

S. WASHINGTON ST. & S. EMERSON ST. TWO-WAY CONVERSION EVALUATION

Executive Summary

At the request of West Washington Park Neighborhood Association (WWPNA), The Fox Higgins Transportation Group performed a traffic evaluation of the conversion of S. Washington and S. Emerson St. (between I-25 and Speer Blvd.) from one-way to two-way operation. Previous relevant transportation plans and studies, available traffic data, and proposed land used changes in the surrounding area were reviewed. The evaluation yielded the following findings and conclusions:

Background

Two previous studies have been performed by the City and County of Denver, the Central Denver North-South Traffic Impact Mitigation Study in 1986 and the Central Denver Transportation Study in 1998.

- Both studies have recommended the conversion of these roadway segments from one-way to two-way operation to mitigate the effects increasing traffic.
- Washington and Emerson south of I-25 were converted to two-way after the 1986 study.

Current Situation

The traffic volumes on neighborhood arterial and collector roadways are anticipated to continue to increase with regional traffic growth. Area redevelopment projects, including the Gates area projects and the County Club Gardens (1st & Ogden) project, will create additional traffic demands on north-south arterials and collectors.

- The most recent traffic data, collected prior to TREX, indicates that Downing St. is operating at or near its designed capacity and that Logan St. is operating with some excess capacity.
- The Broadway / Lincoln corridor will serve as a major north-south route for additional traffic volumes created by the Gates redevelopment projects, thereby increasing traffic on these roadways to capacity levels.

General Conclusions

As a result of the differences in capacities and travel times often associated with one-way vs. two-way streets, it is anticipated that conversion from one-way to two-way operation on S. Washington St. and S. Emerson St. will affect some shift in traffic volumes within the neighborhood.

- Conversion of these roadway segments would be similar to that achieved with prior conversion of these roadways south of I-25, with the goal of providing a safer street system with less traffic intrusion into the neighborhood, slower speeds, and thereby a generally higher quality of life.

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Executive Summary (Continued)

- Based on the pre-TREX traffic counts and relative available capacities on each of the roadways, it is not anticipated that the conversion will cause a significant shift onto any single local street within the neighborhood.
- It is estimated that 30%-50% of the existing traffic on S. Washington St. and S. Emerson St. would shift to Broadway / Lincoln St., Logan St., Downing, and I-25.
- With relative excess capacity along Logan St. compared to the other north-south arterial routes, it is anticipated that the impact of this shift would be most noticeable there in the short term (5 year planning horizon).
- In the short term, there will be minimal effects on the parallel arterial roadways resulting from the traffic shift of the one-way to two-way conversion.
- In the long-term, it is conceivable that all neighborhood arterial roadways will approach and/or stabilize at or near capacity volumes, typical in built out urban areas. This will likely happen regardless of the proposed one-way to two-way conversion project.

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Prepared For:

West Washington Park
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At the request of the West Washington Park Neighborhood Association (WWPNA), the Fox Higgins Transportation Group has completed a traffic evaluation of the conversion of S. Washington St. and S. Emerson St. (between I-25 and Speer Blvd) from one-way to two-way operation within the West Washington Park Neighborhood Association area. We have reviewed previous relevant transportation plans and studies, available traffic data, and proposed land use changes in the vicinity which may impact traffic in the neighborhood. Our evaluation includes a discussion of relative capacities on collector and arterial roadways within and adjacent to the neighborhood and potential impacts to the neighborhood associated with such a project.

Background

In the 1950's, use of one-way streets and couplets became a popular tool in many urban areas within the United States as a means of increasing roadway capacity on older grid street systems where roadway width is limited. Many of these street systems and neighborhoods were designed prior to the automobile and thus provided little right-of-way and building setbacks to allow for roadway widening. Without available width to expand roadways to include additional through lanes and turn lanes, traffic engineers often turned to one-way streets to increase capacity on congested corridors. More specifically, these efforts were made to allow efficient travel to and from downtown areas.

