered and not selected. Because it was identified in the interchange study and because of its location, no other alternate was considered for this section and it is consistent in all of the alternates.

2.3 Build Alternatives

Four alternative configurations were studied as part of the Crosstown Boulevard EA, one being the original six-lane boulevard committed to in the ROD. The alternatives vary through the Transition Section and the Core Section. These alternatives and their specific qualities are further described below.

2.3.1 Alternative A

Alternative A was first presented as part of the functional plans for the I-40 Crosstown Expressway Relocation and approved in the ROD. Additionally, per the City of Oklahoma City request, the Western Avenue/Classen Boulevard connection is included in this alternative. Under Alternative A, the third auxiliary lanes in the west connection would continue as through lanes throughout the transition and center sections. Alternative A roughly follows the original I-40 alignment from Klein Avenue to Walker Avenue with the centerline pushed slightly north of the original to provide additional clearance from the existing businesses on the roadway's south side. Between Walker Avenue and E. K. Gaylord Boulevard, the alignment would be pushed south of the original I-40 alignment but would run parallel to the original alignment 85 feet north of the south right-of-way line. Typically, the roadway would have a 22-foot wide raised center median. The median would be reduced in width in areas with dedicated left-turn lanes.

The transition section of this alternative would provide an approximately 1,600-foot-long bridge that would span Western Avenue, Classen Boulevard, and Reno Avenue. The bridge would begin slightly west of Western Avenue and end slightly east of Shartel Avenue. Retaining walls would be constructed parallel to the roadway on all four corners of the bridge, from 200 feet west of the bridge to the west abutment and then continuing from the east abutment eastward for approximately 700 feet. These retaining walls would reduce fill slopes and the impacts to properties along the alignment. There would be no access to and from the boulevard between Klein Avenue and Walker Avenue because of the bridge and retaining walls. The primary purpose of the bridge would be to allow traffic on the boulevard and on city streets to flow independently with no conflicts.

The alternative would contain a realigned Western Avenue that is described further for Alternative C. Reno Avenue would be unchanged from its current configuration, and Lee Avenue would be closed at the boulevard. Broadway Avenue would remain with access to the south and a right on/right off configuration, and Harvey Avenue would be eliminated because of the City of Oklahoma City's proposed convention center to the north of the alignment and the proposed city park to the south of the alignment.

2.3.2 Alternative B

Alternative B was developed based upon an Oklahoma City request early in the public comment process for the Crosstown Boulevard. Oklahoma City asked that a four-lane version of the functional boulevard six-lane option (Alternative A) be analyzed to construct a more pedestrian-friendly facility by reducing the overlay width of the street. Alternative B would share the same alignment as Alternative A except it would have four through lanes, two in each direction. The auxiliary lanes in the west segment would transitions into the four through lanes.

Reno Avenue would be unchanged from its current configuration, and Lee Avenue would be closed at the proposed boulevard. Dedicated left-turn lanes would be provided along the eastbound boulevard at Walker Avenue, Hudson Avenue, and E. K. Gaylord Boulevard. A right-turn lane would extend westbound from E. K. Gaylord Boulevard to Robinson Avenue. Additionally, bike lanes and parking lanes would be provided on both sides of the proposed boulevard from Walker Avenue to Robinson Avenue and on the south side of the proposed boulevard from Robinson Avenue to E. K. Gaylord Boulevard.

2.3.3 Alternative C

In response to citizen requests, the City of Oklahoma City studied a roundabout option at the Classen Boulevard/proposed boulevard area as an alternative to the 1,600-foot-long bridge presented in Alternatives A and B. After evaluation, Oklahoma City determined that a roundabout was not a viable option. However, an option was identified that reduced the scale of the grade separation for the proposed boulevard. Oklahoma City approved the recommendation, which included three main points to address potential traffic issues in the area where Western Avenue, Classen Boulevard, and the proposed boulevard converge:

- Realign Western Avenue to join Classen Boulevard at the Sheridan Avenue intersection. This would connect traffic from the new I-40 Crosstown Expressway exit at Western Avenue to the higher-capacity Classen Boulevard at Sheridan Avenueand resolve long standing traffic problems at Sheridan and Western Avenues.
- Provide a grade separation with the proposed boulevard passing over the new Western Avenue alignment and coming down to a street-level intersection with Reno Avenue.
- Close Classen Boulevard between Reno Avenue and the new Western Avenue, and close Exchange Avenue between 3rd Street and Reno Avenue, eliminating the fifth

leg at the Western Avenue/Reno Avenue intersection. Exchange Avenue would remain open to local traffic, but access would be from 3rd Street.

The centerline of Alternative C would follow the same alignment as Alternatives A and B, closely following the original I-40 alignment. Western Avenue would be realigned to join Classen Boulevard at Sheridan Avenue. A grade separation would be provided at the intersection of the proposed boulevard and the new Western Avenue alignment with the proposed boulevard passing over Western Avenue via an approximately 100-foot-long bridge. Retaining walls would be placed from approximately 325 feet west of the bridge to approximately 575 feet east of the bridge to minimize grading requirements and reduce impacts to adjacent properties. The roadway would have a landscaped center median throughout the majority of the alignment. The center median at the beginning of this segment would be 42 feet wide and extend through the bridge over Western Avenue to provide natural sunlight under the bridge. After the bridge passes over Western Avenue, the median would be reduced to 30 feet in width to provide a greater buffer from adjacent properties. This 30-foot median would be maintained throughout the majority of the remaining alignment, except for areas containing dedicated left-turn lanes and in the area between Hudson and Robinson Avenues.

The intersection with Reno Avenue would be at street level, but because the streets do not intersect squarely, safe traffic operation will not permit left turns from either roadway. Additionally, because the streets do not intersect squarely and because of limited right-of-way, traffic on the westbound boulevard would not be able to turn right onto Reno Avenue. Vehicles wanting to turn right on Reno Avenue would need to turn right on Shartel Avenue then turn on Reno Avenue. Shartel Avenue and Lee Avenue will both have full access to the Crosstown Boulevard with left turns permitted. On the proposed boulevard, eastbound traffic would have a dedicated left-turn lane onto Walker Avenue and all intersection movements would be allowed at Walker Avenue.

Alternative C between Walker Avenue and Hudson Avenue will transition from the divided raised median to a typical non-divided city street with on-street parking on the north side. Oklahoma City requested a roadway between Hudson and Robinson Avenues that aligns with the proposed convention center and city park. Oklahoma City also requested that this segment of roadway be a total of four through lanes with a dedicated left turn lanes at Hudson Avenue and Robinson Avenue and on-street parking on the north side. East of Robinson Avenue to E. K. Gaylord Boulevard, the roadway would transition to a divided raised median that joins with the east section of the proposed boulevard at E. K. Gaylord Boulevard. The eastbound facility would contain two through lanes and dedicated left- and right-turn lanes at E. K. Gaylord Boulevard. The westbound facility would contain two through lanes to Robinson Avenue and a left-turn lane.

2.3.4 Alternative D

Alternative D was developed based upon citizen requests made through the public involvement process for the Crosstown Boulevard. The alternative is based upon the idea that the downtown street grid system would carry traffic to the same locations as the proposed boulevard. Under Alternative D, the West and East Connections would remain the same as Alternatives A, B, and C. The difference would occur in the section of the proposed boulevard between Klein Avenue and E. K. Gaylord Boulevard. On the west side of the central section, instead of following the original I-40 horizontal alignment, the proposed boulevard would turn slightly to align with California Avenue. The proposed boulevard would come down to street level at an at-grade intersection with the existing Western Avenue alignment. The Western Avenue/ Classen Boulevard connection described in Alternative C would not be included. This would be the extent of the proposed boulevard on the west. East of Western Avenue, California Avenue could require rehabilitation from Western Avenue to Dewey Avenue to ensure the roadway could withstand the increased traffic and connect to Project 180 improvements.

Similarly on the east side of the boulevard and west of E. K. Gaylord Boulevard, Alternative D would swing south from its location at E. K. Gaylord Boulevard to the existing 3rd Street alignment. The two streets would converge approximately at the intersection of Broadway Avenue and 3rd Street. Currently, 3rd Street varies from a two-lane to a four-lane roadway between Walker Avenue and E. K. Gaylord Boulevard and would be a one-way road eastbound. It would have intermittent medians that would separate the through lanes from on- and off-ramp lanes for the original I-40. Alternative D would provide an undivided, two-way, four-lane facility between the convergence point and Walker Avenue. West of Walker Avenue, the reconstruction would continue for approximately 450 feet with a two-lane, two-direction roadway. The construction would increase 3rd Street's capacity to that of similar surrounding roadways. No new connection would be constructed between the west and east sections.

3.0 Methodology and Evaluation Criteria

As defined in the ROD, the general purpose of the Crosstown Boulevard is to provide additional access points into Downtown Oklahoma City from the old I-40 right-of-way. Beginning and end points were set by the I-40 Crosstown relocation as defined by Alternative D in the ROD. The alignment choices for the boulevard alternatives were to follow the original footprint of the original I-40 ROW or follow existing Oklahoma City streets. Of the alternatives evaluated, three follow the original I-40 alignment (Alternatives A, B, and C), and one follows existing city streets (Alternative D).

Based on extensive stakeholder coordination, the evaluation criteria established for the boulevard are as follows:

- Estimated Construction Costs—Determination of the preliminary costs associated with construction, including improving the intersecting roadways
- Traffic functionality—Identification of the traffic level of service of each alternative and the impact on the adjacent street network
- Impacts to right-of-way— Identification of additional right-of-way that would be required
- Constructability—Identification of construction issues that would result in additional cost or construction/disruption time
- Construction impacts to traffic—Review of the effects of traffic during construction and a determination of whether traffic would be allowed to continue while construction occurs
- Stakeholder objectives—Review of the primary stakeholders' project objectives for the project
- Environmental impacts—Consideration of the environmental, social, and economic impacts on the natural and built environments

4.0 Results

4.1 Purpose and Need

The purpose of constructing the Crosstown Boulevard is to complete the I-40 Crosstown Relocation Project in a way that is consistent with the EIS, and makes sense with the changes that have happened in Oklahoma City since 2002. A primary purpose of the Crosstown Boulevard is to help restore connections that were lost when I-40 was relocated south to its current location. As a result, the Crosstown Boulevard should be easy to drive with little delay which allows for easy access for conducting downtown business while accommodating the planned vision of the downtown area. The Record of Decision stipulates that the Crosstown Boulevard's general purpose is to provide additional access points into downtown Oklahoma City from the old I-40 right-of-way while meeting engineering and design standards for ODOT and Oklahoma City. Alternatives A, B, and C all provide additional access points into downtown from Western Avenue to E.K Gaylord Boulevard, while Alternative D would utilize the local network to distribute traffic from the I-40 Crosstown Expressway at Western and E.K. Gaylord Boulevard. Additionally, Alternative C has received the support of Oklahoma City, and would comply with current planning initiatives identified by MAPS 3.
Alternative C was ranked the highest (four) in terms of meeting the Purpose and Need of the project because it provides the greatest access into downtown while promoting opportunities for pedestrian and bicyclists. It is also consistent with the *Core to Shore Plan* (2008), and supported by Oklahoma City. Alternatives B was ranked higher than Alternative A because of roadway section is narrower, but both were ranked lower than Alternative C because of the extended bridge is not consistent with local planning initiatives. Alternative D ranked the lowest (one) because it does not provide efficient movement of traffic into and through the downtown, and does not support planning initiatives adopted by Oklahoma City.

4.2 Estimated Construction Costs

The cost of construction can be separated by section. As describe above, the west and east sections are the same for the four build alternatives. These costs (in 2013 dollars) are as follows:

West Connection	$ 8,508,300
East Connection (Railroad Bridge to I-40 Ramps)	$16,059,600

Alternative construction costs are separated into two categories, mainline and side roads. Mainline costs are limited to the costs associated with constructing the boulevard and the intersections; the side road costs are limited to the end of the intersection limits. For comparison purposes, the estimated construction costs reflect concrete pavement for roadways and the alternatives.

Alternative A (Transition and Core Section)

Boulevard	$33,491,711
Street Connection	$ 3,952,433
Total Alternative A	**$62,012,044** (includes West and East Connections)

Alternative B (Transition and Core Section)

Boulevard	$27,687,065
Street Connection	$ 4,589,623
Total Alternative B	**$56,445,588** (includes West and East Connections)

Alternative C (Transition and Core Section)

Boulevard	$ 9,240,720
Street Connection	$ 5,643,036
Total Alternative C	**$39,451,656** (includes West and East Connections)

Alternative D (Transition and Core Section)

California and 3rd Street	$ 6,101,921
Street Connection	$ 3,094,997
Total Alternative D	**$33,764,818** (includes West and East Connections)

The cost estimates indicate that Alternative D would be the lowest cost alternative. The difference between Alternative A & B and C & D is related primarily to the cost of the long bridge under Alternatives A and B.

4.3 Traffic Functionality

Traffic Engineering Consultants studied the traffic operations for the four alternatives (Appendix B). The analysis examined the functionality of the intersections for each alternative as well as adjacent intersections. The traffic was analyzed for projected 2015 and 2040 traffic at the morning (A) and evening (PM) peak hours (Appendix A).

Traffic analysts rate the working conditions of roadways and intersections by levels of service (LOS). LOS ratings range from A to F, with A being the best and F the worst. For intersections, the LOS is defined by the average time of vehicle delay. In general, a LOS A refers to a free-flowing condition, with LOS B through F referring to progressively congested intersections. LOS E refers to an intersection that is approaching failure, and LOS F is considered a failing condition.

For the analysis, the total number of intersections with at least one leg with a LOS E or F was calculated, including morning and evening peak traffic hours. This total was divided by the total number of intersections in the alternative. This allowed the failing LOS intersections to be expressed as a percentage of the total intersections. The following table summarizes the results.

	2015 Analysis	2040 Analysis
Alternative	Percent of LOS E and F Intersections	Percent of LOS E and F Intersections
A	40%	67%
B	57%	70%
C	36%	64%
D	46%	74%

As indicated above, Alternative C has the lowest percentage of failing intersections and has the most advantageous traffic operations of the four build alternatives for both 2015 and 2040. The complete traffic report is provided in Appendix A.

4.4 Impacts to Right-of-Way

One of the primary constraints for the boulevard is the stakeholders' desire to keep the improvements inside the old I-40 right-of-way to the greatest extent possible. Alternatives A, B, and C contain an alignment change to the existing Western Avenue, diverting it to Classen Boulevard between Reno Avenue and Sheridan Avenue. This alignment would require approximately 0.3 acre of ROW between Western Avenue and Classen Boulevard, north of California Avenue.

The only alternative that would not require additional ROW is Alternative D.

As a result of the above discussion, Alternatives A, B, and C were all ranked the same (three). This level of ranking was given because the alignment change to Western Avenue is supported by Oklahoma City. The alternative that would not require any additional right-of-way would be Alternative D, which was ranked the highest (three).

4.5 Constructability

The bridge included in Alternatives A and B would create a constructability challenge. Although the aboveground portion of the old I-40 structure was removed, the underground components remain in place. As a result, construction of the foundation for the new bridge under Alternative A and B would have to avoid the foundation of the old I-40 Crosstown Expressway Bridge. Removing the old foundations and rebuilding the new bridge piers may require additional changes to the local street grid. As a result, avoiding the foundation of the old I-40 Crosstown Expressway Bridge would require additional time and expense to construct.

Alternative C would be constructed over existing utilities (water, gas, sanitary sewer, and storm sewer) under the west bridge abutments. Relocating these utilities or constructing the bridge abutment would be complex, but more manageable than the bridge piers associated with Alternatives A and B.

Alternative D would be located within the existing local street grid. In general, conflict with utilities in the local street network would be greater because Alternatives A, B, and C would be constructed in currently undeveloped old I-40 right-of-way where detailed utility plans exist. The unanticipated conflicts with existing utilities could result in unexpected costs and construction delays.

As a result of the above discussion, Alternatives C was ranked as the highest (four) because the shorter bridge could be built with minimal disruption to the downtown street grid. Alternative D was given a slightly lower ranking (three) because of the issues concerning building within the existing right-of-way of local streets. Alternatives A and B were both ranked the lowest (one) because of the complexity involved with the new bridge foundations.

4.6 Construction Impacts to Traffic

Construction on roadways where existing traffic operates would disrupt and inconvenience area motorists. Although all four alternatives include some components that would be constructed in locations where traffic would be affected, significant segments of Alternatives A, B, and C are located in areas currently closed to traffic because no roadway exists in the old I-40 ROW. As a result, these areas could be constructed without adversely affecting traffic.

For Alternatives A, B, and C, Western Avenue will be realigned with Classen Boulevard. Alternative C would involve the reconstruction of a portion of Reno Avenue, as requested by Oklahoma City. These areas would be constructed in phases and would affect local traffic. During construction, portions of some local streets and intersections with the Crosstown Boulevard would be closed. Area access would be maintained by providing detours to the adjacent street network through a Maintenance of Traffic Plan developed during final design. The duration of closures will be minimized to the greatest extent possible. Alternative D would be constructed completely within existing city streets and would have the biggest negative effect on traffic and businesses during construction.
Based on the above discussion, Alternatives A, B, and C could be sequenced to minimize overall impacts to traffic during construction, and were ranked the same (two). Alternative D was ranked as the lowest (one) in terms of all the alternatives because it would be constructed within existing streets and would have the greatest disruption to people and businesses during construction.

4.7 Stakeholder Objectives

Project stakeholders are those who are affected by the project, either directly or indirectly, feel they would be affected, and public and agency officials. During the EA process, the public outreach efforts included four public meetings which were attended by nearly 700 people and resulted in almost 500 written comments. Public comments varied from the first meeting to the last meeting but overall, the top three themes included: make the Crosstown Boulevard bicycle and pedestrian friendly; be consistent with current Oklahoma City plans and studies; and provide opportunities for economic development.

Based on stakeholder comments, Alternative D was ranked the highest (four). The ranking was based on the general public's desire to utilize the existing street grid and to maximize the amount of land available for redevelopment. In addition, many stakeholders were opposed to the long elevated structure that would interfere with downtown views, reminiscent to the old I-40 Crosstown Expressway that was included in Alternatives A and B. Alternative C was ranked next (three) because it would provide the best traffic flow and provide more efficient access into downtown. In addition, as a result of the multi-use path, Alternative C would also provide the opportunities for pedestrians and bicyclists when compared to all the other alternatives.

Alternative B was ranked higher than Alternative A (which was ranked lowest [one]) because it would perform relatively well with traffic flow, however, the long bridge would limit the views into the downtown. Alternative B would provide for on-street parking and bicycle lanes in the downtown area and would accommodate pedestrians while reducing the overall width of the Crosstown Boulevard when compared to Alternative A.

4.8 Consistency with Local Planning Efforts

Alternatives A, B, and C would be consistent with the area MAPS 3 plans , would support new land development consistent with the *Core to Shore Plan*, and provide improved access for various transportation modes including walking, and bicycling. A large portion of the *Core to Shore Plan* (Oklahoma City 2008) planning area lies within the EA study area, and the would be expected to provide necessary access and related improvements accommodating current and planned development that supports walkability and multimodal uses.
Alternative C was ranked as the highest (four) in regard to consistency with local planning efforts because of its narrowed footprint (four-lanes), shorter bridge at Western Avenue, the shared use path between Western Avenue and the Bricktown Canal. It also has the support of Oklahoma City. Alternatives A and B were given intermediate rankings (three) because both support MAPS 3 initiatives, but not as fully as Alternative C, primarily because of the length of the bridge over Western Avenue. Alternative D was ranked as the least (one) consistent with the local planning efforts, but it would provide the greatest amount of leftover right-of-way (27.4 acres) from the old I-40 location which could be used for redevelopment.

4.9 Environmental Impacts

Environmental impacts have been identified in accordance with the National Environmental Policy Act, as amended and can be found in the other attachments for the EA Document. In terms of environmental resources, all of the alternatives are relatively comparable. However, Alternative C was ranked highest (four) because it provides the best balance between vehicles, bikes and pedestrians and it also provides the greatest potential to improve visual quality among the four alternatives. Alternative D was ranked the lowest (one) because of it would have the most intersections with unacceptable LOS among the alternatives and not change regional visual quality of downtown, but it would require the least amount of energy to construct.

4.10 Decision Matrix

An alternative's likely ability to meet the above-described criteria was assigned a score ranging from 1 to 4, with 4 being the highest (or best). The scores were then totaled. The alternative with the highest total would best meet the study objectives overall. These results are provided below.

Alternative	Purpose And Need	Construction Costs	Traffic Functionality	Impacts to Right-of-Way	Construct-ability	Construction Impacts to Traffic	Stakeholder Objectives	Consistency with Local Planning	Environmental Impacts	Total
A	2	1	3	3	1	2	1	3	2	18
B	3	2	2	3	1	2	2	3	3	21
C	4	3	4	3	4	2	3	4	4	31
D	1	4	1	4	3	1	4	1	1	20

As indicated in the above, Alternative C has the highest total score. After reviewing the criteria and considering them in a decision matrix, Alternative C would best meet the project purpose and need, as well as the engineering and design standards for ODOT and Oklahoma City and minimizes negative environmental impacts. As a result, ODOT, FHWA and Oklahoma City identify Alternative C as the Preferred Alternative for the Crosstown Boulevard.

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Appendix A.
Overall Plan with Alternatives

DESIGN	KRG	
DRAWN	RH	
CHECKED	KBA	
APPROVED		
SQUAD	MacArthur	

OKLAHOMA DEPARTMENT OF TRANSPORTATION

ALTERNATE A
PENN TO BYERS

STATE JOB NO. JP 17428(80) SHEET NO.

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PRINT DATE: 7/9/2014

PRINT DATE: 7/9/2014 T:\0303\Working Files\Boulevard EA\Blvd Concepts 2013\4 lane concepts BIG BRIDGE\0303 Penn to Byers Alt Align B Exhibit.dgn

DESIGN	KRG	
DRAWN	RH	
CHECKED	KBA	
APPROVED		
SQUAD	MacArthur	

OKLAHOMA DEPARTMENT OF TRANSPORTATION

ALTERNATE C
PENN TO BYERS

STATE JOB NO. JP 17428(80) SHEET NO.______

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Appendix B.
Traffic Study

Crosstown Boulevard
Traffic Operational Analysis

Prepared For:
Oklahoma Department of Transportation

Prepared By:
Traffic Engineering Consultants, Inc.