Within this context, in the mid 1950's, the City and County of Denver created one-way couplets on several area streets, including Broadway / Lincoln St., S. Washington St. / S. Emerson St., and Logan St. / Grant St. These streets allowed for increased capacity to and from downtown. In the 1970's and 80's, resident requests prompted Denver to produce the Central Denver North-South Traffic Impact Mitigation Study¹, citing increased volumes and perceived declines in safety, livability, and property values. Recommendations from this study included the following:

¹ Central Denver North-South Traffic Impact Mitigation Study. City and County of Denver. 1986.

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- a phased conversion plan that resulted in conversion of Logan St. / Grant St. and S. Washington St. / S. Emerson St. (south of I-25) back to two-way operation
 - recommendation that additional streets, such as S. Washington / S. Emerson north of I-25, be converted back to two-way operation once the 6th Ave. / Speer Blvd. / Lincoln St. intersection was rebuilt (this was completed in the early 1990's).

In 1998, the Central Denver Transportation Study² was prepared to provide guidance for addressing traffic concerns in Central Denver neighborhoods. Expecting to effect a reduction in traffic "intrusion" into the Central Denver neighborhoods and creating a "slower, more comfortable pace" throughout the study area, the Central Denver study:

- analyzed one-way vs. two-way operations along study area one-way couplets
- found that, although changing *all* of the one-way streets to two-way streets in the Central Denver area would produce an unacceptable shift in traffic to nearby streets, the conversion of S. Washington St. and S. Emerson St. (between I-25 and Speer Blvd.) to two-way operation was still a favored long-term objective.
- discussed "balancing" the conversion of S. Washington St. and S. Emerson St. to two-way operation with the needs of residents along Logan St.
- recommended, as a short-term solution, converting existing two-lane, one-way streets to one-lane, one-way streets with parking on both sides.

Some of the short-term improvements recommended in the Central Denver study have since been implemented, including two-side parking on S Washington St. and S. Emerson St. with one lane of traffic. However, the long-term recommendation to convert S. Washington St. and S. Emerson St. to two-way operation has yet to be completed.

The conversion of one-way streets back to two-way operation has become an increasingly popular movement through the United States over the past decade, both in residential areas and in business districts. The purpose of this memorandum is to evaluate the previously recommended conversion of S. Washington St. and S. Emerson St. to two-way operation within the neighborhood, as proposed in each of these previous plans and studies. The study area for this effort comprises the area of the West Washington Park neighborhood bounded by Speer Blvd. to the north, Broadway to the west, Downing St. to the east, and I-25 to the south.

Existing Roadways

As a result of the first phase of the 1998 Central Denver Transportation Study, S. Washington St. and S. Emerson St. are currently both one-lane, one-way streets between Speer and I-25. Parking is permitted 24 hours a day on both sides of the street. Both S. Washington and S. Emerson have bridges crossing I-25 to the south of

² Central Denver Transportation Study. City and County of Denver Transportation Planning and Engineering, Planning and Community Development. May 1998.

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the neighborhood. South of I-25, both roadways transition to two-lane, two-way streets. These segments south of I-25 were converted from one-way streets to two-way as a result of the 1986 study in order to mitigate the effects of increasing traffic. North of Speer Blvd., S. Emerson operates as a two-way local street, while S. Washington St. operates as a one-lane, one-way street with Clarkson St. serving as the northbound half of the one-way couplet. S. Washington St. and S. Emerson St. are classified as residential collector streets within the neighborhood per the Blueprint Denver³ plan. Both roadways have a 30' flow-line (curb to curb) width typical cross-section and 30 mph posted speed limits.

Logan St. and Downing St. are classified as residential arterial roadways and are two-lane, two way streets through the neighborhood that also provide bridge crossings over I-25. Downing transitions to one-way operation north of Speer Blvd., comprising a one-way couplet with Corona St). Logan St. also transitions to one-way operation north of Speer Blvd., comprising a one-way couplet with Grant St.

Broadway and Lincoln St. serve as a one-way couplet at the west edge of the neighborhood. Broadway is classified as a "main" and "mixed-use" arterial (depending on the section) while Lincoln is classified as a residential arterial. East-west residential collector roadways in the neighborhood include 1st Ave., Virginia Ave., and Louisiana Ave. East-west arterials include Speer Blvd. (a mixed-use arterial) and Alameda Ave (a mixed-use and residential arterial, depending on the section within the neighborhood). There are no east-west one-way streets in the neighborhood.

Existing Traffic Volumes

The most recent available traffic data was obtained from the City and County of Denver to provide a context for this evaluation. This data included counts performed in 2000 and 2001 prior to the beginning of the I-25 Transportation Expansion (TRES) project. Since TRES construction resulted in the closing of the Downing St., S. Emerson St., and S. Washington St. ramps were closed during the five-year construction period, counts performed during the construction period were considered not applicable for this evaluation due to construction diversion and detours. TRES construction was completed, with all ramps reopened, in August of 2006.

Figure 1 provides a summary of pre-TRES daily traffic volumes within the neighborhood. These counts were performed in March 2001 by the City and County of Denver (with the exception of Logan St. north of Ohio St., which was counted in 2000). While some changes in traffic volumes since these counts are anticipated (increases due to area growth and changes in traffic patterns due to TRES improvements) these volumes can provide a basis for generalized discussion of relative capacities on study area roadways.

Future Traffic Volumes

Population growth within the area and region is anticipated to result in increased traffic volumes over time. The Central Denver Transportation Study estimated that, over a five-year period in the 1990's, traffic volumes in the area had been growing by roughly

³Blueprint Denver, An Integrated Land Use and Transportation Plan. City and County of Denver. Adopted 2002.

3% per year. This represents a fairly significant growth rate, likely due to the relatively short historical period studied. The addition of TREC and capacity improvements along I-25 may slow this historic growth. However, it is indicative that residents can expect traffic volumes on the north-south arterial and collector streets to continue to grow incrementally as demand increases.

The West Washington Park neighborhood, like much of the Central Denver area, is relatively built out, with population growth primarily occurring through redevelopment projects. Future traffic growth will likely be more attributable to external sources (traffic "intrusion", as discussed in the 1998 Central Denver study) than internal to the neighborhood. It is anticipated that this increased demand will be focused on the area arterial streets, and as these reach or exceed capacity, on parallel collector routes.

Denver Regional Council of Governments (DRCOG) regional traffic model data for the Year 2030 was reviewed within the study area, although regional models are typically not precise enough to be utilized at a "zoomed in" neighborhood scale. Several of the DRCOG roadway forecasts within the neighborhood were counterintuitive (such as a significant decrease in traffic along Downing St.). As expected, the DRCOG model volumes were concluded to be inappropriate for use in this analysis since the model lacks precision when applied to the neighborhood level.

Area Redevelopment

Additional projects which are likely to result in some increase in traffic volumes along the north-south neighborhood streets and exterior arterials include the Gates Rubber Factory area redevelopment projects and the Country Club Gardens project. These projects are discussed in the following paragraphs.

The Gates Rubber Factory redevelopment involves the redevelopment of a formerly industrial 50-acre site with new mixed-use (residential, office, and retail), transit-oriented land uses. The redevelopment master plan projected between 5 million to 7 million square feet of development with up to 4,000 residential units and 4 million square feet of office/retail/commercial uses. The 50-acre site has been divided into several, unique projects which are in various stages of planning and design. It is anticipated that the new trips generated by the Gates area redevelopment projects will create significant additional demand on area north-south arterials, such as Broadway / Lincoln St. Since these roadways are near capacity, there is also the potential for these projects to create additional traffic demand on the Logan St. corridor and to a lesser extent Downing St. and the existing one-way couplet on S. Washington St. and S. Emerson St. While preliminary traffic studies for the Gates area projects have quantified future traffic demands on the Broadway / Lincoln St. corridor, these studies have not quantified possible impacts to other north-south streets within the neighborhood.

Along the north side of the neighborhood, the Country Club Gardens could potentially develop 500 new residential units at the intersection of 1st Ave. & Ogden St., though a detailed land use plan is not yet available. At your request, we have provided an analysis of the potential trip generation associated with this site. To estimate the potential added traffic with the development of the Country Club Gardens, trip rates

contained in the Institute of Transportation Engineers (ITE) trip generation manual⁴ were reviewed. For the proposed use, ITE rates for “Condominium/Townhouse” were applied. Based on the ITE rates, the project is anticipated to generate roughly 2,900 new trips on an average weekday. The trip generation calculations are attached for reference.