REGISTERED PROFESSIONAL ENGINEER
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7-29-14
Date

TEC
A CLEAR DIRECTION

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SUMMARY OF FINDINGS

This Traffic Operational Analysis was conducted to identify potential impacts to the traffic and transportation facilities resulting from the Crosstown Boulevard project. Four alternatives were considered and reviewed. Alternatives A, B, and C are the most similar as each of these boulevard alternatives would follow the same general alignment. Alternative D is significantly different as it has no continuous boulevard connections from one end to the other and relies solely on the existing street grid.

Alternative A, the six-lane facility, would provide the most capacity but would not provide the most access. Alternatives B and C, the four-lane facilities, would have less capacity when compared to Alternative A. Alternative B would maintain the same access as Alternative A, but Alternative C would increase the number of access points to include the intersections along the new Boulevard at Reno Avenue, Lee Avenue, and Shartel Avenue. Alternative D would rely solely on the existing street grid system. Therefore, this alternative would provide no new capacity in the downtown area. Based on the results of the intersection capacity analyses conducted, Alternative C is expected to provide adequate capacity, the optimum number of points of access to and from the boulevard, as well as the optimum pedestrian experience.

1.0 INTRODUCTION

MacArthur Associated Consultants, LLC, retained Traffic Engineering Consultants, Inc. (TEC) to conduct a traffic operational analysis of the proposed Crosstown Boulevard, including four alternatives, in Oklahoma City, Oklahoma. This technical report reviews the expected levels of operation along the boulevard based on the projected traffic and different lane configurations. **Figures 1A and 1B** show the project area boundaries.

2.0 BACKGROUND

As part of the Crosstown Expressway project, the Oklahoma Department of Transportation (ODOT) prepared an operational analysis report analyzing the effects on traffic in the downtown area from relocating Interstate 40 and constructing a boulevard in the resulting right-of-way. Completed in 2004, the *Operational Analysis Report* (ODOT 2004) is subsequently referred to as the ODOT Report throughout the remainder of this technical report.

Functioning together, the Crosstown Boulevard and Interstate 40 were analyzed as integral parts of the transportation system in the ODOT Report. Both facilities were to function as support to one another. The design horizon year in the ODOT Report was 2030. Traffic projections in the ODOT Report were based on the anticipated growth (at the time the ODOT Report was conducted) in the downtown area over 20+ years and based on the Association of Central Oklahoma Government travel forecasts. The future traffic projections include traffic increases resulting from expected future commercial, retail, and residential growth. These projected traffic increases were then added to existing traffic data previously collected for the ODOT Report to develop the 2030 traffic projections. These traffic projections were accepted by both ODOT and the Federal Highway Administration, and the results of the analyses that were conducted using the projected traffic were submitted as part of the Environmental Impact Statement (EIS).

The ODOT Report analyzed both the relocation of Interstate 40 and the construction of the Crosstown Boulevard as a system. This is important to note because of the change in the primary access points to downtown from the interstate. In its original location, Interstate 40 provided access to downtown via ramps (primary access points to downtown) at Pennsylvania Avenue (an off-ramp in the eastbound direction and an on-ramp in the westbound direction), Virginia Avenue (an on-ramp in the eastbound direction and an off-ramp in the westbound direction), Western Avenue (off- and on-ramps in both the eastbound and westbound directions), Classen Boulevard (an off-ramp in the westbound direction only), Walker Avenue (an off-ramp in the eastbound direction only), Hudson Avenue (an on-ramp in the westbound direction only), Harvey Avenue (an off-ramp in the eastbound direction only), and Robinson Avenue (both off- and on-ramps in the westbound direction and an on-ramp in the eastbound direction).

As part of the relocation of Interstate 40, access points from Interstate 40 were consolidated. In its new alignment, Interstate 40 has ramps at the west boulevard connection, Pennsylvania Avenue (off- and on-ramps in both the eastbound and westbound directions), Western Avenue (off- and on-ramps in both the eastbound and westbound directions), Robinson Avenue (an off-ramp in the westbound direction), Shields Boulevard (both off- and on-ramps in the eastbound direction and an on-ramp in the westbound direction), and the east boulevard connection to I-235/I-35.

The number of overall access points from the new Interstate 40 decreased from what it was under the old conditions. The decrease in access points was made possible with the anticipation of the good connectivity of the boulevard to Interstate 40. With good vehicular capacity on the boulevard and its good connectivity to Interstate 40 on the east and west ends, the interchanges at Western Avenue and Shields Avenue (in conjunction with the Boulevard connections) were projected to be sufficient to handle the projected 2030 traffic accessing the downtown area.

Based on the EIS and Record of Decision, and reconfirmed by the ODOT Report, the boulevard was committed to be built as a six-lane cross section with turn lanes at major intersections. **Figures 2A** through **2C** show the lane and intersection geometry for the Boulevard. A further review of the ODOT Report reveals that several intersections along the boulevard would be anticipated to operate poorly by 2030.

Since 2004, when the original study was conducted and the EIS was submitted and accepted, there has been much discussion pertaining to the design or geometric layout of the boulevard. Ultimately, it has been decided that the six-lane cross section of the boulevard is not conducive to a pedestrian-friendly area and other options/designs should be studied. This study is a result of the changes in intersection and lane geometry being considered with a comparison to the originally approved design.

3.0 STUDY GEOMETRY AND TRAFFIC

3.1 Geometry

This technical report focuses on the Central Section of the study area, from Klein Avenue to E.K. Gaylord/Shields Boulevard, for determining impacts to the traffic and transportation facilities since this area is where the differences among the alternatives occur. The West Connection, the portion of the study area from Pennsylvania Avenue to Western Avenue, is the same for all of the alternatives. The East Connection of the Crosstown Boulevard was identified and approved during the interchange study for the *Interstate 40 – Crosstown Expressway from I-235 to Meridian Avenue Oklahoma City, Oklahoma Final Environmental Impact Statement/Record of Decision* (FHWA 2002). Since the East Connection previously was approved for the area east of the Santa Fe Railroad to Lincoln Boulevard, no differences exist between the alternatives in this area. As a result, no other alternative was considered for this section in the new Environmental Assessment for the Crosstown Boulevard project. The following sections describe each of the alternatives analyzed as part of this study.

3.1.1 Alternative A: Six-Lane Functional Design

This alternative is generally the same as that studied in the ODOT Report. The proposed layout for Alternative A is shown in **Figures 3A** through **3C**. Under this alternative, the boulevard would be a six-lane cross section. The major difference between the geometric layout of this alternative when compared to that studied in the ODOT Report is the realignment of Western Avenue as previously described.

3.1.2 Alternative B: Four-Lane Functional Design

This alternative is generally the same as that studied in the ODOT Report but with a four-lane cross section. The proposed layout for Alternative B is shown in **Figures 4A** through **4C**. As with Alternative A, Western Avenue is realigned under this alternative.

3.1.3 Alternative C: Four-Lane Functional Design with Additional Boulevard Connections

This alternative is generally the same as Alternative B with the four-lane cross-section. The proposed layout for Alternative C is shown in **Figures 5A** through **5C**. The most significant difference with this alternative is that the boulevard comes down to grade prior to Reno Avenue. As a result, there would be an at-grade intersection between Reno Avenue and the boulevard under this alternative.

3.1.4 Alternative D: Grid Option

This alternative is significantly different from the other alternatives and is considered the “Grid Option.” The proposed layout for Alternative D is shown in **Figures 6A** through **6C**. The intent of this alternative is to leave as much of the existing city street grid in place as possible while still connecting the original boulevard connections to/from I-40 on both the east and west ends. The original boulevard connection on the west end would be at-grade just west of the Western Avenue intersection and would eventually tie into the existing California Avenue. The original boulevard connection on the east end would be at-grade just east of Oklahoma Avenue and would tie into the existing S.W. 3rd Street. All internal intersections bounded by Western Avenue on the west, Gaylord Avenue on the east, California Avenue on the north, and S.W. 3rd Street on the south were assumed to remain with their existing geometric and traffic control conditions, with the exception of modifying a few one-way locations to two-way.

3.2 Traffic

ODOT provided the 2030 traffic projections from the original study to be used for this study. **Figures 7A** through **7C** show the original traffic data from the ODOT Report. Since the original study was conducted, the City of Oklahoma City has constructed portions of the Downtown Streetscape Project 180. Project 180 has resulted in the conversion of some previously one-way streets to two-way operations and has modified various lane geometries throughout the downtown area. These changes affected downtown traffic patterns. As a result, ODOT asked TEC to modify the 2030 original traffic data reflecting the Project 180 changes. These modifications were minor and consisted of reassigning traffic from one intersection to another based on the cross-street geometrics. The overall traffic on the boulevard was kept the same.

TEC also reviewed the traffic distribution so the volumes account for known future developments and land uses in the area. The City of Oklahoma City, as well as the Alliance for Economic Development of Oklahoma City, provided this information. This included information regarding land uses and developments such as the new convention center, new hotels, high-density residential, and additional commercial and retail developments. Many of these land uses are proposed to be constructed south of the boulevard, as reflected in the traffic volumes. Based on the information provided, traffic distribution along the Boulevard reasonably reflects the anticipated area developments and land uses.

The design years for this study are 2015 and 2040. Through discussions with ODOT, it was determined that the traffic originally projected for 2030 in the ODOT Report would be appropriate for the 2040 traffic. This determination was made based on the projected leveling of overall traffic growth after the area commercial, retail, and residential development is built. As a result, the modifications reflecting new development made to the ODOT Report 2030 traffic are used as the 2040 traffic in this report. The 2015 traffic was then factored using a straight-line two percent average annual growth rate. **Figures 8A, 8B, 9A, 9B, 10A,** and **10B** show the approved 2015 traffic. **Figures 11A, 11B, 12A, 12B, 13A,** and **13B** show the approved 2040 traffic for each alternative**.**

4.0 ANALYSIS

TEC used two standard traffic engineering methodologies to conduct intersection capacity analyses. For signalized intersections, TEC used *Synchro Professional, Version 7.0,* which is a software package for modeling and optimizing traffic signal timings at signalized intersections. For unsignalized intersections, TEC used the methodology from the 2010 (5th) edition of the *Highway Capacity Manual* (Transportation Research Board, 2010).

The capacity analysis provides a measures of the quantity of traffic that a given facility can accommodate. Traffic facilities generally operate poorly at or near capacity. The analysis is intended to estimate the maximum traffic that a facility can accommodate while maintaining prescribed operational qualities. The operational criteria use level-of-service (LOS). This is a qualitative measure and describes operational conditions such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. Six levels-of-service are defined and are given letter designations, from “A” to “F,” with LOS A representing the best operating conditions and LOS F the worst.

The time it takes drivers to enter and clear an intersection is called the average control delay. This delay is estimated for each lane movement and then averaged for the overall intersection LOS. For signalized intersections, the LOS is directly related to the control delay value in average seconds per vehicle (s/veh).

The LOS criteria for signalized intersections are as follows:

SIGNALIZED INTERSECTIONS

Level-of-Service	Control Delay per Vehicle (s/veh)
A	≤ 10
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 80

The criteria for stop-controlled or unsignalized intersections differ from signalized intersections. A higher level of control delay has been determined to be acceptable at a signalized intersection for the same LOS. The LOS criteria for unsignalized intersections are as follows:

UNSIGNALIZED INTERSECTIONS

Level-of-Service	Control Delay per Vehicle (s/veh)
A	0-10
B	> 10-15
C	> 15-25
D	> 25-35
E	> 35-50
F	> 50

TEC conducted the intersection capacity analyses for the four different alternative scenarios. **Tables 1 through 5** summarize the results of these analyses. These tables present the LOS and delay in average seconds per vehicle for the a.m. peak hour (the highest one-hour traffic period between 7:00 and 9:00 a.m.) and the p.m. peak hour (the highest one-hour period between 4:00 and 6:00 p.m.) at the intersections analyzed in the study area for the alternatives for the years 2015 and 2040.

4.1 Alternative A Results

The Alternative A intersection capacity analysis was conducted to allow for a direct comparison to the results determined in the original ODOT Report. This design included six lanes and turn lanes at most intersections. This geometric layout would provide the most capacity of all the alternatives. **Table 1** presents the results of the Alternative A analyses. Under the 2015 projected traffic conditions, the following three intersections in the study area would have unacceptable levels-of-service:

- Reno Avenue and Western Avenue during the a.m. peak hour – LOS E
- Reno Avenue and Walker Avenue during the p.m. peak hour – LOS E
- Reno Avenue and Gaylord Avenue during the p.m. peak hour – LOS F

Intersections along the new Boulevard are expected to operate at LOS D or better under the 2015 projected traffic conditions. By 2040, operations at several additional intersections are expected to deteriorate to unacceptable levels-of-service. These intersections, in addition to the previously listed intersections, are as follows:

- Boulevard and Klein Avenue during the p.m. peak hour – LOS F
- Boulevard and Walker Avenue during the p.m. peak hour – LOS F
- Boulevard and Robinson Avenue during the a.m. peak hour – LOS E
- Boulevard and Gaylord Avenue during both peak hours – LOS F and LOS E, respectively
- Reno Avenue and Klein Avenue during the p.m. peak hour – LOS E
- Reno Avenue and Hudson Avenue during both peak hours – LOS F
- Reno Avenue and Robinson Avenue during the a.m. peak hour – LOS F

4.2 Alternative B Results

Alternative B is similar to the Alternative A design but with a four-lane cross section that begins east of Klein Avenue. This geometric layout provides less capacity than Alternative A. **Table 2** summarizes the analysis results of Alternative B. Under the 2015 projected traffic conditions, the following four intersections in the study area would have unacceptable levels-of-service:

- Boulevard and Hudson Avenue during the a.m. peak hour – LOS E

- Boulevard and Gaylord Avenue during both peak hours – LOS E
- Reno Avenue and Western Avenue during the a.m. peak hour – LOS E

By 2040, operations at several additional intersections are expected to deteriorate to unacceptable levels-of-service. These intersections, in addition to the previously listed intersections, are as follows:

- Boulevard and Klein Avenue during the p.m. peak hour – LOS F
- Boulevard and Walker Avenue during both peak hours – LOS E and LOS F, respectively
- Boulevard and Robinson Avenue during both peak hours – LOS F
- Reno Avenue and Klein Avenue during the p.m. peak hour – LOS E
- Reno Avenue and Walker Avenue during both peak hours – LOS F
- Reno Avenue and Hudson Avenue during both peak hours – LOS F and LOS E, respectively
- Reno Avenue and Gaylord Avenue during the p.m. peak hour – LOS F

4.3 Alternative C Results

Alternative C is similar to the Alternative B design but with an at-grade intersection at Reno Avenue and Lee Avenue. This geometric layout provides approximately the same capacity as Alternative B but provides additional access to the downtown area. **Table 3** summarizes the analysis results of Alternative C**.** Under the 2015 projected traffic conditions, the following four intersections in the study area will have unacceptable levels-of-service:

- Boulevard and Gaylord Avenue during both the a.m. and p.m. peak hours – LOS E
- Boulevard and Shartel Avenue during both a.m. and p.m. peak hours – LOS F
- Boulevard and Lee Avenue during both a.m. and p.m. peak hours – LOS F
- Reno Avenue and Walker Avenue during the p.m. peak hour – LOS E
- Reno Avenue and Gaylord Avenue during the p.m. peak hour – LOS E

By 2040, operations at several additional intersections are expected to deteriorate to unacceptable levels-of-service. These intersections, in addition to the previously listed intersections, are as follows:

- Boulevard and Klein Avenue during the p.m. peak hour – LOS F
- Boulevard and Walker Avenue during both the a.m. and p.m. peak hours – LOS E and LOS F, respectively

- Boulevard and Hudson Avenue during both peak hours – LOS F and LOS E, respectively
- Boulevard and Robinson Avenue during both peak hours – LOS F
- Reno Avenue and Western Avenue during both peak hours – LOS F and LOS E, respectively
- Reno Avenue and Hudson Avenue during both peak hours – LOS F
- Reno Avenue and Robinson Avenue during the a.m. peak hour – LOS E

4.4 Alternative D Results

Alternative D would connect the boulevard to the city street grid system and leave much of the existing street geometry in place. As a result, this option does not increase the existing capacity within the system but rather increases accessibility to the downtown area with both the east and west boulevard connections. To study this alternative, the original study area had to be expanded to 31 intersections. This is double the number of intersections included in the study area for the other alternatives. **Tables 4 and 5** show the results of this analysis. Under the 2015 projected traffic conditions, the following seven intersections in the study area would have unacceptable levels-of-service:

- California Avenue and Shartel Avenue during both peak hours – LOS F
- California Avenue and Walker Avenue during both peak hours – LOS F
- Reno Avenue and Walker Avenue during the p.m. peak hour – LOS F
- S.W. 3rd Street and Walker Avenue during both the a.m. and p.m. peak hours – LOS F and LOS E, respectively
- S.W. 3rd Street and Hudson Avenue during the a.m. peak hour – LOS E
- S.W. 3rd Street and Robinson Avenue during both the a.m. and p.m. peak hours – LOS E and LOS F, respectively
- S.W. 3rd Street and Gaylord Avenue during both peak hours – LOS F

By 2040, operations at several additional intersections are expected to deteriorate to unacceptable levels-of-service. These intersections, in addition to the previously listed intersections, are as follows:

- California Avenue and Western Avenue during both peak hours – LOS F
- California Avenue and Classen Avenue during both peak hours – LOS F
- California Avenue and Lee Avenue during both peak hours – LOS F
- California Avenue and Dewey Avenue during both peak hours – LOS F
- Reno Avenue and Western Avenue during the p.m. peak hour – LOS E

- Reno Avenue and Shartel Avenue during both the a.m. and p.m. peak hours – LOS F and LOS E, respectively
- Reno Avenue and Dewey Avenue during the p.m. peak hour – LOS F
- Reno Avenue and Hudson Avenue during both the a.m. and p.m. peak hours – LOS E and LOS F, respectively
- Reno Avenue and Robinson Avenue during the a.m. peak hour – LOS F
- Reno Avenue and Gaylord Avenue during the a.m. peak hour – LOS F
- S.W. 2nd Street and Shartel Avenue during both peak hours – LOS F
- S.W. 2nd Street and Walker Avenue during both peak hours – LOS F
- S.W. 3rd Street and Shartel Avenue during both peak hours – LOS F
- S.W. 3rd Street and Lee Avenue during both peak hours – LOS F

5.0 CONCLUSIONS

Because the Boulevard will provide good access to the downtown area via the two interchanges with Interstate 40, there is expected to be a moderate volume of traffic using the boulevard for primary downtown access. When comparing the four alternatives, Alternatives A, B, and C are the most similar because the boulevard would follow the same general alignment. Alternative D is significantly different than the other alternatives because there would be no continuous boulevard connection from one end to the other. The study area for Alternative D had to be expanded from the study area used for Alternatives A, B, and C, which doubled the number of study intersections. Although no quantitative comparison of intersections can be made between those analyzed for Alternative D and the same intersections not analyzed for Alternatives A, B, and C, a qualitative comparison was made of the expected intersection operations. The operational reviews of the additional intersections for Alternatives A, B, and C were prepared based on TEC's 25 years of experience in working on downtown traffic and transportation-related projects, as well as the results of the analyses conducted on nearby intersections. **Figures 14 through 21** show the results from these operational assessments. The green color indicates the expected operation would be good (LOS D or better). The red color indicates the expected operation would be poor (LOS E or F).

Alternatives A, B, and C would provide varying degrees of vehicular capacity and downtown access. Alternative A would provide the most capacity resulting from the three through lanes in each direction; however, it would not provide the most downtown access points among the three alternatives. Alternatives B and C would have less capacity than Alternative A because of the four-lane cross section. Alternative B would maintain the same level of downtown access points as Alternative A, but Alternative

C would increase the number of downtown access points by adding three intersections along the west end of the boulevard: Reno Avenue, Lee Avenue, and Shartel Avenue. In summary, with its six-lane cross section, Alternative A would provide the most capacity; Alternatives B and C would provide less capacity than Alternative A because they each have four-lane cross sections; Alternative C would provide the most downtown access points and the same capacity as Alternative B.

Alternative D was developed to maintain the existing infrastructure and city street grid. This alternative is not directly comparable to Alternatives A, B, and C because there is no continuous connection of the boulevard from one end to the other. Under Alternative D, the boulevard connects directly to California Avenue to/from the west and directly to S.W. 3rd Street to/from the east. As a result, the traffic study area was expanded to include the intersections bounded by Western Avenue to the west, Gaylord Avenue to the east, California Avenue to the north, and S.W. 3rd Street to the south. Existing traffic control and lane geometries were assumed to be as they currently exist. The one exception is the current one-way portion of S.W. 3rd Street, which was assumed to be two-way operation.

Alternative D would provides no new capacity to the downtown area. By 2040, 21 of the 31 intersections are expected to operate at unacceptable levels-of-service for at least one peak hour. For the existing city street grid to accommodate the expected increase in traffic, the majority of the study-area roadways would need to be widened to a four-lane cross section with signalized intersections that have turn lanes.

6.0 REFERENCES

Federal Highway Administration (FHWA). 2002. *Interstate 40 - Crosstown Expressway from I-235 to Meridian Avenue Oklahoma City, Oklahoma FHWA-OK-EIS-01-(1)-F, Record of Decision.* May 2002.

Oklahoma Department of Transportation (ODOT). 2004. *Operational Analysis Report*, Chapter 4 – Boulevard Analysis. Prepared in conjunction with Parsons Brinckerhoff and MacArthur Associated Consultants.

Transportation Research Board. 2010. *Highway Capacity Manual.* Fifth Edition.