In order to estimate the additional daily traffic associated with the County Club Gardens project on neighborhood arterial and collector streets, site trip distribution were assumed. Based on existing traffic patterns in the study area and on anticipated destinations by future residents of Country Club Gardens, it is estimated that roughly 50%-60% of the project traffic would be oriented along Speer Blvd. (east and west) with roughly 40%-50% of the site traffic oriented along S. Downing St. and the S. Washington St. / S. Emerson St. (north-south) one-way couplet through the neighborhood. With the current one-way couplet configuration, it is estimated that approximately 1,200 to 1,500 new trips would be added to S. Downing St. and roughly 600 to 800 new trips added to S. Washington St. and S. Emerson St. (each) within the neighborhood. If the S. Washington St. / S. Emerson St. one-way couplet is converted to two-way operation, it would be anticipated that Downing St. would carry a higher percentage of this traffic while S. Washington St. and S. Emerson St. would carry less.

These assumptions are based on the likely “desired” paths of residents of this project. However, consideration of the existing congestion along Downing St. should be given. Per the pre-TREX traffic volumes, Downing St. is currently operating at or near typical daily volume thresholds for a two-lane roadway (this is discussed in more detail on Page 6). Thus, it is questionable of whether new traffic created by the Country Club Gardens project would utilize Downing St. or seek alternate, less congested routes through the neighborhood. The Country Club Gardens project would also result in an increase on some local streets within the neighborhood, particularly adjacent to the site (1st Ave., Ogden St., Corona St., and Ellsworth Ave.). However, without a detailed site and access plan, accurate traffic volumes projections at this scale cannot be made at this time.

Additional development projects along the West Washington Park boundaries, such as the transit oriented development for the Alameda Station, will add traffic to the area. However, specific details of these developments were not available at the time of this study so were not included.

Conceptual Impacts of One-Way vs. Two-Way Operation

To evaluate the impacts of converting S. Washington St. and S. Emerson St. from one-way to two-way operation between I-25 and Speer Blvd., the basic principles of one-way and two-way streets were reviewed. One-way couplets are typically installed to increase capacity through a corridor. This is achieved by allowing for simplified coordination of traffic signals along a one-way street and a decrease in the number of conflicting movements at intersections. Although the travel speeds on one-way streets can often be mitigated by allowing signal progression only at the desired (often posted) speed, travel speeds are usually higher than on similar two-way streets.

⁴ Trip Generation, Institute of Transportation Engineers, 6th Edition, 1997.

Pedestrian impacts of one-way streets are mixed, with the higher traffic speeds offset by pedestrians having to only look in one direction prior to crossing the street. One-way streets provide less conflicting movements at intersections, for both vehicles and pedestrians. One-way streets can create diversion of traffic and increased travel distances since desired travel paths may be restricted.

Conversely, two-way streets, particularly with on-street parking, provide less capacity than one-way streets and often lower travel speeds. This is generally considered a positive on local residential streets where livability and quality of life are often closely tied with traffic volumes and travel speeds.

As a result of the differences in capacities and travel times often associated with one-way vs. two-way streets, it is anticipated that conversion from one-way to two-way operation will effect some shift in traffic volumes.

Estimated Shifts in Traffic with One-Way to Two-Way Conversion

The conversion of S. Washington St. and S. Emerson St. from one-way to two-way operation, as recommended in the previous studies performed by the City and County of Denver, would involve physical changes to the street system as well as signing and marking modifications. Traffic control, both existing traffic signals and the need for future all-way stop signs, and on-street parking accommodation would need to be reviewed. In estimating potential shifts in traffic associated with the conversion of a one-way street to a two-way street, traffic control plays a significant part. While some conversions involve relatively little change in traffic control, others have prompted the removal of traffic signals and/or installation of stop signs. These changes can have a significant affect on travel times, capacities, and traffic volumes on these corridors. In addition to these physical changes, reclassification of S. Washington St. and S. Emerson St. from residential collector roadways to local roadways, similar to what was achieved with prior conversion of these roadways south of I-25, could be considered.