FIGURE 1A. Boulevard Study Area
Former I-40 Alignment
Oklahoma City, OK

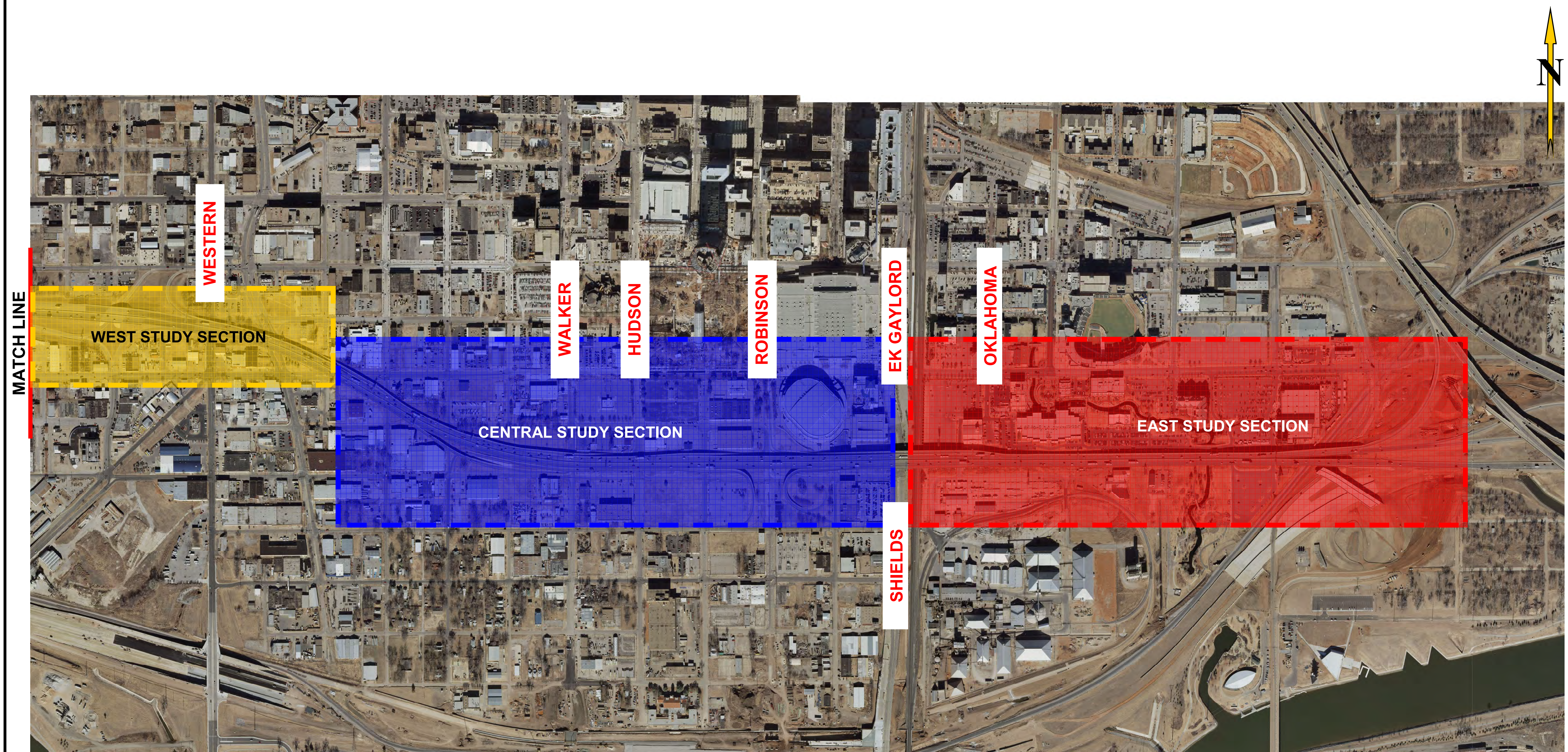
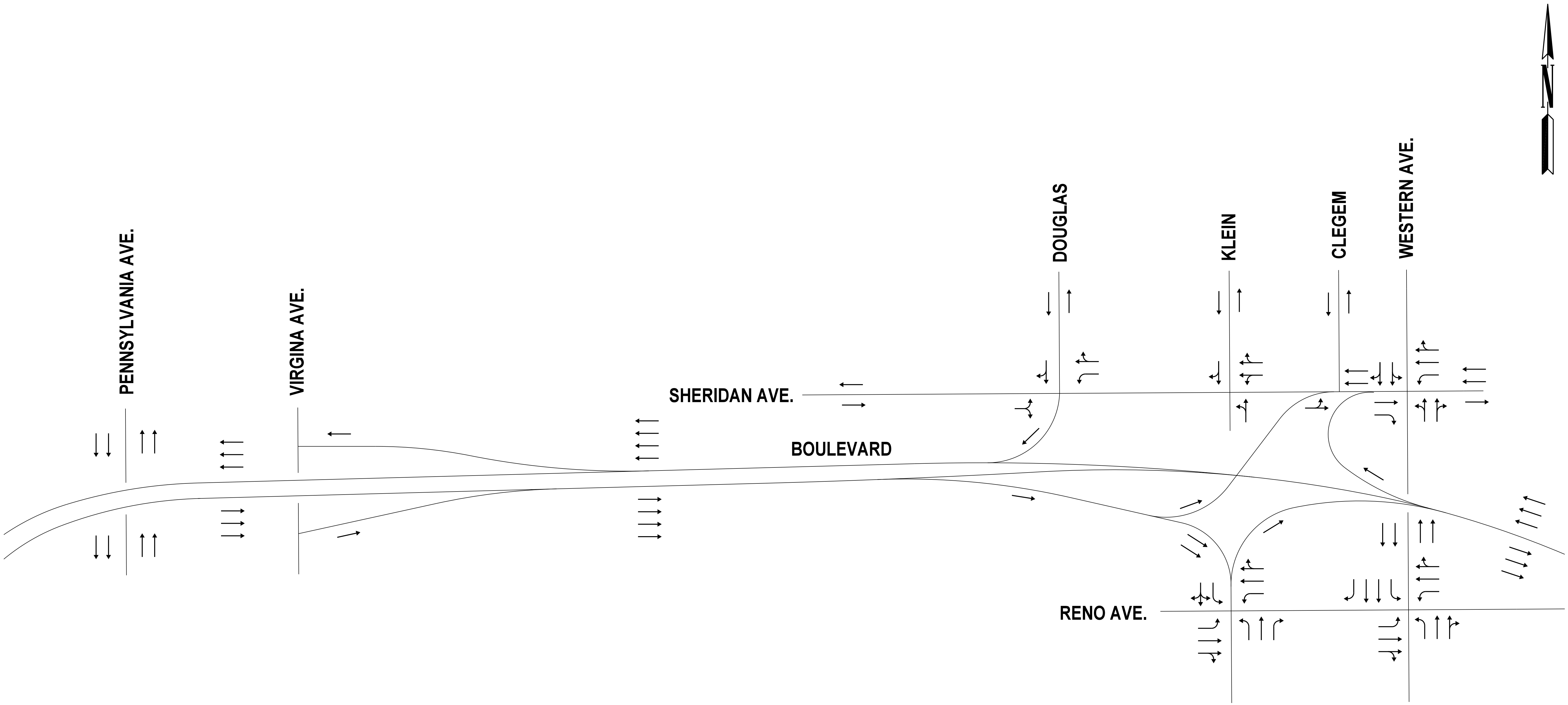


FIGURE 1B. Boulevard Study Area
Former I-40 Alignment
Oklahoma City, OK



TEC A CLEAR DIRECTION

FIGURE 2A. Original Lane Geometry from 2004 ODOT Report

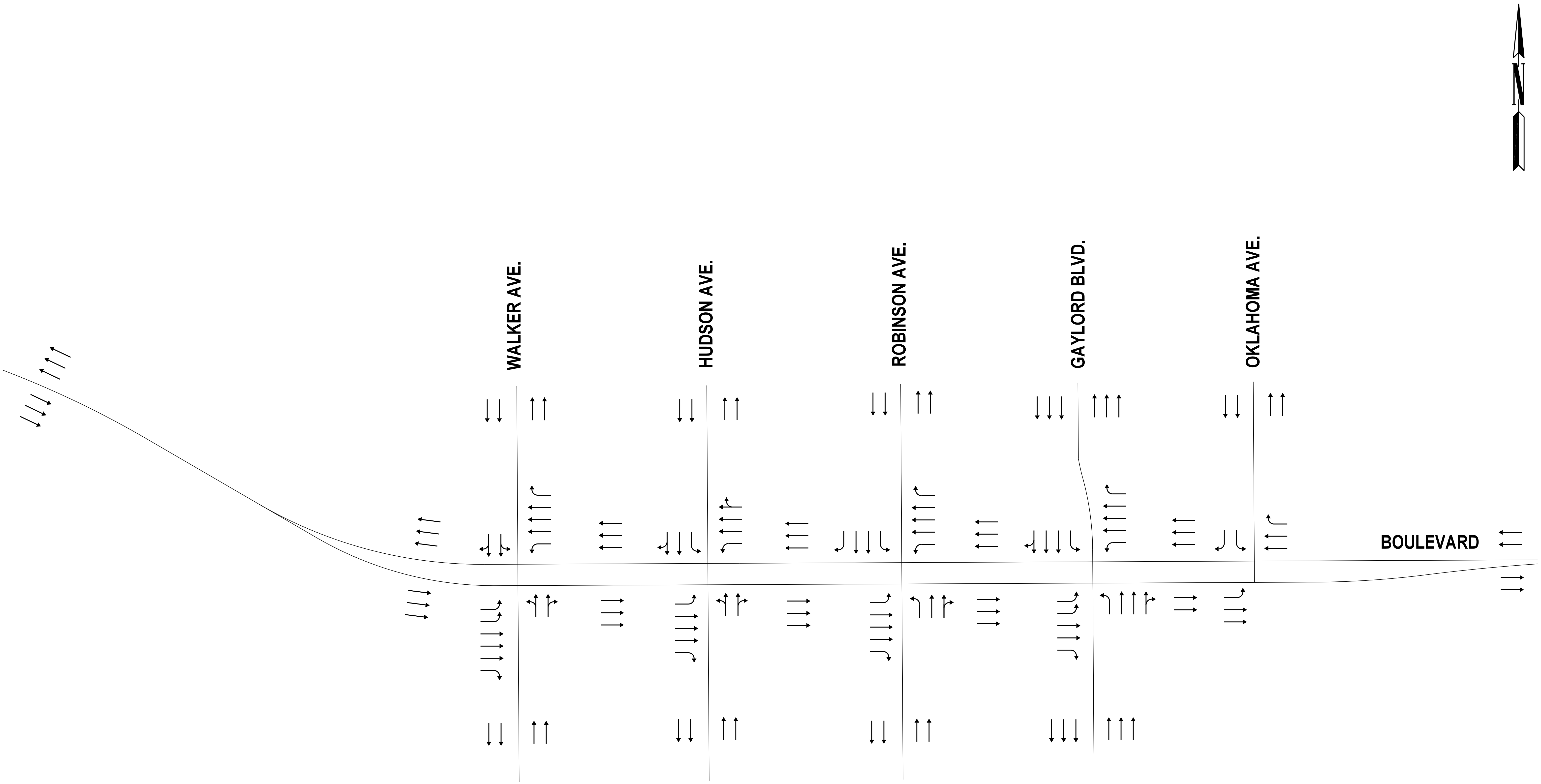


FIGURE 2B. Original Lane Geometry from 2004 ODOT Report

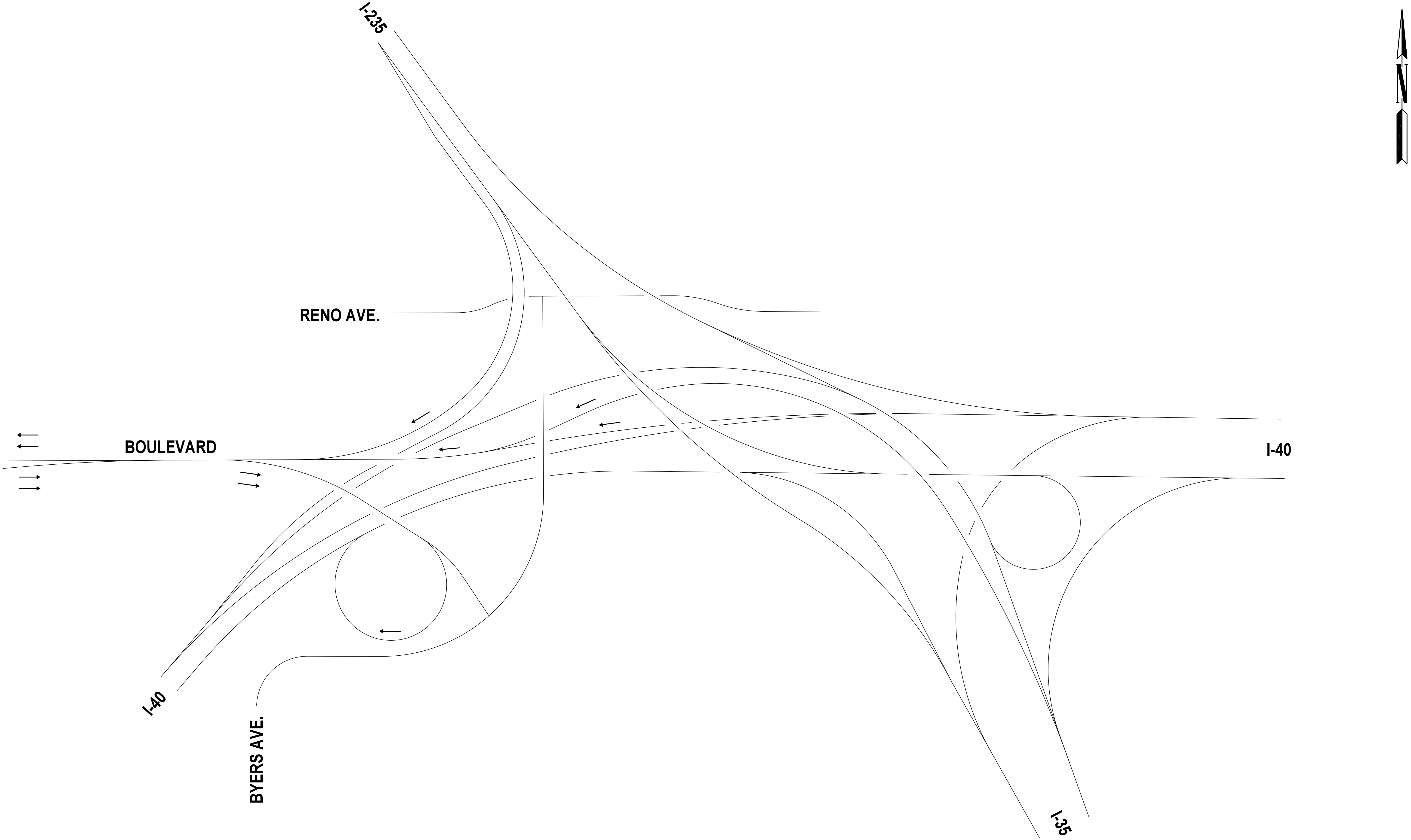


FIGURE 2C. Original Lane Geometry from 2004 ODOT Report

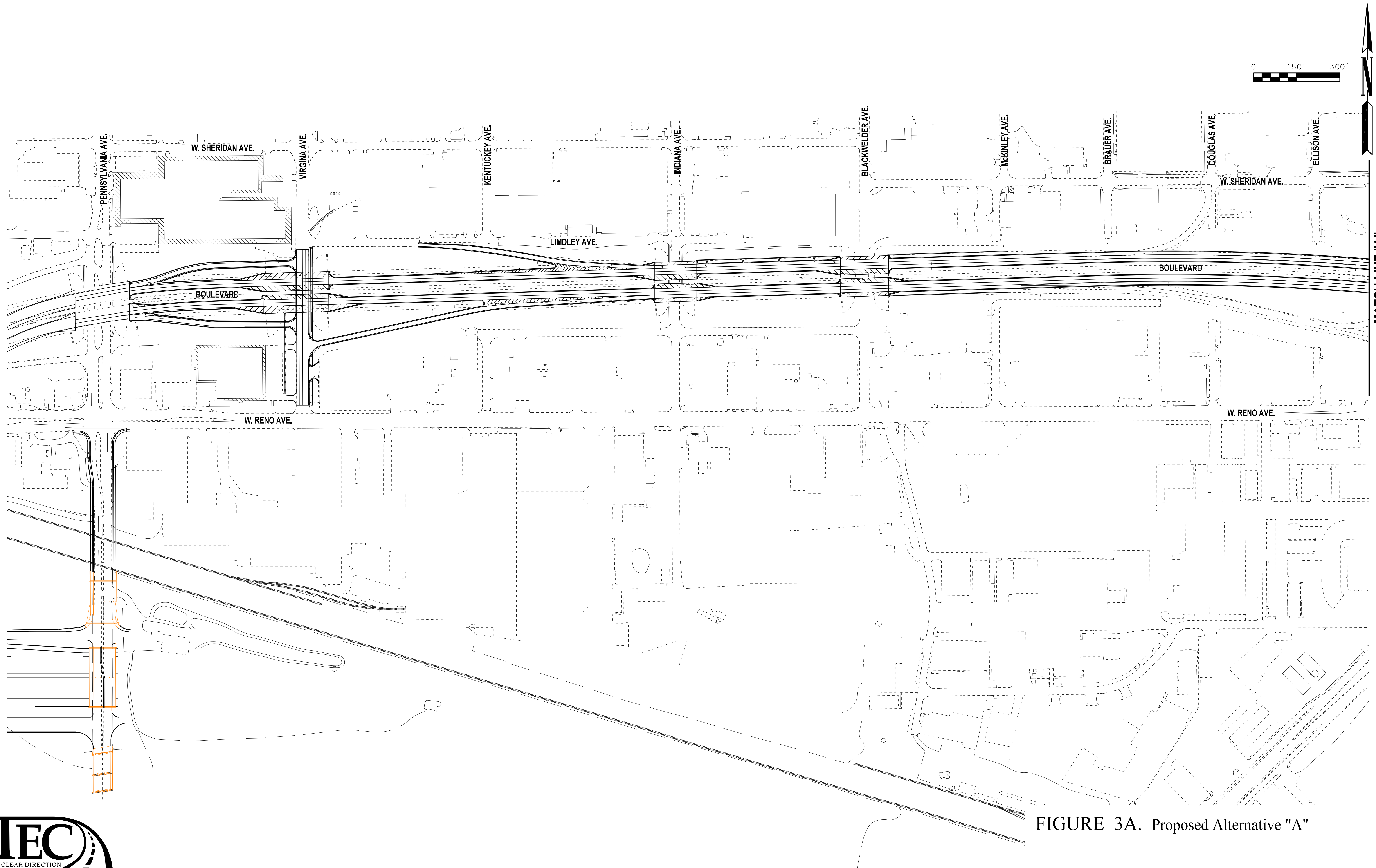
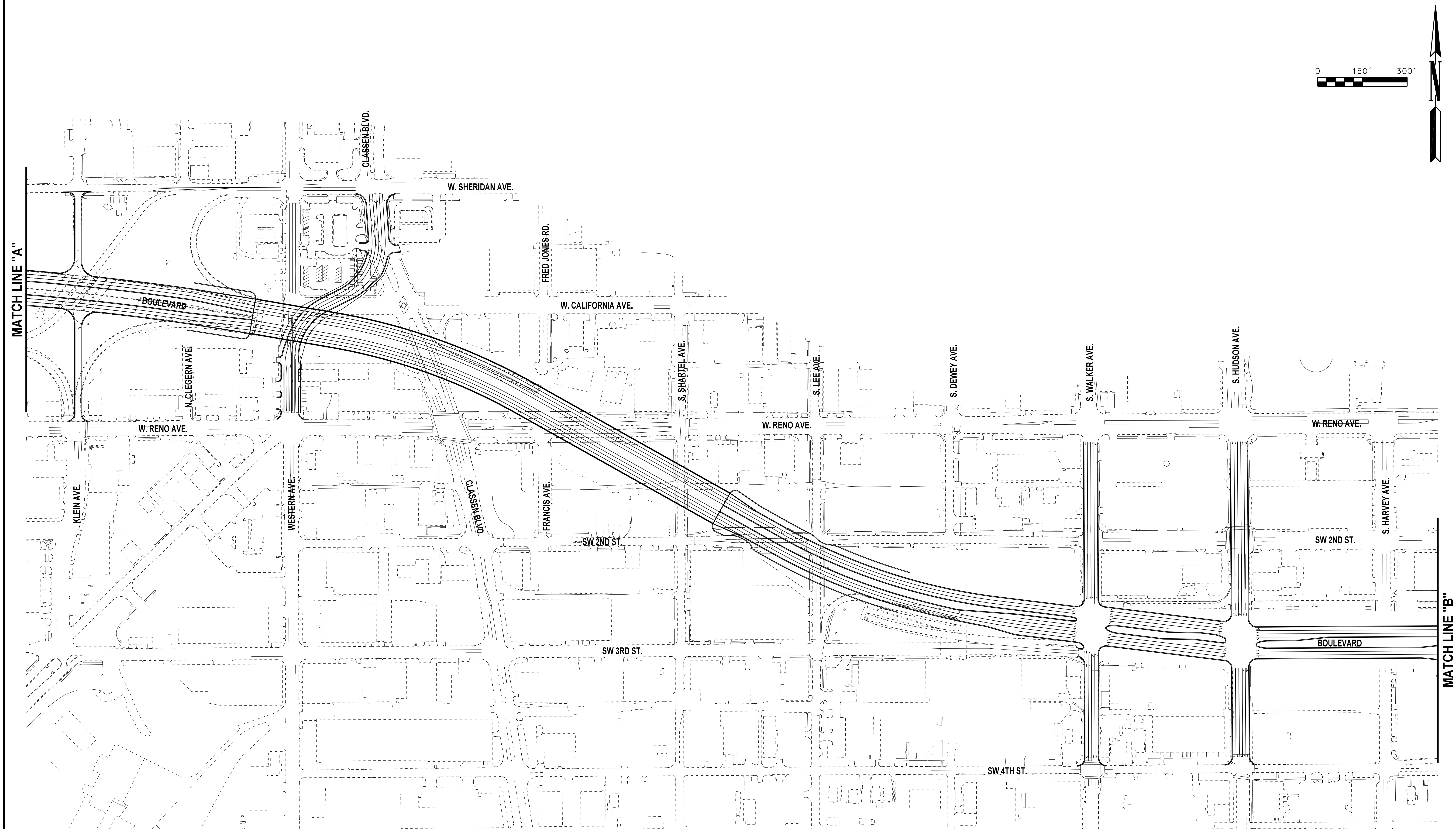


FIGURE 3A. Proposed Alternative "A"

TEC
A CLEAR DIRECTION



TEC
A CLEAR DIRECTION

FIGURE 3B. Proposed Alternative "A"

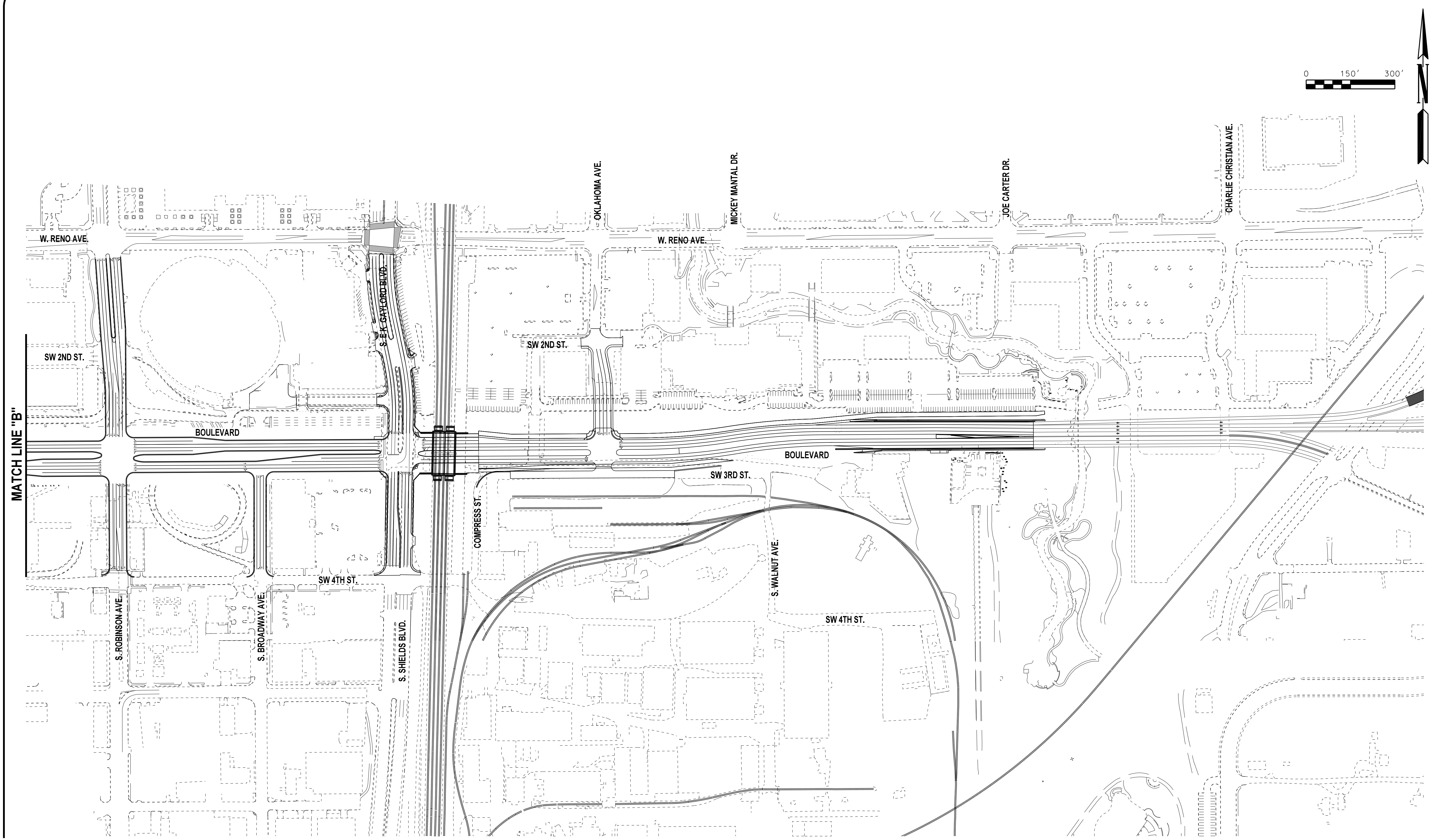


FIGURE 3C. Proposed Alternative "A"

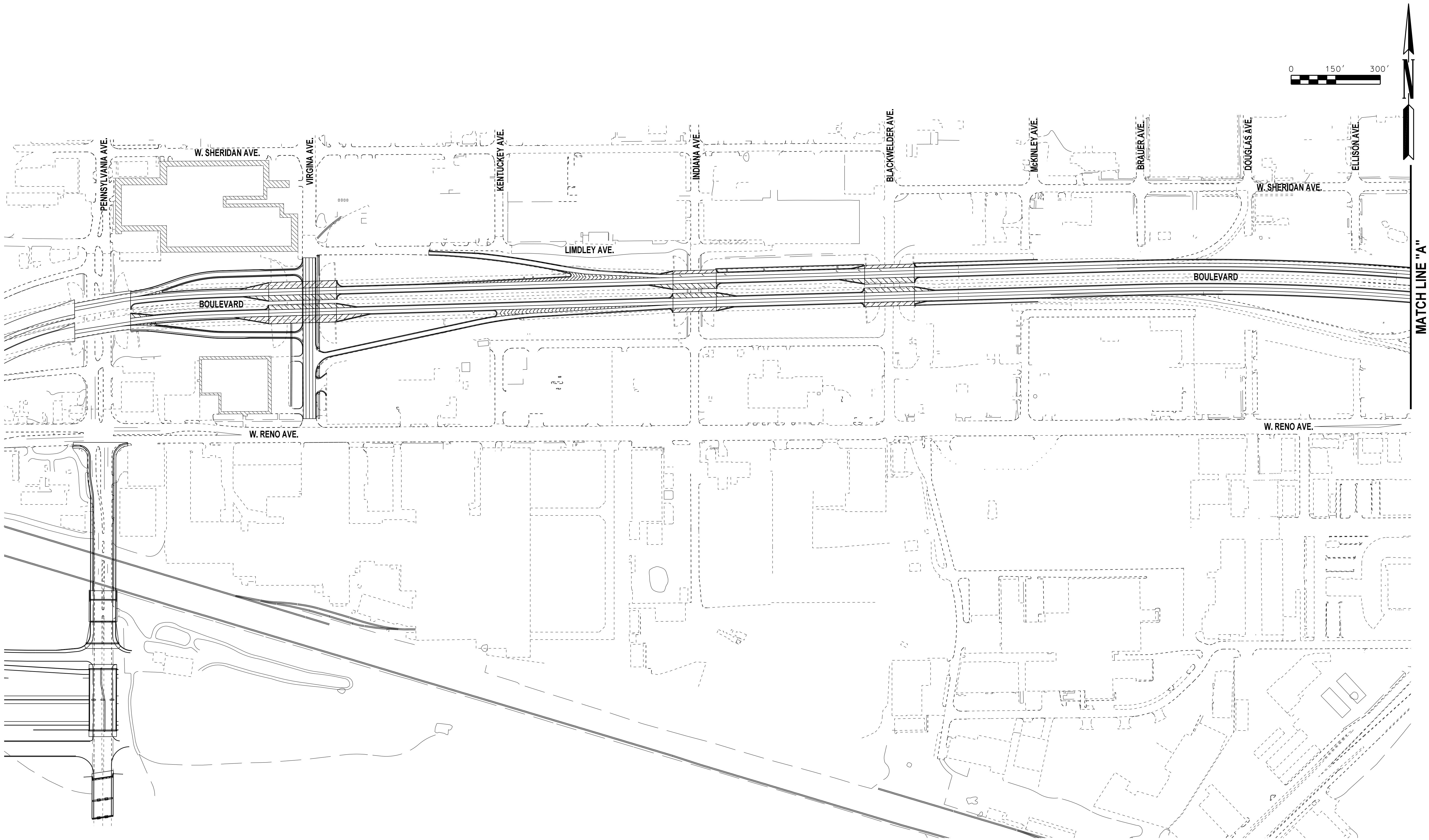


FIGURE 4A. Proposed Alternative "B"

TEC
A CLEAR DIRECTION

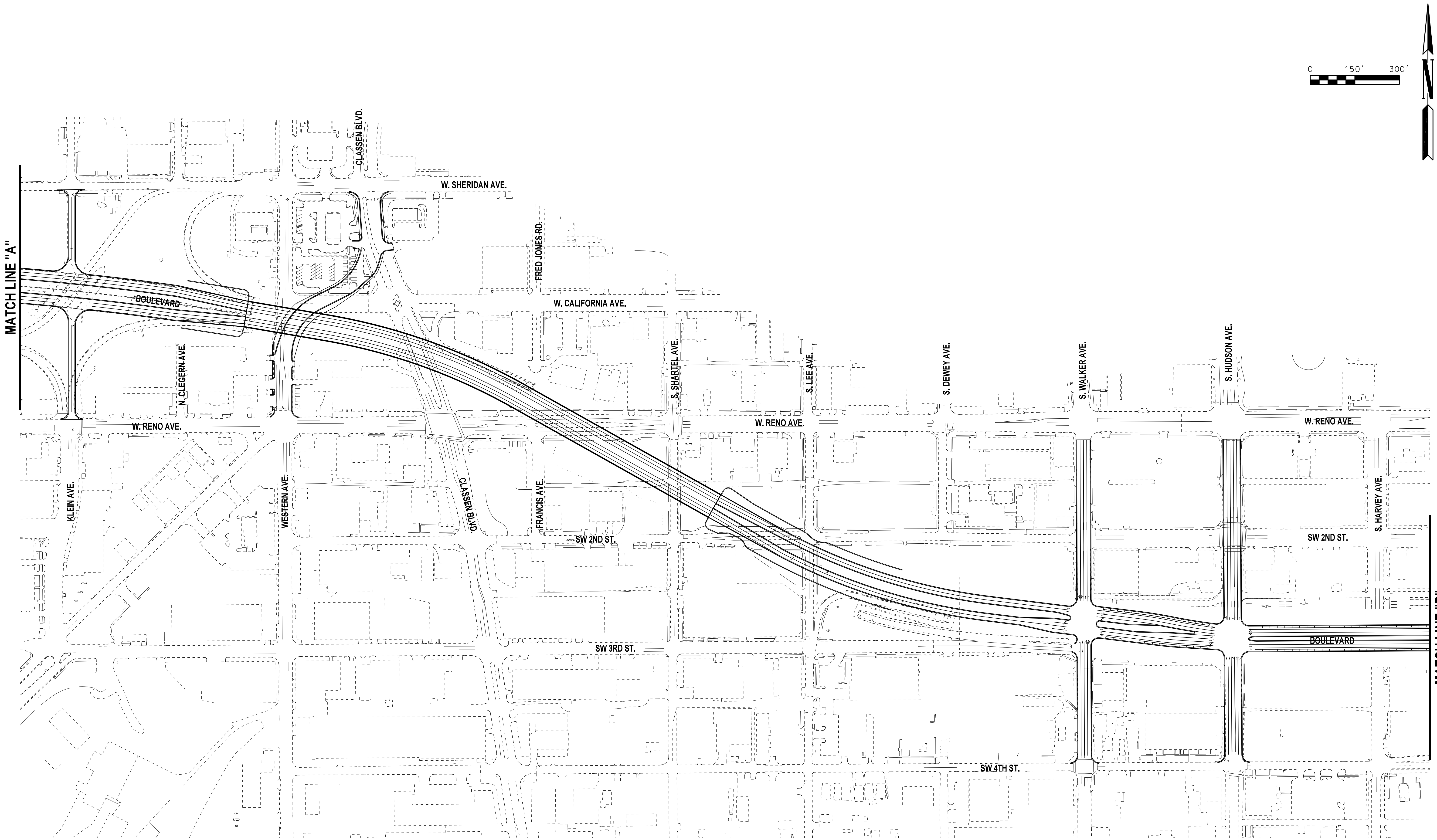


FIGURE 4B. Proposed Alternative "B"

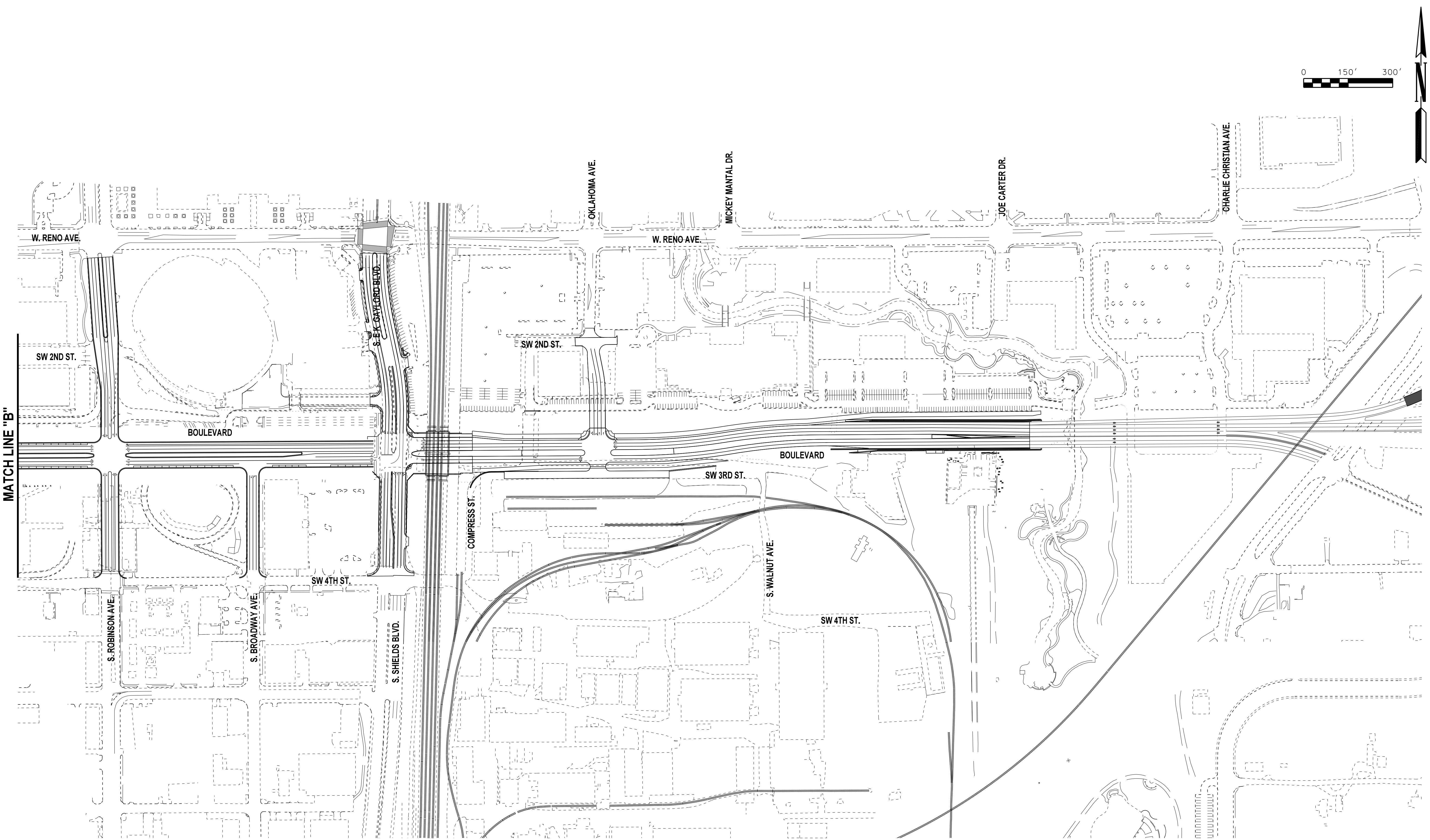


FIGURE 4C. Proposed Alternative "B"

TEC
A CLEAR DIRECTION

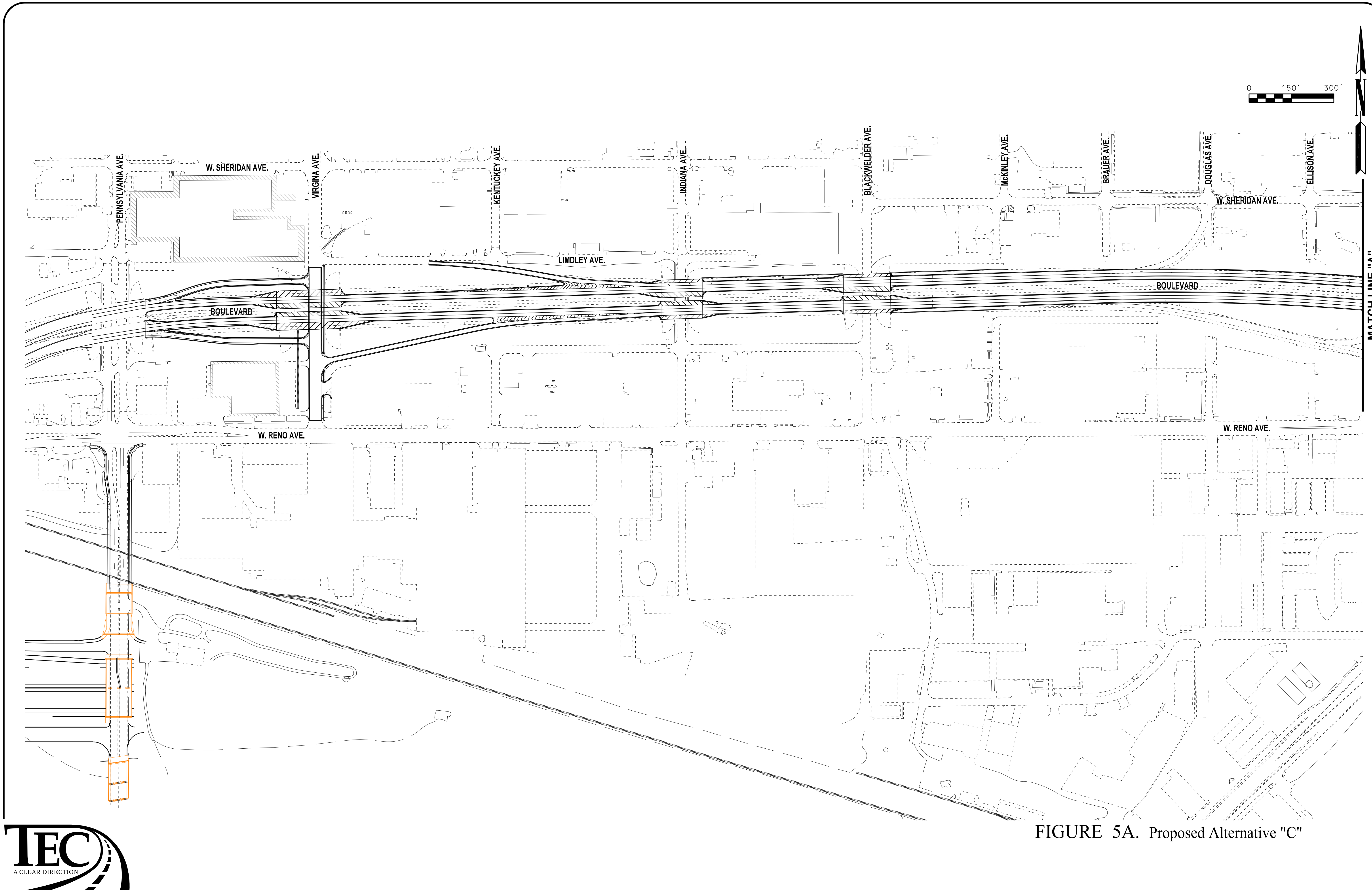


FIGURE 5A. Proposed Alternative "C"

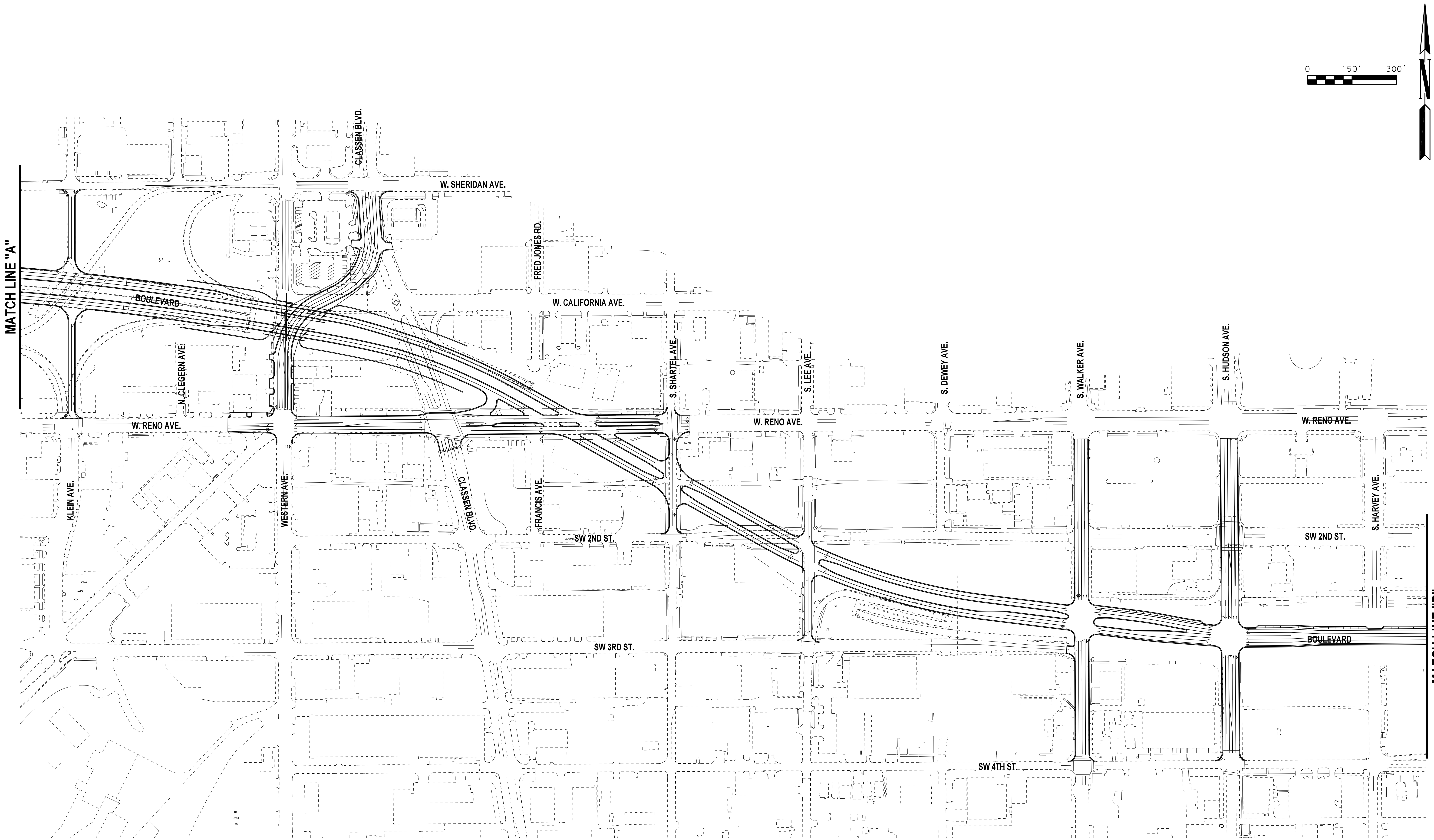


FIGURE 5B. Proposed Alternative "C"