Traffic volumes on one-way vs. two-way streets are a function of the demand of that travel corridor. Demand on a particular street or within that corridor is influenced by the desired travel paths for motorists, congestion on parallel or adjacent streets and corridors, and/or on congestion (or lack thereof) on the street in question. Congestion can also be discussed in terms of roadway capacity. If a roadway volume is at or exceeding its capacity, it is likely that motorists will seek alternate routes – likely routes that are not at capacity, or have “excess” capacity. Motorists most typically seek arterial routes and other high capacity roadways for regional travel. When these routes become congested, streets with lower classifications (collectors and local streets) may become more attractive.

Applying rule-of-thumb planning capacity thresholds to the Year 2001 (pre-TREX) traffic volumes suggests that Downing St. is currently operating at or above its designed capacity and that and Logan St. is operating with some excess capacity. Roadway capacity is a function of many variables: number of lanes, lane width, traffic controls, traffic speeds, on-street parking, driveway/access frequency, typical vehicle types (cars vs. trucks and buses), and other characteristics. Transportation planning guidelines typically utilize the number of lanes, along with the roadway classification (arterial,

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collector, local, etc.), to establish average daily volume (ADT) capacity thresholds for generalized categories of streets. Typical capacity thresholds for 2-lane arterial (non-principal) roadways, such as Downing St. and Logan St., are in the 15,000 to 20,000 ADT range. Logan St. likely falls higher in that range due to the presence of raised medians on some sections and wider lanes than Downing St. in most areas.

With the conversion of S. Washington St. and S. Emerson St. from one-way to two-way operation it is anticipated that some traffic currently using this one-way couplet would divert to parallel routes. This is primarily based on the narrowing of travel lanes (to accommodate two lanes of travel plus two lanes of parking within the 30' existing flow line width, similar to adjacent local streets in the neighborhood) and changes in traffic control that would need to occur to implement the conversion. The two-way, two-lane configuration is inherently less efficient in accommodating through traffic, due to much narrower travel lanes and the friction created by on-street parking maneuvers. Without detailed origin-destination studies, modeling, and current traffic volumes, a precise shift in volume cannot be determined. However, based on the 2001 volumes and area land uses serving these streets, some estimation can be made.

The Year 2001 traffic volumes show roughly 8,000-11,000 ADT on S. Washington St. and S. Emerson St. combined. With a change from one-way to two-way operation, it is estimated that 30%-50%⁵ of this traffic would shift from the S. Washington St. / S. Emerson St. corridor to Broadway / Lincoln St., Logan St., Downing St., or remain on I-25. The presence of bridges over I-25 and access to I-25 along S. Washington St. and S. Emerson St. will still create more demand for these streets over adjacent two-lane local streets, such as Ogden St., or Pearl St. However, as these routes become less efficient with two-way operation for travel through from one end of the neighborhood to the other, regional trips on these streets and those originating from outside the neighborhood will become fewer. This impact would be consistent with the one of the key goals outlined in both the Neighborhood Plan and Central Denver plan: to reduce non-neighborhood traffic within the neighborhood.

As discussed above, this 30% to 50% will seek alternate routes on arterial streets, likely those where excess capacity exists. It is not anticipated that this change will cause a significant shift onto any single local street within the neighborhood, since the grid system provides many travel options and the roadway capacities and travel times on these streets are not conducive to efficient travel over long distances through the neighborhood.

The roadway most likely to feel the negative effects of a shift in traffic is Logan St, since this route has excess capacity based on the 2001 traffic volumes and may become more attractive as a north-south route than a two-way S. Washington St. and S. Emerson St. The potential effects of the Gates Redevelopment projects, which will result in an increased north-south demand at the west edge of the neighborhood that will likely affect Logan St., should also be considered. Conversely, S. Washington St. and S. Emerson St. would experience a reduction of traffic volumes and speeds associated with the two-way conversion.

⁵ Estimated shift based on land use and density within the study area.