TEC
A CLEAR DIRECTION

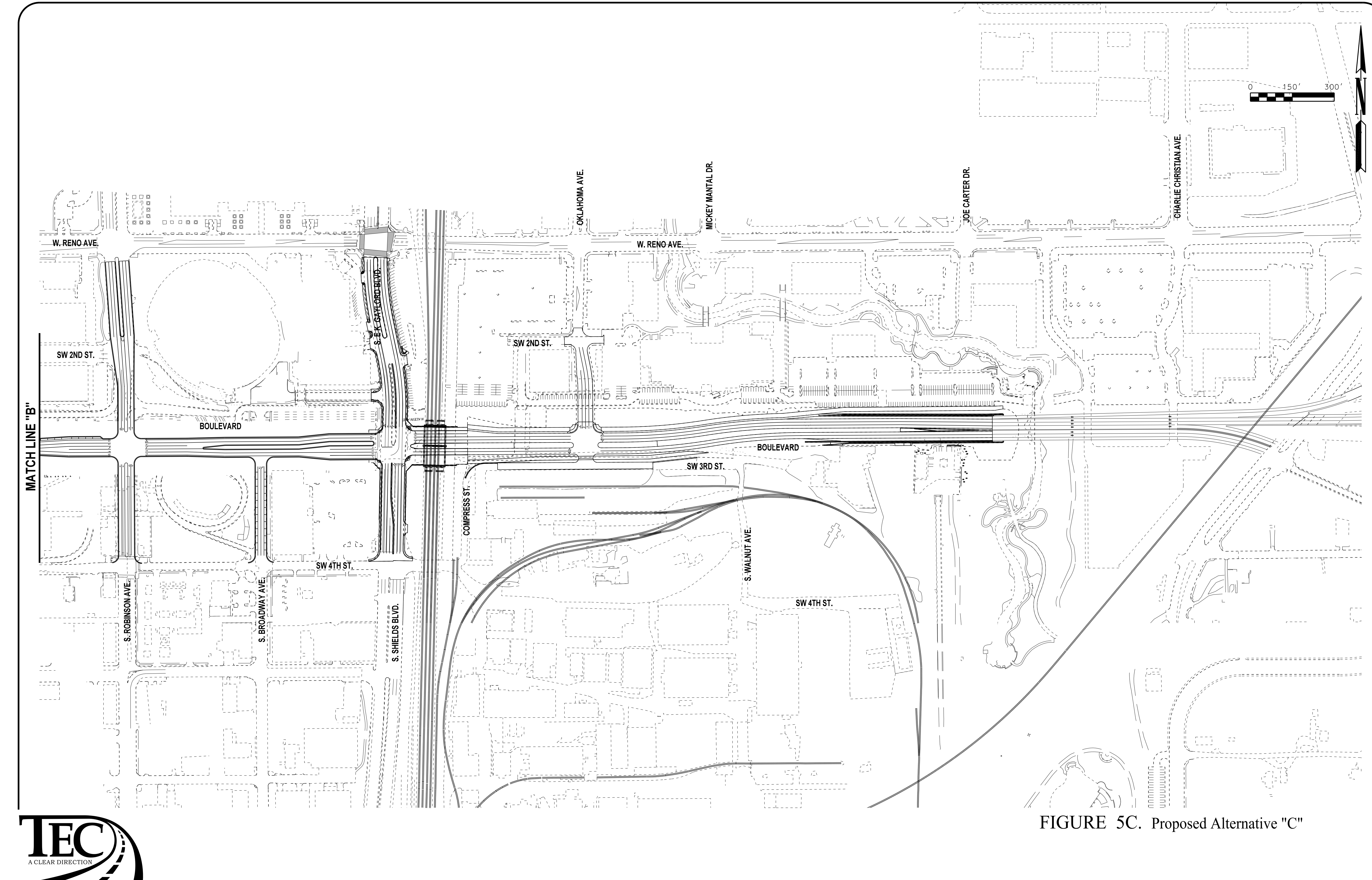
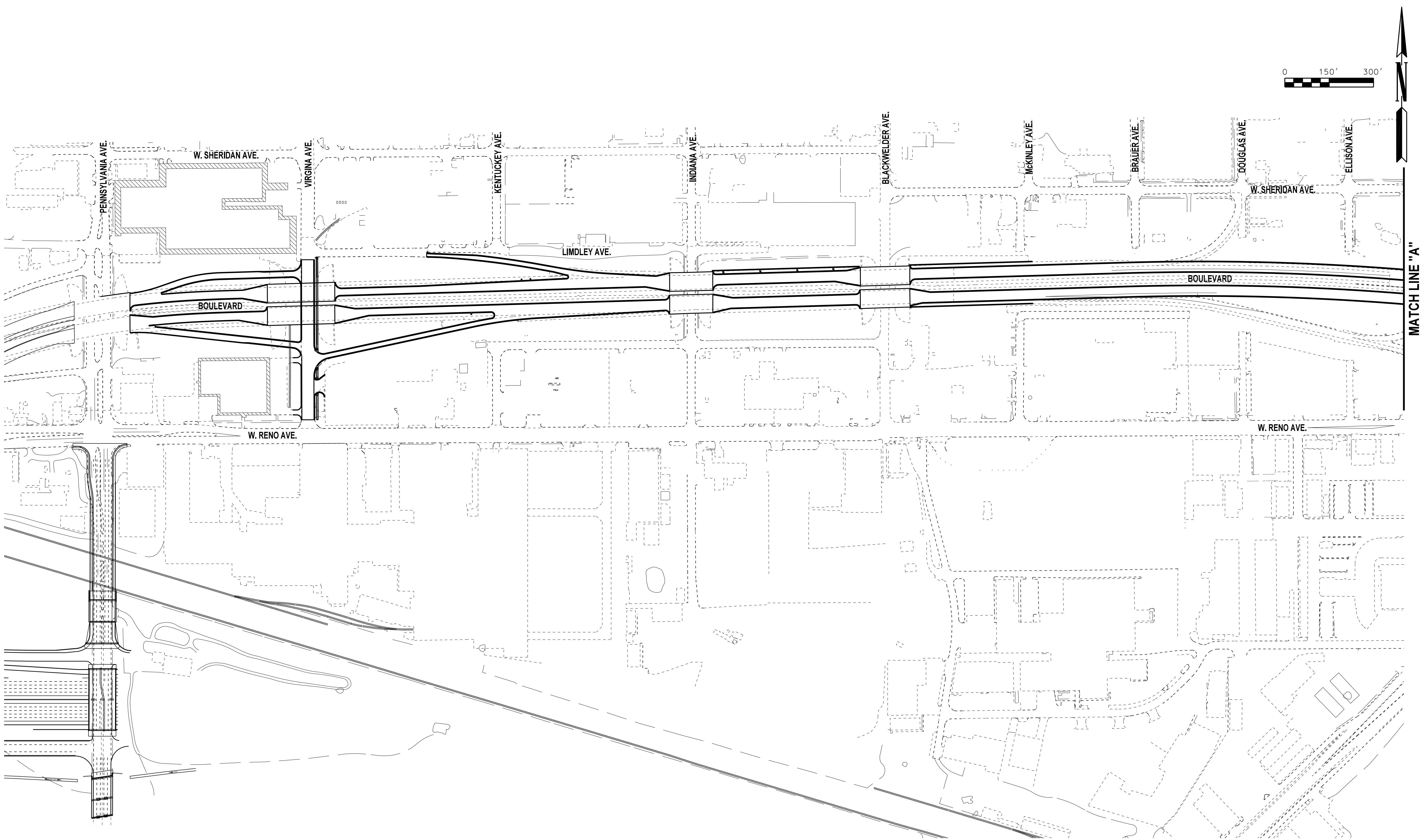


FIGURE 5C. Proposed Alternative "C"



TEC
A CLEAR DIRECTION

FIGURE 6A. Proposed Alternative "D"

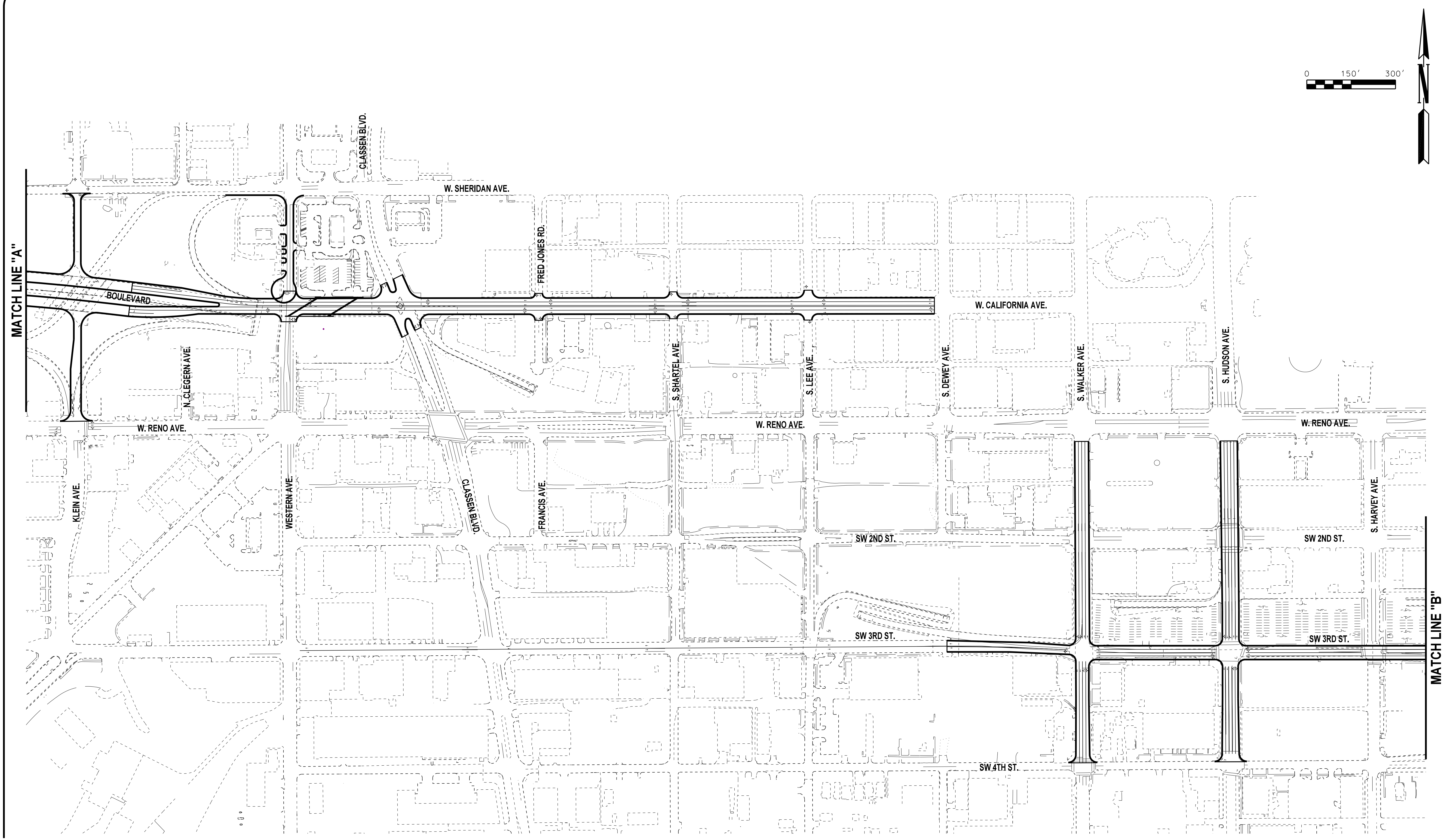


FIGURE 6B. Proposed Alternative "D"

TEC
A CLEAR DIRECTION

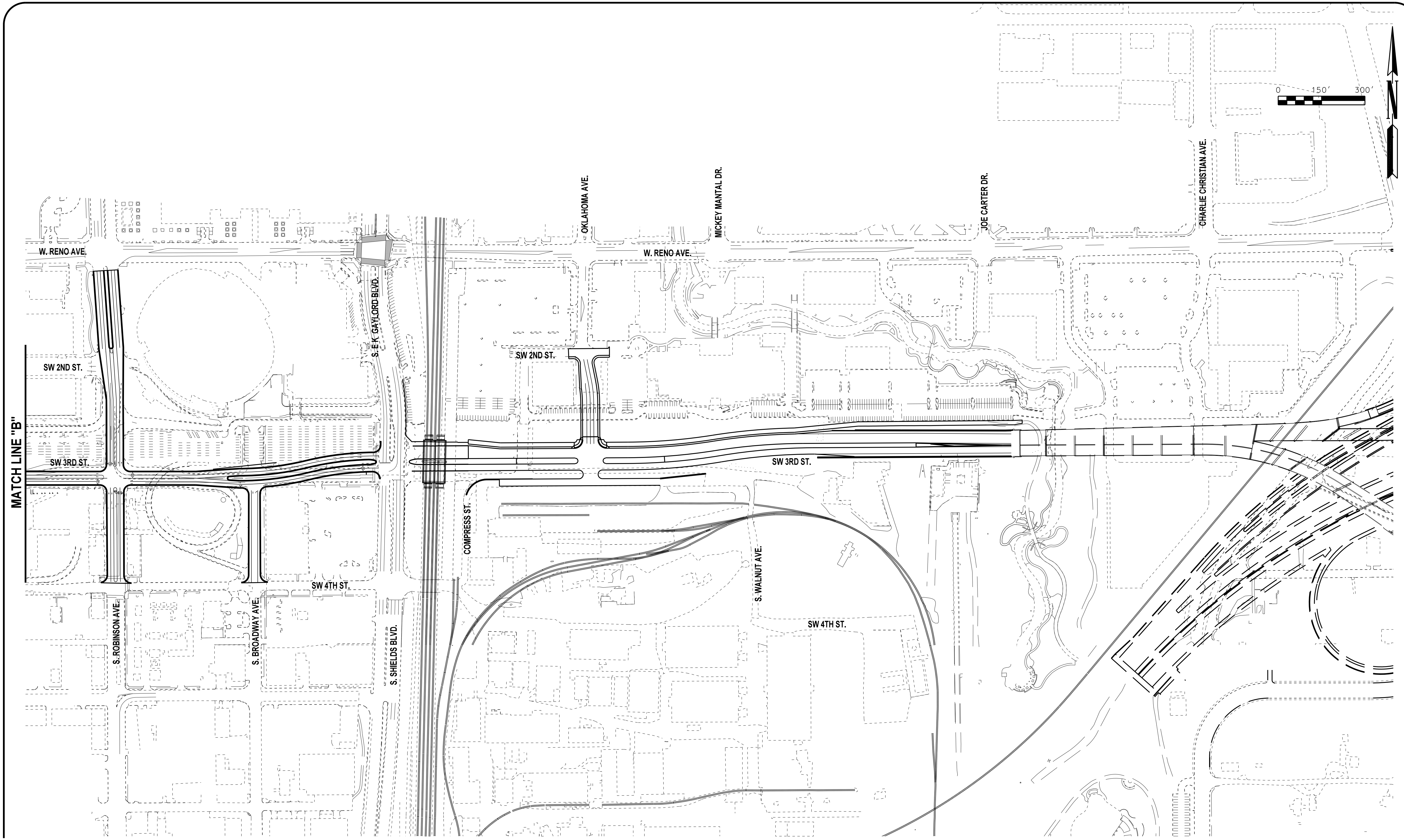


FIGURE 6C. Proposed Alternative "D"

TEC
A CLEAR DIRECTION

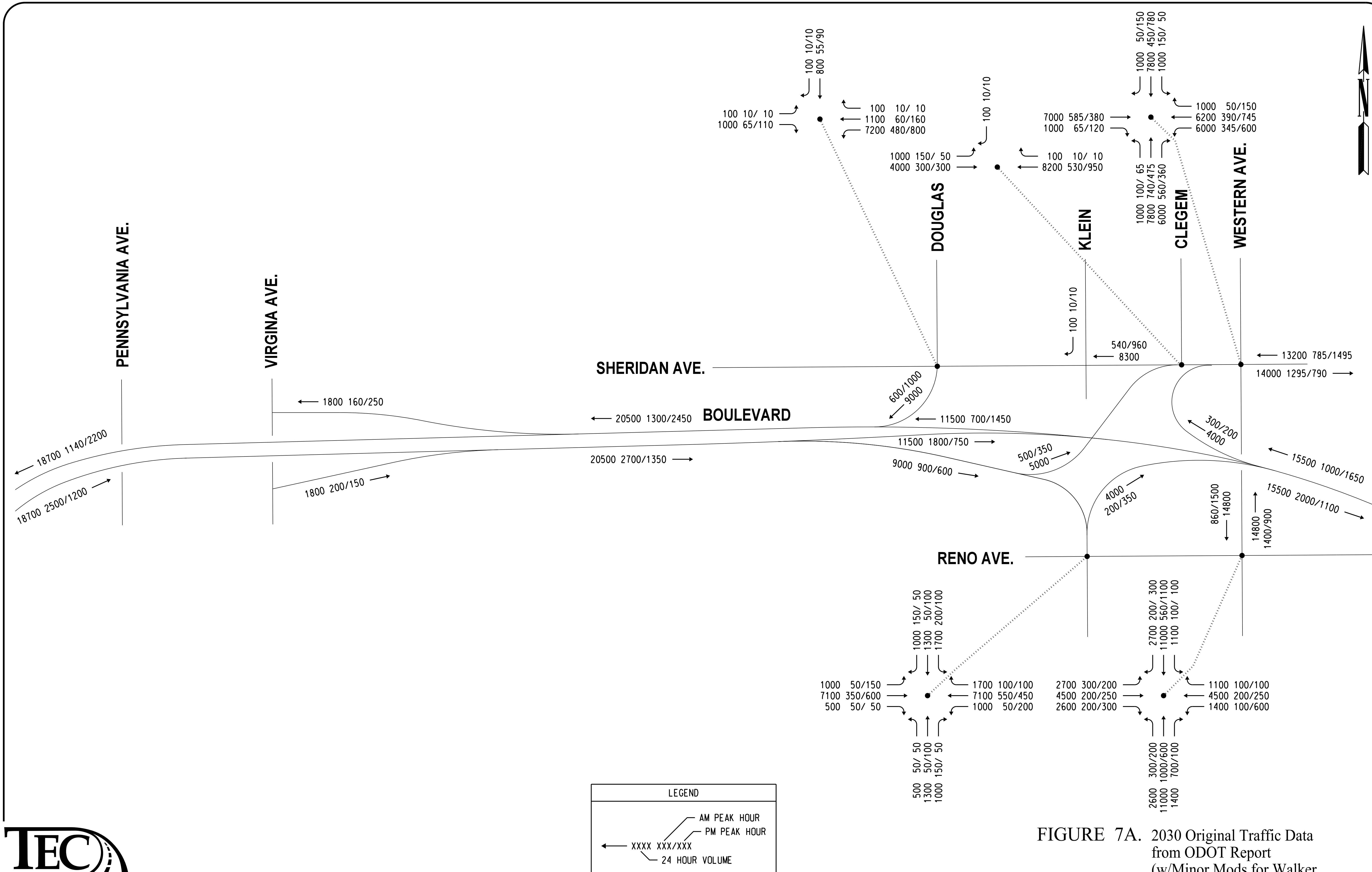


FIGURE 7A. 2030 Original Traffic Data from ODOT Report (w/Minor Mods for Walker, Oklahoma & Byers.)

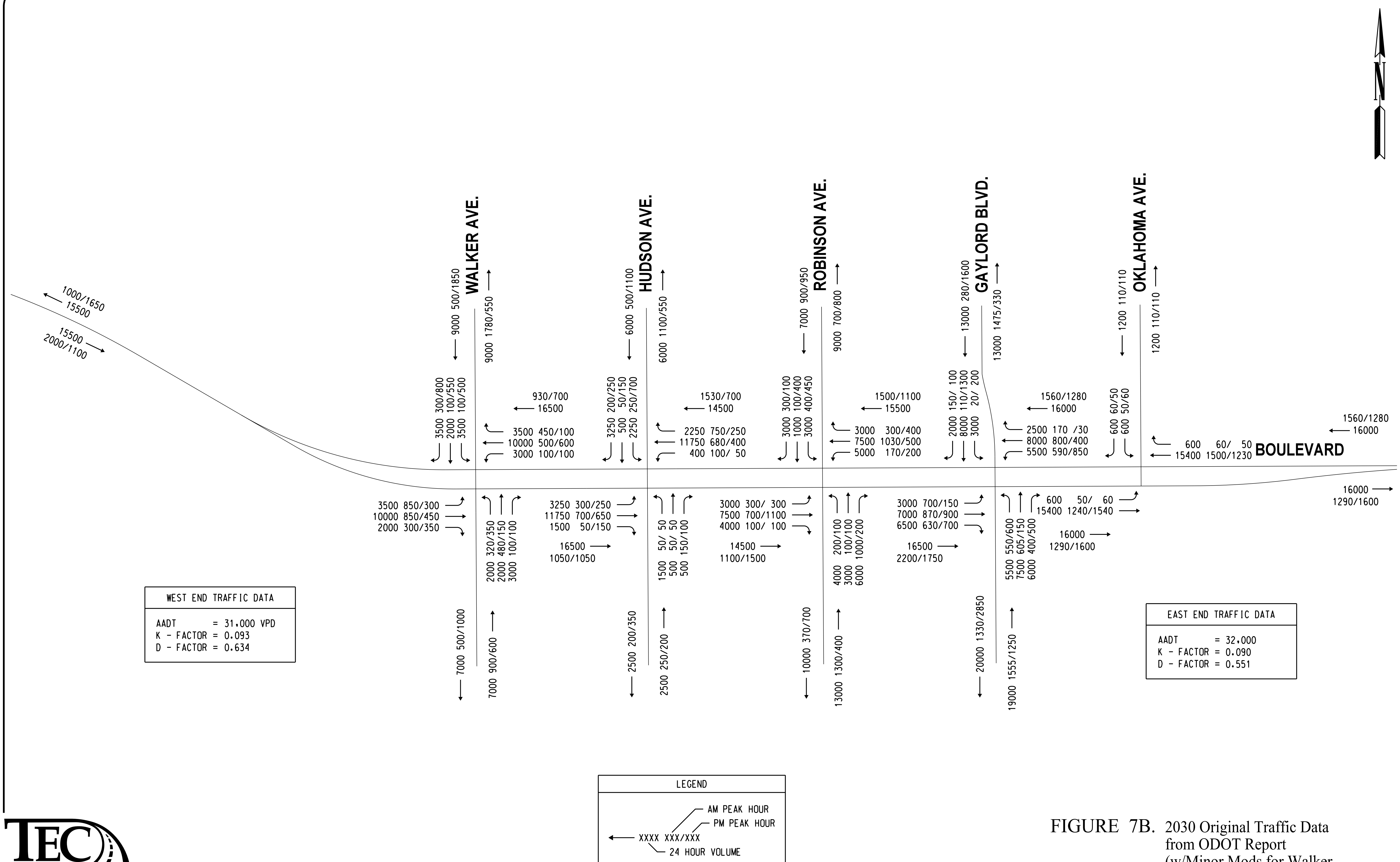


FIGURE 7B. 2030 Original Traffic Data from ODOT Report (w/Minor Mods for Walker, Oklahoma & Byers)

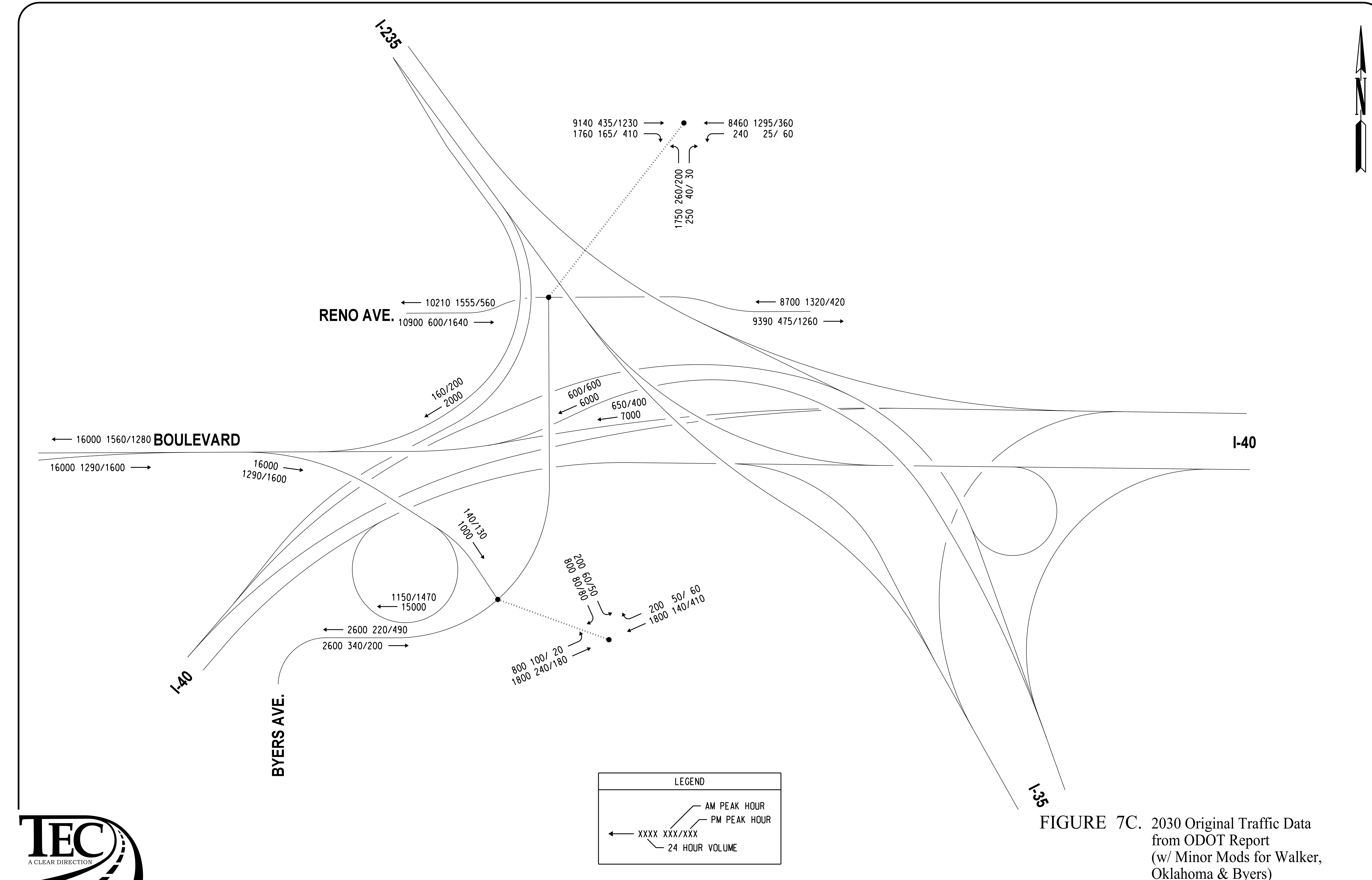


FIGURE 7C. 2030 Original Traffic Data from ODOT Report (w/ Minor Mods for Walker, Oklahoma & Byers)