Conclusion

The conversion of S. Washington St. and S. Emerson St. from one-way to two-way operation between I-25 and Speer Blvd. has been recommended by City & County of Denver through previous neighborhood studies. As discussed in these studies, the goal of these projects are to provide a safer street system with less traffic intrusion into the neighborhood, slower speeds, and thereby a generally higher quality of life. With redevelopment occurring in the area and historic traffic growth increases, local and regional traffic will continue to increase along neighborhood collector and arterial streets, thus reaffirming the previously determined need for these projects.

Conversion of S. Washington St. and S. Emerson St. between I-25 and Speer Blvd. would effect an estimated 30%-50% decrease in traffic volumes along these roadways due to narrower travel lanes and decreased efficiency with two-way operation and on-street parking. Along with the reduction in volumes, there would likely be a reduction in travel speeds due to the change from one-way to two-way operations and changes in traffic controls (e.g., signals and stop signs) that are often implemented with such conversions.

The conversion would decrease the north-south capacity through the neighborhood and likely result in a shift of traffic onto parallel arterial corridors. It is anticipated that the majority of this traffic would shift onto parallel arterial routes, such as Logan St., the Broadway/Lincoln corridor, Downing St., and I-25. With relative excess capacity along Logan St. compared to the other north-south arterial routes, it is anticipated that the impact of this shift would be most noticeable there, though all of these arterials would likely share some portion of this additional traffic burden. Downing St., which is operating at or near its capacity based on the most recent traffic volumes data, may be able to carry less of this additional traffic than the other roadways mentioned.

It is not anticipated that a significant shift onto adjacent/parallel local streets would occur as these streets offer no benefit (in terms of efficiency). Without extensive existing traffic data and modeling available for the neighborhood, detailed quantification of the additional traffic load on each roadway cannot be estimated. However, based on the pre-TREX traffic counts and relative available capacities on each of the roadways it is determined that the resulting traffic shift of the one-way to two-way conversion can be accommodated on the parallel arterial roadways with minimal effects in the short-term. In the long-term, it is conceivable that all neighborhood arterial roadways will approach and/or stabilize at or near capacity volumes, typical in built out urban areas. This would likely happen regardless of the proposed one-way to two-way conversion project.