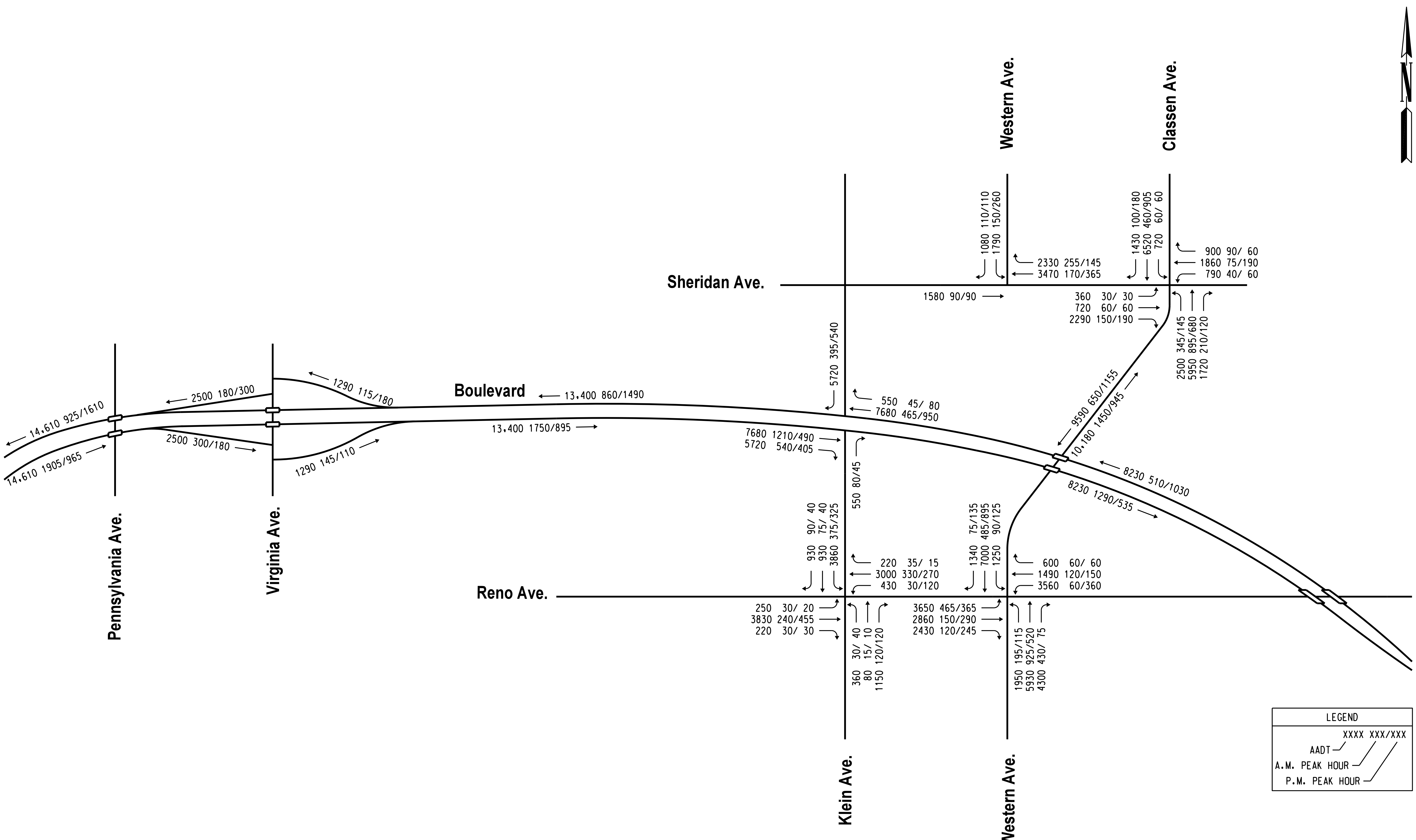


FIGURE 8A. Alternatives A & B
2015 Traffic Data

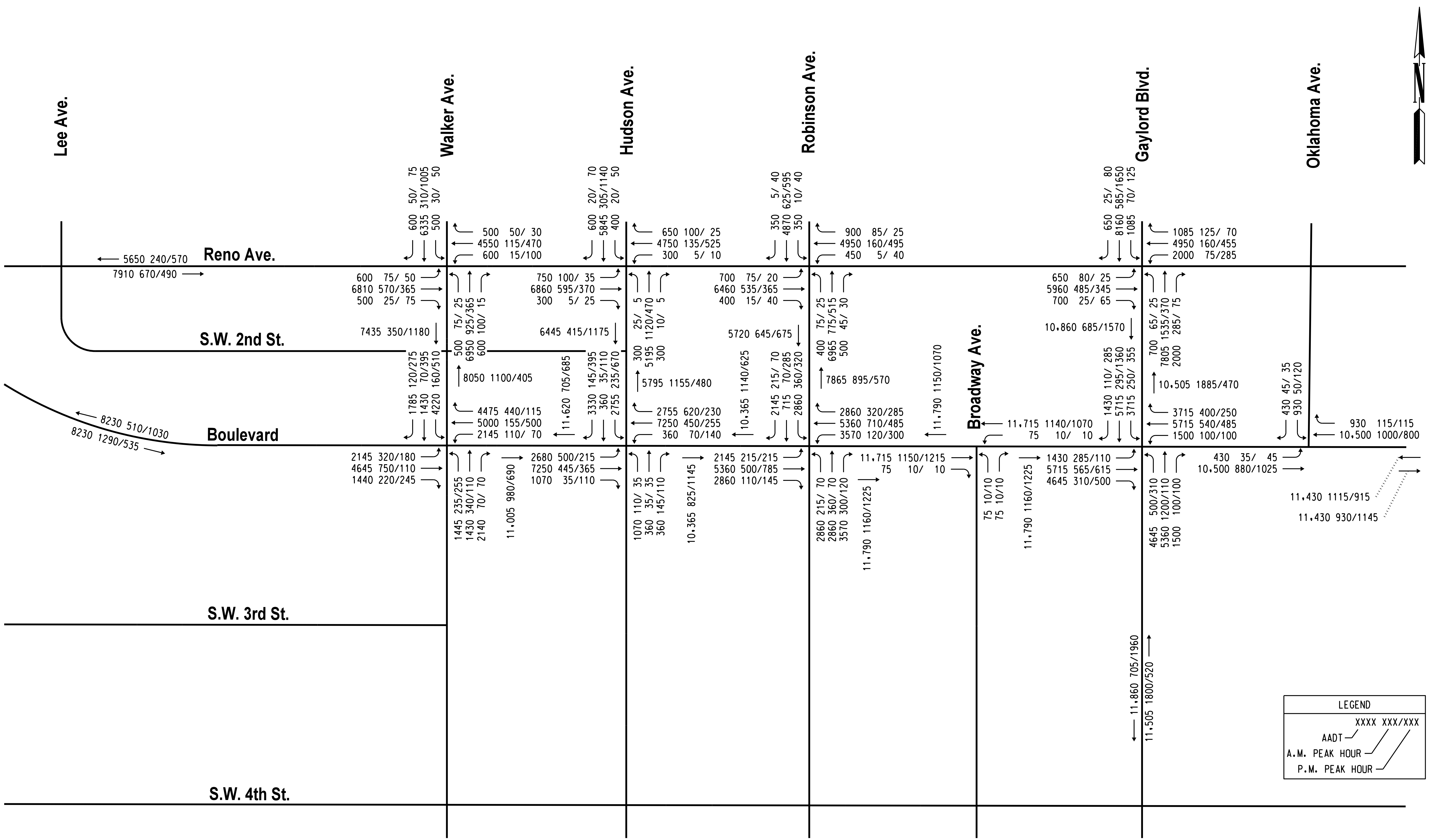


FIGURE 8B. Alternatives A & B
2015 Traffic Data

TEC
A CLEAR DIRECTION

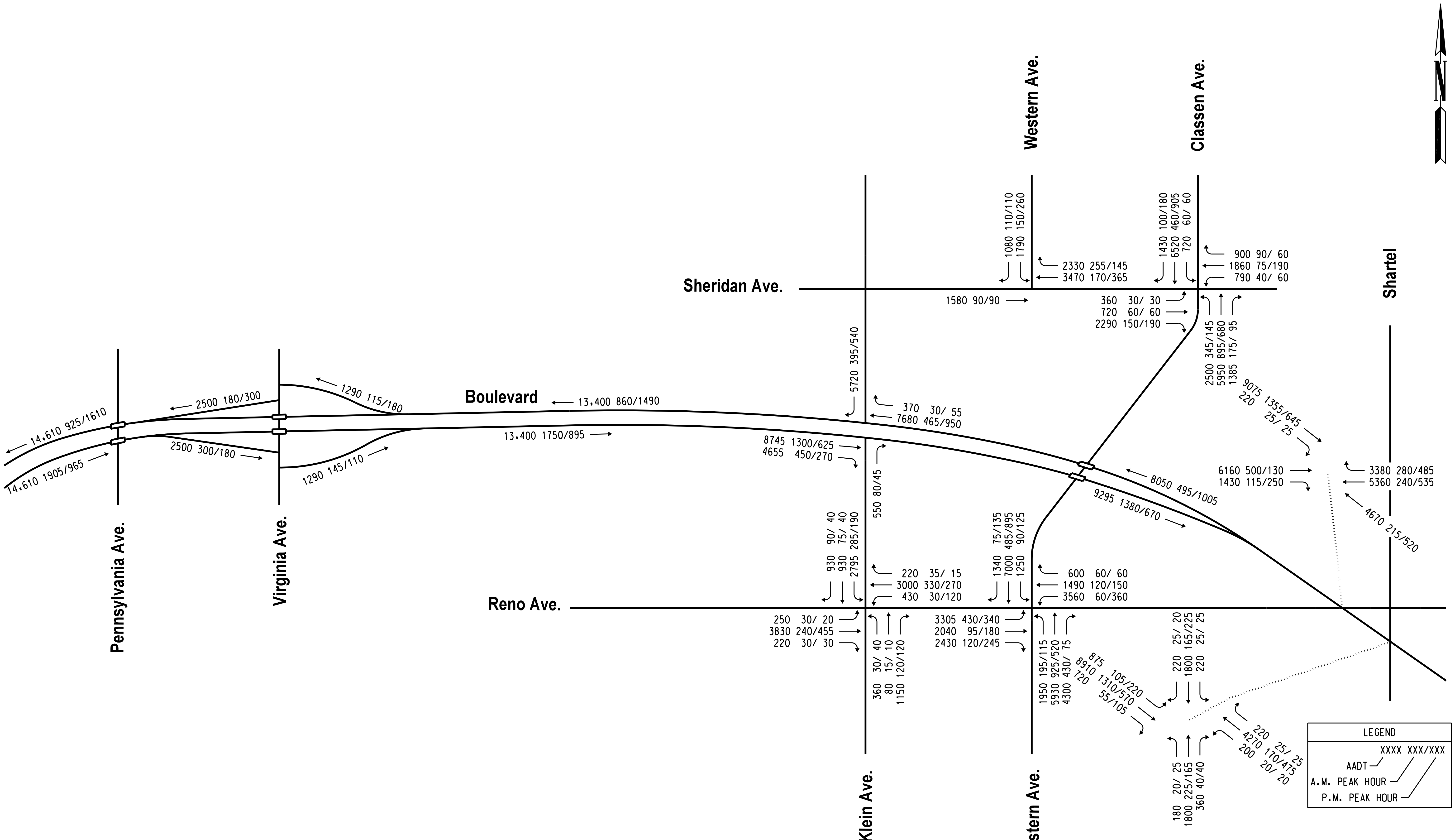


FIGURE 9A. Alternative C
2015 Traffic Data

TEC
A CLEAR DIRECTION

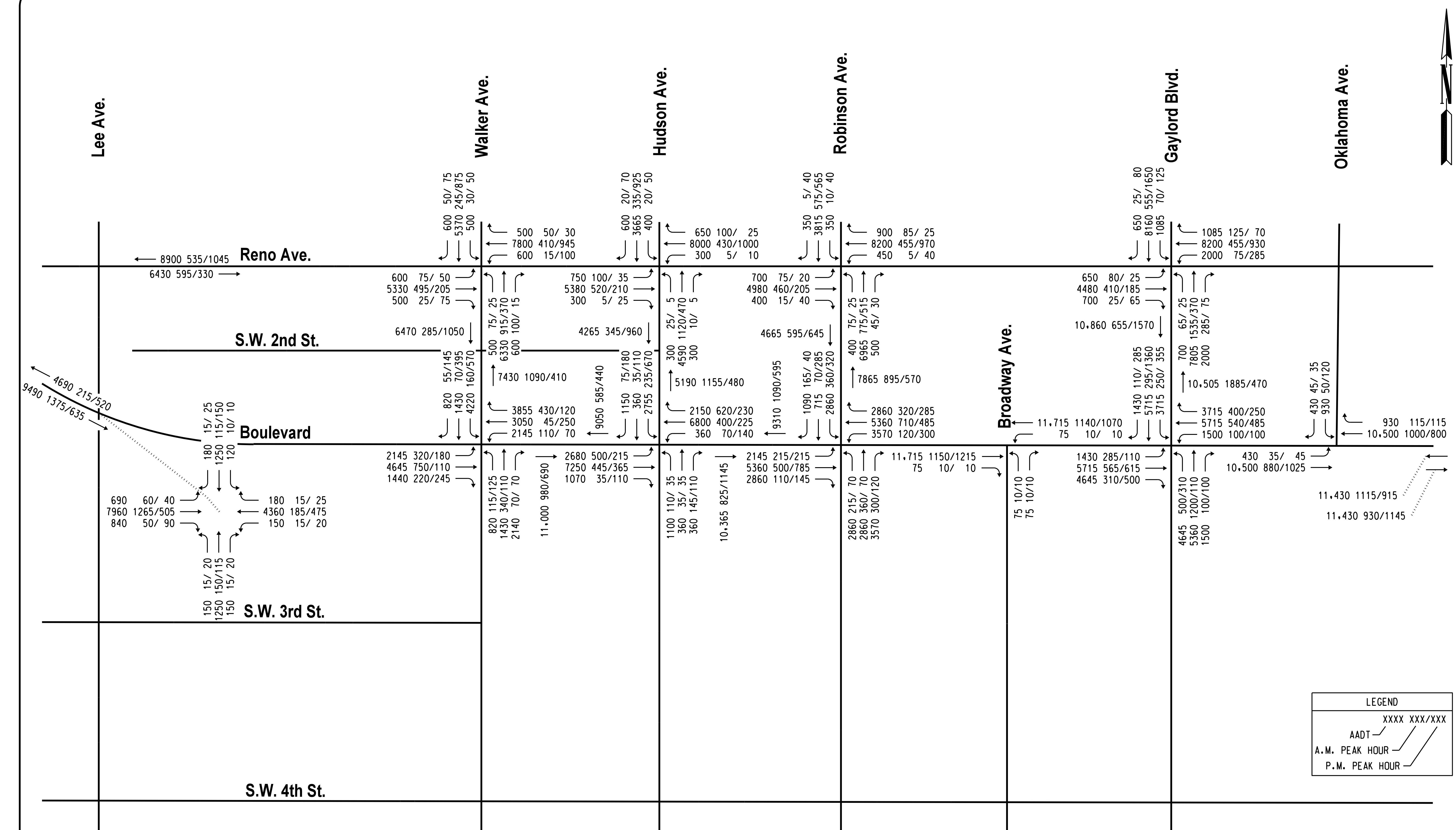


FIGURE 9B. Alternative C
2015 Traffic Data

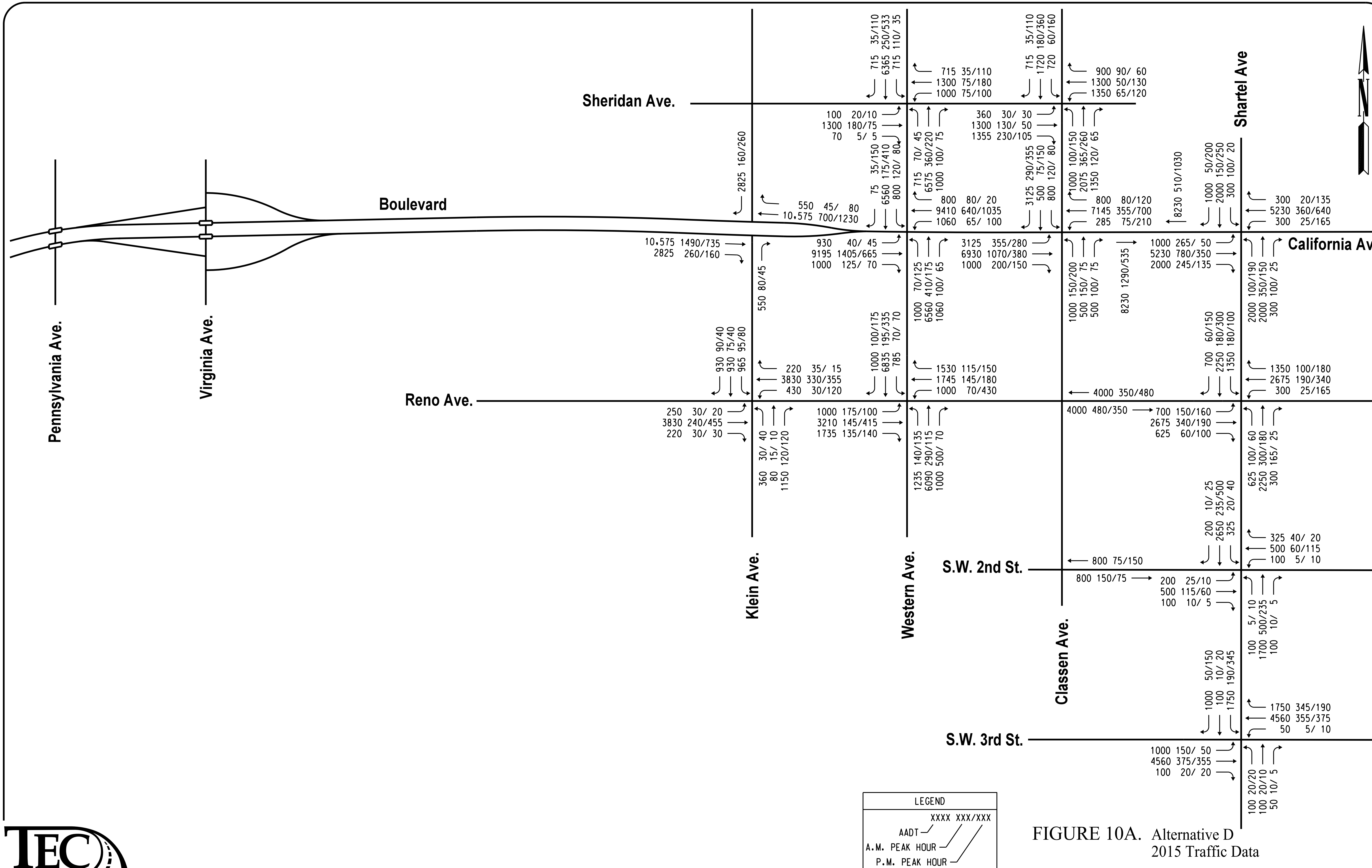


FIGURE 10A. Alternative D
2015 Traffic Data

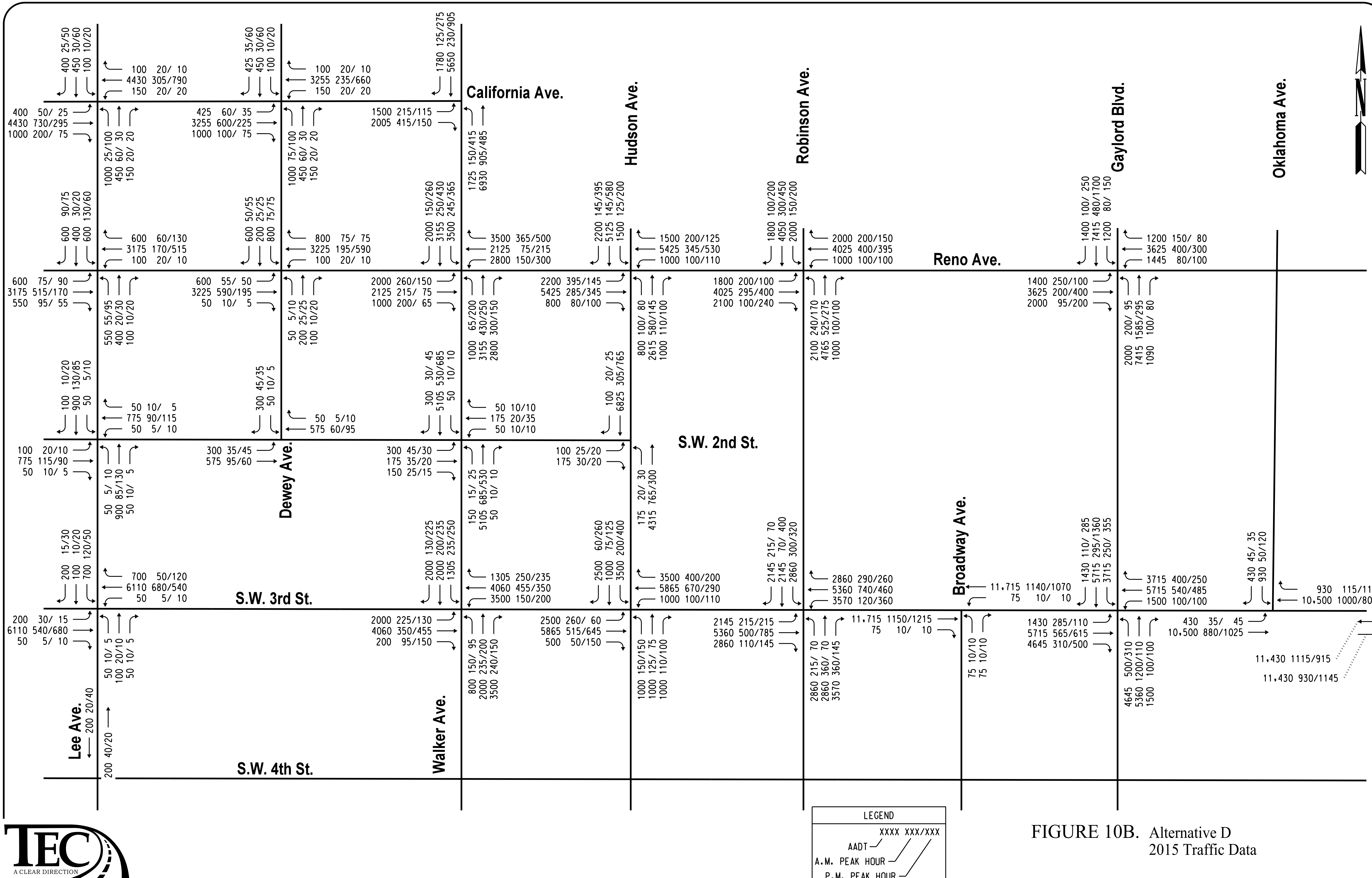


FIGURE 10B. Alternative D
2015 Traffic Data

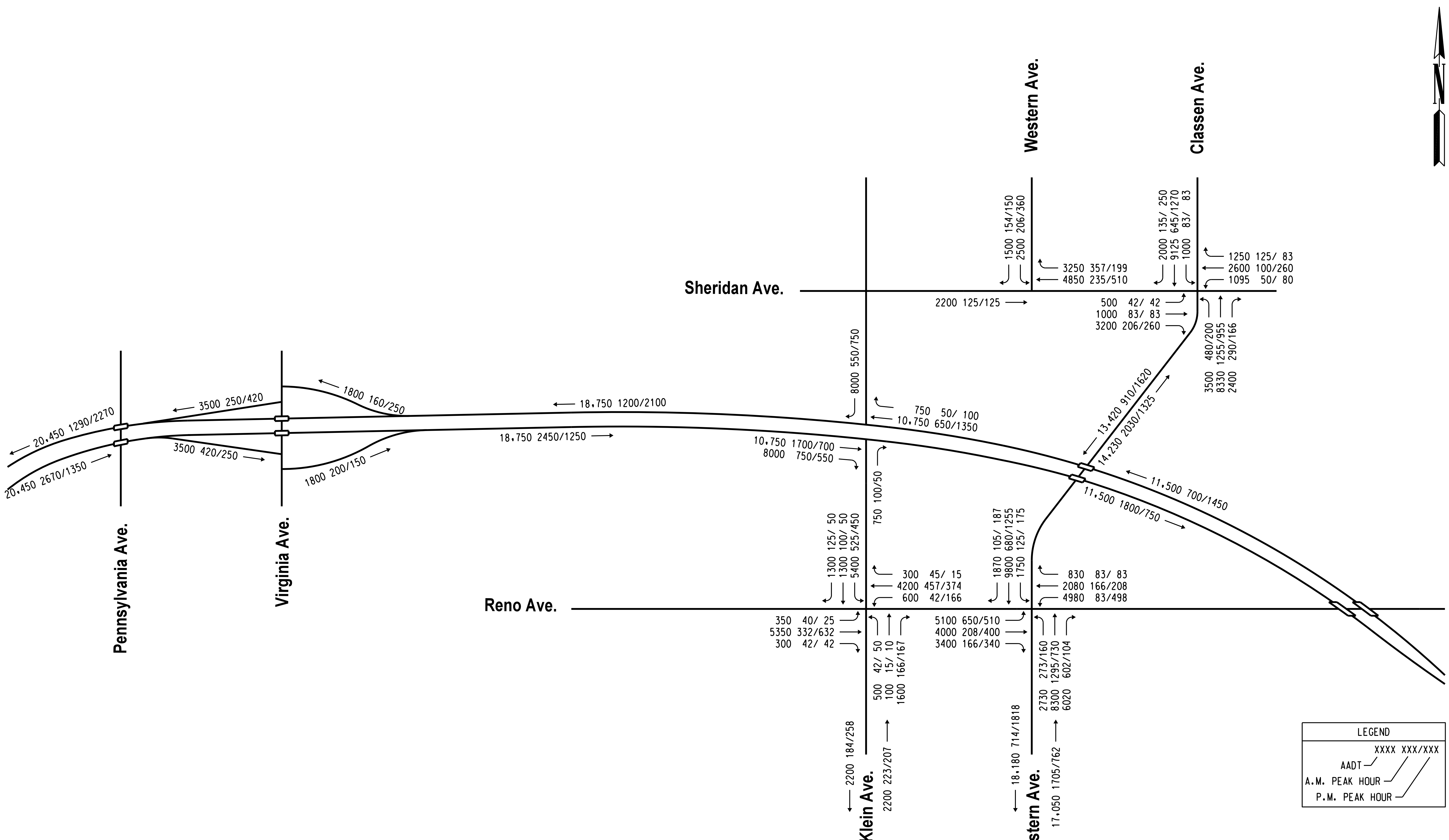


FIGURE 11A. Alternatives A & B
2040 Traffic Data

TEC
A CLEAR DIRECTION

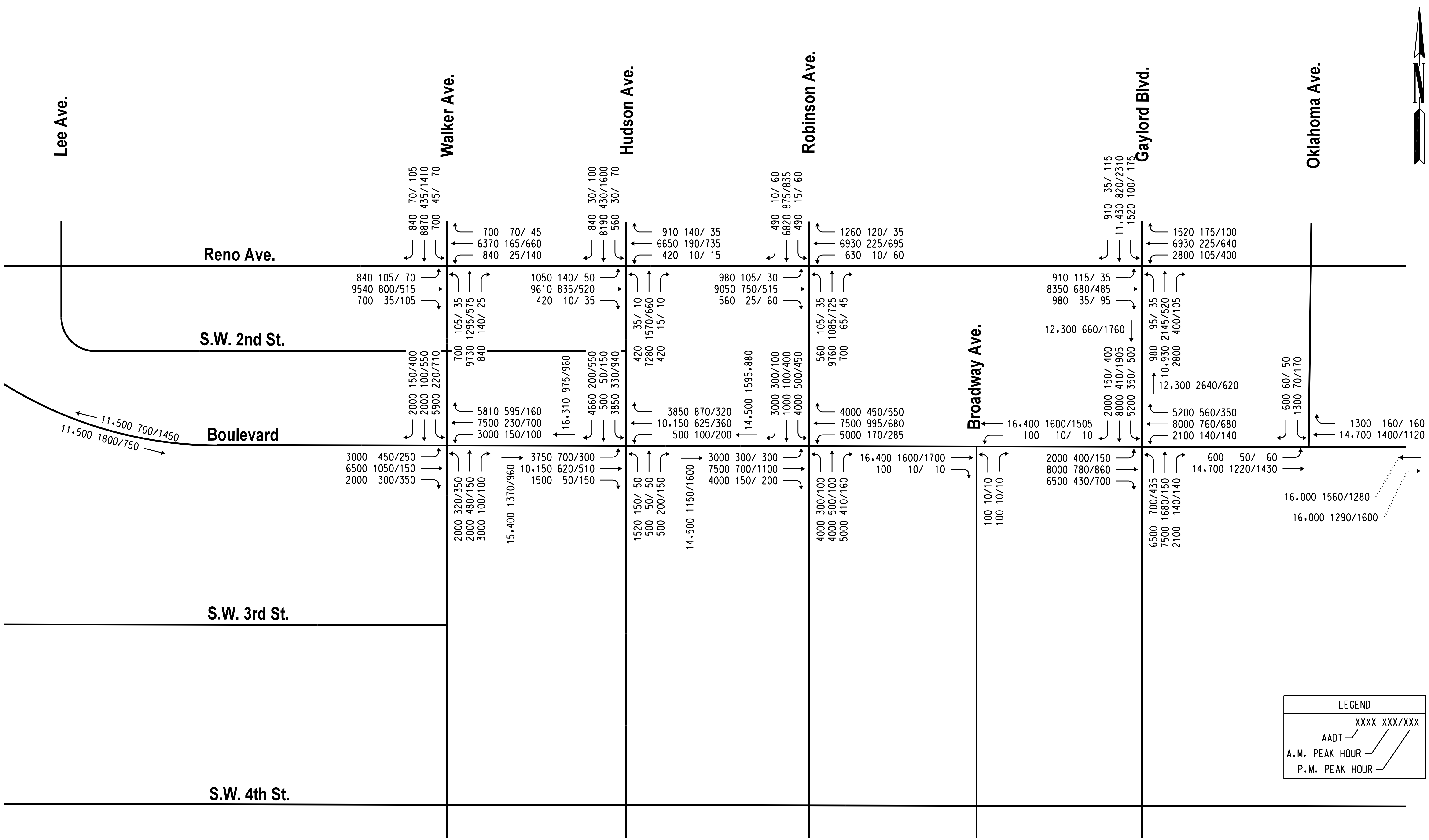


FIGURE 11B. Alternatives A & B
2040 Traffic Data

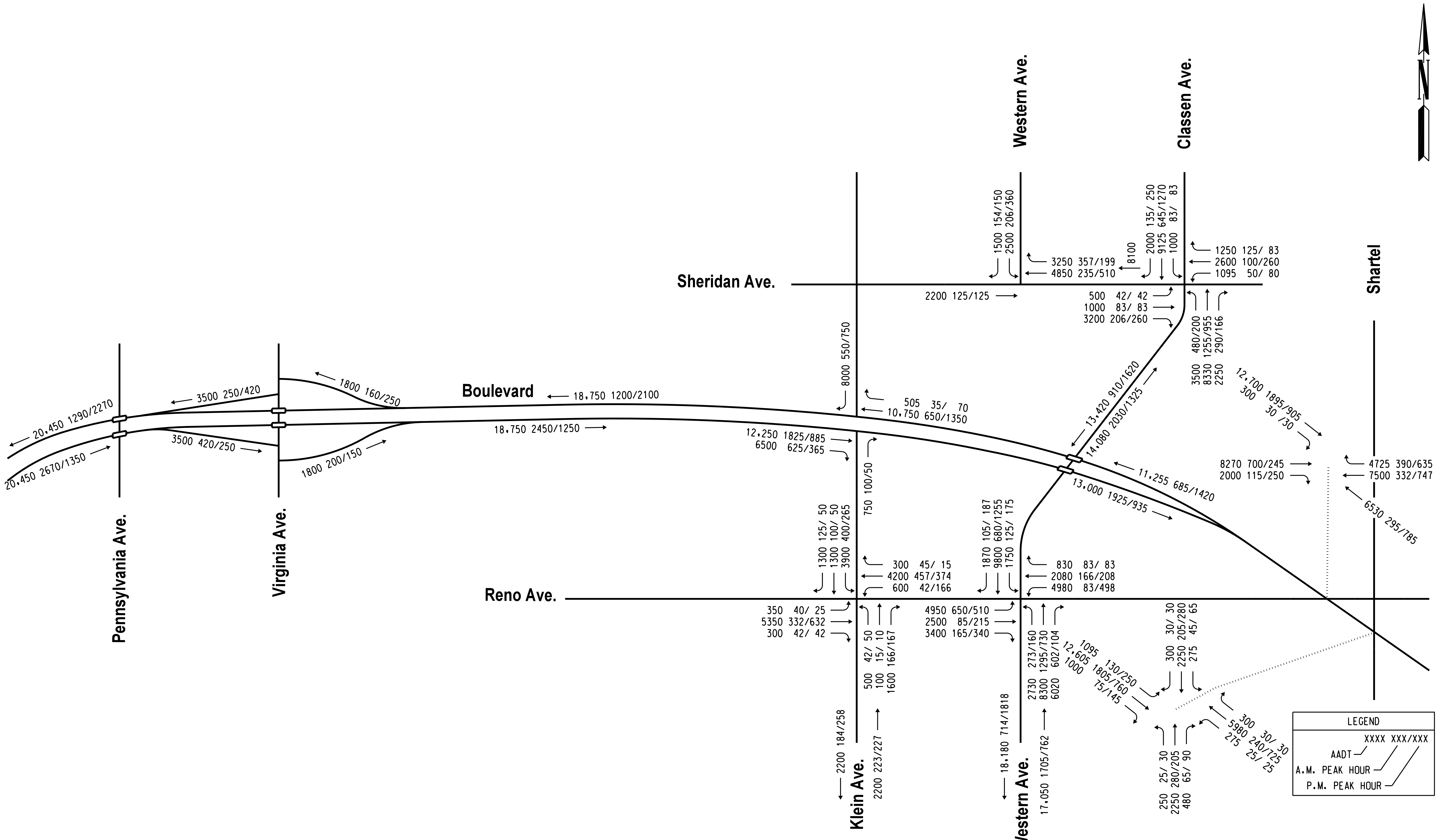


FIGURE 12A. Alternative C
2040 Traffic Data

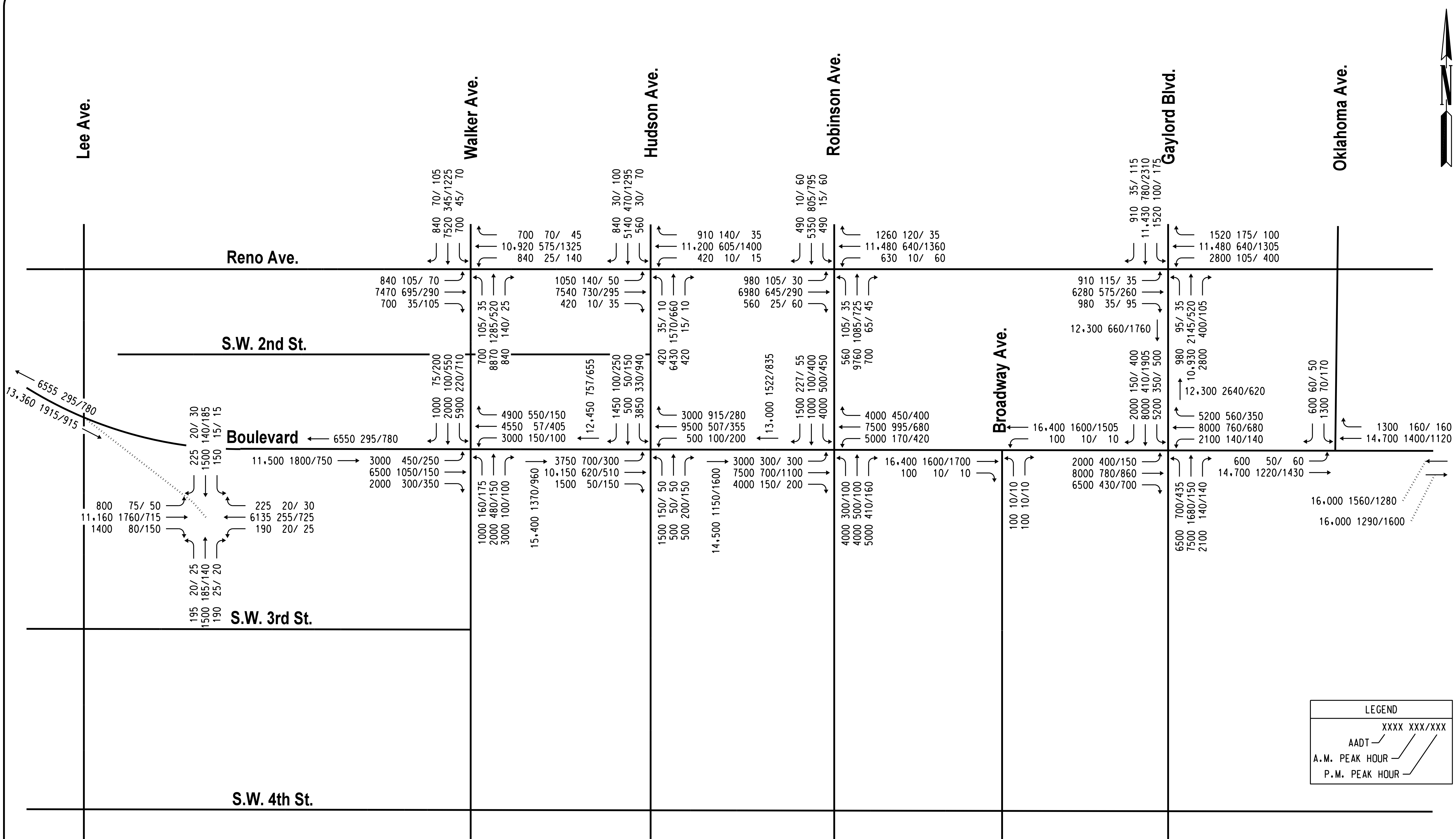


FIGURE 12B. Alternative C
2040 Traffic Data

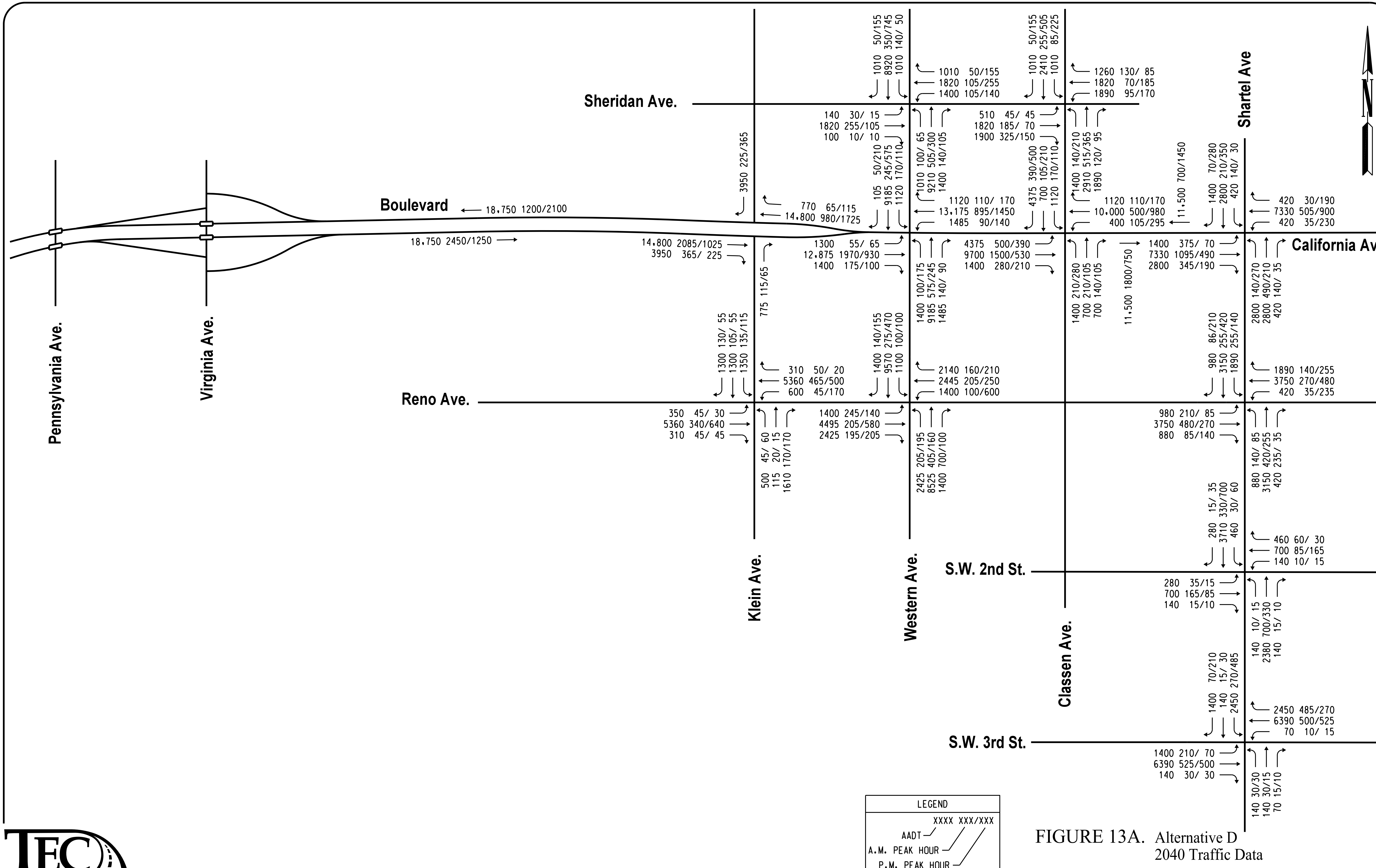


FIGURE 13A. Alternative D
2040 Traffic Data

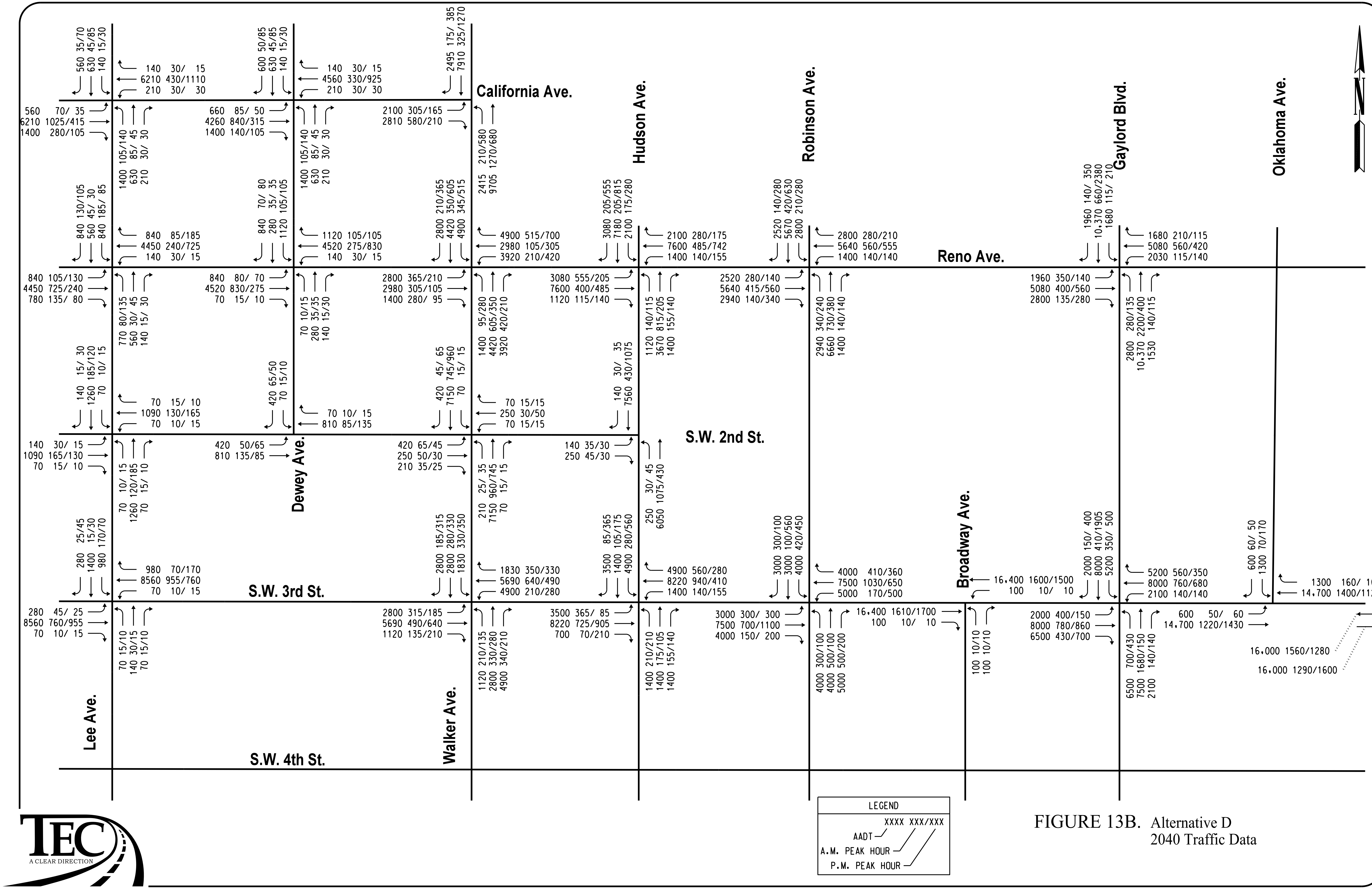


FIGURE 13B. Alternative D
2040 Traffic Data

TABLE 1 - INTERSECTION CAPACITY ANALYSIS RESULTS
ALTERNATIVE A: SIX-LANE FUNCTIONAL DESIGN

2015 ANALYSIS

Intersections	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Approach			Intersection		Critical Approach			Intersection	
		Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Boulevard & Klein	Unsignalized	NB	18.0	C	2.6	A	SB	53.3	F	11.7	B
Boulevard & Walker	Signalized	NB	51.7	D	27.7	C	SB	40.8	D	33.8	C
Boulevard & Hudson	Signalized	NB	64.6	E	32.7	C	SB	43.6	D	34.0	C
Boulevard & Robinson	Signalized	NB	55.9	E	38.3	D	EB	38.9	D	33.2	C
Boulevard & Broadway	Unsignalized	NB	9.4	A	0.0	A	NB	8.9	A	0.0	A
Boulevard & Gaylord	Signalized	SB	65.1	E	44.0	D	EB	49.9	D	43.6	D
Boulevard & Oklahoma	Signalized	SB	28.8	C	4.1	A	SB	38.2	D	6.1	A
Reno & Klein	Signalized	SB	35.1	D	24.8	C	SB	39.9	D	25.4	C
Reno & Western	Signalized	EB	166.8	F	57.7	E	WB	42.8	D	33.4	C
Sheridan & Classen	Signalized	WB	38.1	D	17.6	B	WB	34.8	C	19.8	B
Sheridan & Western	Signalized	WB	51.8	D	33.7	C	EB	29.5	C	25.1	C
Reno & Walker	Signalized	EB	66.9	E	43.7	D	SB	117.8	F	68.6	E
Reno & Hudson	Signalized	EB	50.5	D	28.2	C	SB	25.0	C	18.1	B
Reno & Robinson	Signalized	EB	65.7	E	29.3	C	EB	38.3	D	18.8	B
Reno & Gaylord	Signalized	WB	61.5	E	25.8	C	SB	82.2	F	56.3	F

2040 ANALYSIS

Intersections	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Approach			Intersection		Critical Approach			Intersection	
		Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Boulevard & Klein	Unsignalized	NB	33.3	D	4.8	A	SB	338.4	F	72.7	F
Boulevard & Walker	Signalized	NB	104.7	F	47.6	D	SB	188.0	F	119.6	F
Boulevard & Hudson	Signalized	SB	106.4	F	30.3	C	SB	55.1	E	48.3	D
Boulevard & Robinson	Signalized	NB	105.1	F	67.8	E	WB	57.8	E	43.7	D
Boulevard & Broadway	Unsignalized	NB	9.1	A	0.0	A	NB	9.2	A	0.0	A
Boulevard & Gaylord	Signalized	NB	104.2	F	91.6	F	EB	92.6	F	73.5	E
Boulevard & Oklahoma	Signalized	SB	38.3	D	4.8	A	SB	22.8	C	6.5	A
Reno & Klein	Signalized	EB	33.4	C	29.2	C	EB	100.1	F	61.6	E
Reno & Western	Signalized	EB	262.2	F	179.7	F	WB	96.7	F	79.1	E
Sheridan & Classen	Signalized	SB	36.0	D	27.7	C	EB	64.8	E	34.6	C
Sheridan & Western	Signalized	WB	52.0	D	34.0	C	WB	20.9	C	16.3	B
Reno & Walker	Signalized	SB	467.1	F	224.7	F	SB	351.1	F	203.2	F
Reno & Hudson	Signalized	NB	372.9	F	186.5	F	SB	149.6	F	88.4	F
Reno & Robinson	Signalized	NB	194.0	F	85.1	F	WB	42.8	D	26.7	C
Reno & Gaylord	Signalized	NB	157.7	F	97.0	F	SB	225.4	F	163.3	F

TABLE 2 - INTERSECTION CAPACITY ANALYSIS RESULTS
ALTERNATIVE B: FOUR-LANE FUNCTIONAL DESIGN

2015 ANALYSIS

Intersections	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Approach			Intersection		Critical Approach			Intersection	
		Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Boulevard & Klein	Unsignalized	NB	18.0	C	2.6	A	SB	53.3	F	11.7	B
Boulevard & Walker	Signalized	NB	55.6	E	25.4	C	WB	59.6	E	41.4	D
Boulevard & Hudson	Signalized	SB	156.3	F	55.0	E	SB	61.3	E	50.7	D
Boulevard & Robinson	Signalized	NB	86.0	F	54.3	D	SB	88.5	F	44.2	D
Boulevard & Broadway	Unsignalized	NB	12.8	B	0.1	A	NB	10.5	B	0.0	A
Boulevard & Gaylord	Signalized	SB	76.4	E	57.4	E	SB	85.2	F	68.3	E
Boulevard & Oklahoma	Signalized	SB	26.3	C	4.8	A	SB	25.8	C	5.7	A
Reno & Klein	Signalized	SB	35.1	D	23.1	C	SB	38.5	D	23.2	C
Reno & Western	Signalized	EB	166.8	F	57.9	E	WB	73.0	E	35.6	D
Sheridan & Classen	Signalized	WB	38.5	D	9.2	B	WB	32.9	C	10.1	B
Sheridan & Western	Signalized	WB	23.2	C	16.6	B	WB	37.3	D	24.3	C
Reno & Walker	Signalized	EB	68.9	E	37.1	D	EB	74.7	E	51.5	D
Reno & Hudson	Signalized	EB	71.8	E	33.8	C	NB	32.4	C	27.4	C
Reno & Robinson	Signalized	WB	80.5	F	32.2	C	EB	88.3	F	32.2	C
Reno & Gaylord	Signalized	EB	60.4	E	28.2	C	WB	52.7	D	44.2	D

2040 ANALYSIS

Intersections	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Approach			Intersection		Critical Approach			Intersection	
		Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Boulevard & Klein	Unsignalized	NB	33.3	D	4.8	A	SB	338.4	F	72.7	F
Boulevard & Walker	Signalized	NB	134.0	F	73.6	E	SB	272.3	F	175.7	F
Boulevard & Hudson	Signalized	WB	253.8	F	184.0	F	SB	198.1	F	154.4	F
Boulevard & Robinson	Signalized	NB	328.2	F	232.8	F	EB	280.4	F	177.4	F
Boulevard & Broadway	Unsignalized	NB	12.9	B	0.0	A	NB	10.4	B	0.0	A
Boulevard & Gaylord	Signalized	NB	223.0	F	161.5	F	EB	223.3	F	173.1	F
Boulevard & Oklahoma	Signalized	SB	24.0	C	7.2	A	SB	28.6	C	9.7	A
Reno & Klein	Signalized	SB	62.6	E	35.4	D	WB	96.7	F	77.4	E
Reno & Western	Signalized	EB	278.9	F	203.5	F	WB	74.1	E	60.5	E
Sheridan & Classen	Signalized	EB	39.5	D	19.7	B	EB	61.0	E	29.0	C
Sheridan & Western	Signalized	EB	30.0	C	21.4	C	WB	25.5	C	18.8	B
Reno & Walker	Signalized	SB	476.5	F	220.4	F	SB	340.9	F	198.1	F
Reno & Hudson	Signalized	NB	319.8	F	164.5	F	SB	99.1	F	75.4	E
Reno & Robinson	Signalized	NB	84.4	F	50.3	D	EB	57.4	E	37.5	D
Reno & Gaylord	Signalized	EB	78.0	E	50.3	D	WB	645.2	F	171.3	F

TABLE 3 - INTERSECTION CAPACITY ANALYSIS RESULTS
ALTERNATIVE C: FOUR-LANE WITH ADDITIONAL BLVD CONNECTIONS

2015 ANALYSIS

Intersections	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Approach			Intersection		Critical Approach			Intersection	
		Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Boulevard & Klein	Unsignalized	NB	18.0	C	2.6	A	SB	53.3	F	11.7	B
Boulevard & Walker	Signalized	NB	54.2	D	20.1	C	EB	41.2	D	34.6	C
Boulevard & Hudson	Signalized	SB	97.7	F	43.3	D	WB	79.1	E	46.3	D
Boulevard & Robinson	Signalized	NB	68.7	E	47.6	D	SB	63.0	E	39.7	D
Boulevard & Broadway	Unsignalized	NB	12.8	B	0.1	A	NB	10.5	B	0.0	A
Boulevard & Gaylord	Signalized	SB	75.7	E	56.3	E	EB	99.7	F	68.5	E
Boulevard & Oklahoma	Signalized	SB	26.3	C	4.8	A	SB	25.8	C	5.7	A
Reno & Klein	Signalized	SB	33.6	C	21.0	C	SB	38.9	D	23.4	C
Reno & Western	Signalized	EB	141.8	F	49.4	D	WB	80.1	F	36.7	D
Sheridan & Classen	Signalized	WB	38.5	D	9.4	A	WB	32.9	C	10.1	B
Sheridan & Western	Signalized	WB	23.2	C	16.6	B	WB	37.3	D	24.3	C
Boulevard & Shartel	Unsignalized	NB/SB	*	F	*	F	NB/SB	*	F	*	F
Boulevard & Reno	Signalized	EB	51.3	D	26.5	C	WB	37.3	D	27.5	C
Boulevard & Lee	Unsignalized	NB/SB	*	F	*	F	NB/SB	*	F	*	F
Reno & Walker	Signalized	EB	49.9	D	33.6	C	SB	92.6	F	70.2	E
Reno & Hudson	Signalized	EB	41.7	D	39.6	D	NB	54.6	D	34.6	C
Reno & Robinson	Signalized	EB	56.6	E	29.0	C	WB	43.2	D	33.5	C
Reno & Gaylord	Signalized	WB	55.0	E	35.2	D	WB	154.0	F	78.2	E

2040 ANALYSIS

Intersections	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Approach			Intersection		Critical Approach			Intersection	
		Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Boulevard & Klein	Unsignalized	NB	33.3	D	4.8	A	SB	338.4	F	72.7	F
Boulevard & Walker	Signalized	WB	96.3	F	64.7	E	SB	184.7	F	125.6	F
Boulevard & Hudson	Signalized	WB	178.8	F	123.4	F	EB	108.5	F	79.0	E
Boulevard & Robinson	Signalized	NB	305.0	F	183.1	F	SB	165.0	F	107.0	F
Boulevard & Broadway	Unsignalized	NB	12.9	B	0.0	A	NB	10.4	B	0.0	A
Boulevard & Gaylord	Signalized	NB	197.6	F	136.9	F	SB	207.0	F	165.1	F
Boulevard & Oklahoma	Signalized	SB	24.0	C	7.2	A	SB	28.6	C	9.7	A
Reno & Klein	Signalized	SB	31.9	C	22.2	C	SB	35.4	D	22.8	C
Reno & Western	Signalized	EB	318.6	F	206.1	F	EB	98.1	F	63.8	E
Sheridan & Classen	Signalized	EB	39.5	D	21.4	C	WB	93.5	F	29.0	C
Sheridan & Western	Signalized	EB	23.8	C	15.9	B	WB	39.0	D	25.2	C
Boulevard & Shartel	Unsignalized	NB/SB	*	F	*	F	NB/SB	*	F	*	F
Boulevard & Reno	Signalized	EB	55.0	D	34.2	C	SEB	38.0	D	32.8	C
Boulevard & Lee	Unsignalized	NB/SB	*	F	*	F	NB/SB	*	F	*	F
Reno & Walker	Signalized	SB	418.0	F	189.0	F	SB	442.8	F	281.8	F
Reno & Hudson	Signalized	NB	299.3	F	146.0	F	SB	219.7	F	153.7	F
Reno & Robinson	Signalized	WB	154.4	F	56.0	E	WB	73.8	E	49.7	D
Reno & Gaylord	Signalized	NB	158.2	F	110.1	F	WB	313.6	F	243.5	F

* - Delay on N/S approaches is so excessive that Synchro indicates an error in the delay calculation.

TABLE 4 - INTERSECTION CAPACITY ANALYSIS RESULTS
ALTERNATIVE D: GRID OPTION

2015 ANALYSIS

Intersections	Type of Traffic Control	AM Peak Hour					PM Peak Hour				
		Critical Approach			Intersection		Critical Approach			Intersection	
		Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Approach	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Boulevard & Klein	Unsignalized	NB	20.2	C	1.3	A	NB	11.5	B	1.4	A
California & Western	Signalized	NB	48.6	D	27.0	C	NB	32.8	C	23.5	C
California & Classen	Signalized	NB	97.1	F	40.7	D	SB	35.8	D	28.9	C
California & Shartel	Unsignalized	NB/SB	ERR	F	ERR	F	NB/SB	ERR	F	ERR	F
California & Lee	Unsignalized	NB	320.1	F	34.4	D	NB	209.9	F	27.2	D
California & Dewey	Unsignalized	NB	119.0	F	17.1	C	NB	252.0	F	34.3	D
California &Walker	Signalized	EB	173.2	F	127.5	F	NB	1501.5	F	606.2	F
Reno & Klein	Signalized	NB	40.7	D	20.5	C	SB	37.9	D	17.0	B
Reno & Western	Signalized	EB	45.4	D	26.2	C	EB	38.5	D	28.4	C
Reno & Shartel	Signalized	EB	31.7	C	22.8	C	WB	20.2	C	16.1	B
Reno & Lee	Signalized	EB	29.9	C	21.6	C	WB	17.2	B	14.0	B
Reno & Dewey	Unsignalized	NB	18.9	C	3.8	A	SB	45.6	E	7.7	A
Reno & Walker	Signalized	WB	59.9	E	45.9	D	SB	246.7	F	142.0	F
Reno & Hudson	Signalized	WB	83.2	F	51.1	D	WB	49.7	D	35.4	D
Reno & Robinson	Signalized	WB	77.9	E	43.1	D	WB	49.5	D	31.9	C
Reno & Gaylord	Signalized	WB	62.3	E	37.9	D	WB	52.6	D	25.8	C
SW 2nd & Shartel	Unsignalized	EB	37.1	E	7.9	A	EB	28.6	D	7.6	A
SW 2nd & Lee	Unsignalized	EB	12.6	B	6.4	A	WB	12.8	B	6.3	A
SW 2nd & Dewey	Unsignalized	SB	9.1	A	3.1	A	SB	9.2	A	2.9	A
SW 2nd & Walker	Unsignalized	EB	55.0	F	5.3	A	WB	43.8	E	4.4	A
SW 2nd & Hudson	Signalized	EB	32.7	C	4.7	A	EB	29.8	C	3.6	A
SW 3rd & Shartel	Signalized	EB	37.7	D	24.6	C	EB	29.1	C	22.3	C
SW 3rd & Lee	Unsignalized	SB	157.8	B	16.6	C	SB	226.7	F	16.4	C
SW 3rd & Walker	Signalized	EB	160.2	F	103.7	F	SB	166.0	F	73.7	E
SW 3rd & Hudson	Signalized	WB	85.4	F	59.6	E	SB	35.0	C	20.9	C
SW 3rd & Robinson	Signalized	NB	112.4	F	62.1	E	SB	151.2	F	91.3	F
SW 3rd & Broadway	Unsignalized	NB	48.0	E	0.5	A	NB	41.3	E	0.4	A
SW 3rd/Boulevard & Gaylord	Signalized	EB	183.0	F	100.4	F	SB	136.3	F	101.1	F
SW 3rd/Boulevard & Oklahoma	Signalized	SB	23.9	C	5.4	A	SB	25.8	C	6.1	A
Sheridan & Western	Signalized	WB	46.4	D	22.5	C	EB	41.6	D	16.9	B
Sheridan & Classen	Signalized	EB	82.0	F	33.9	C	EB	36.4	D	18.6	B