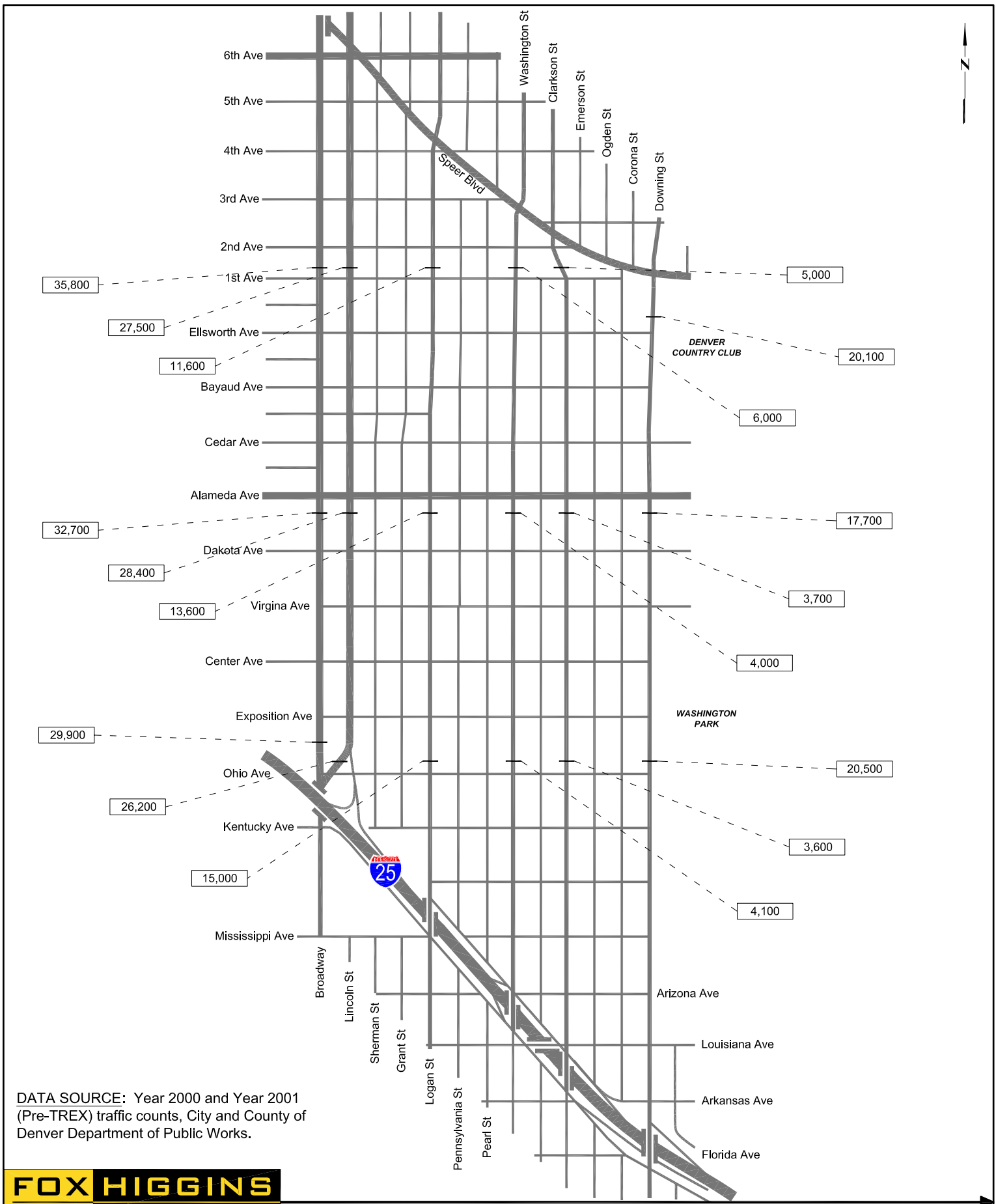
Fox Higgins Transportation Group, LLC



Steve Tuttle, P.E.
Principal

Attachments:

Figure 1 – Daily Traffic Volumes (Pre-TREX)
Trip Generation Estimate – Country Club Gardens



DATA SOURCE: Year 2000 and Year 2001 (Pre-TREX) traffic counts, City and County of Denver Department of Public Works.



S. Washington St. and S. Emerson St. Two-Way Conversion Evaluation
Daily Traffic Volumes (Pre-TREX)

FH Project #	06077	Original Scale	1"=1500'	Date	1/22/07	Drawn by	SGT	Figure #	1
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Country Club Gardens
 Summary of Trip Generation Calculation
 For 500 Dwelling Units of Residential Condominium / Townhouse
 December 13, 2006

	Average Rate	Standard Deviation	Adjustment Factor	Driveway Volume
Avg. Weekday 2-Way Volume	5.86	3.09	1.00	2930
7-9 AM Peak Hour Enter	0.07	0.00	1.00	35
7-9 AM Peak Hour Exit	0.37	0.00	1.00	185
7-9 AM Peak Hour Total	0.44	0.69	1.00	220
4-6 PM Peak Hour Enter	0.35	0.00	1.00	175
4-6 PM Peak Hour Exit	0.17	0.00	1.00	85
4-6 PM Peak Hour Total	0.52	0.75	1.00	260
AM Pk Hr, Generator, Enter	0.08	0.00	1.00	40
AM Pk Hr, Generator, Exit	0.36	0.00	1.00	180
AM Pk Hr, Generator, Total	0.44	0.68	1.00	220
PM Pk Hr, Generator, Enter	0.33	0.00	1.00	165
PM Pk Hr, Generator, Exit	0.19	0.00	1.00	95
PM Pk Hr, Generator, Total	0.52	0.75	1.00	260
Saturday 2-Way Volume	5.67	3.10	1.00	2835
Saturday Peak Hour Enter	0.25	0.00	1.00	125
Saturday Peak Hour Exit	0.22	0.00	1.00	110
Saturday Peak Hour Total	0.47	0.71	1.00	235
Sunday 2-Way Volume	4.84	2.71	1.00	2420
Sunday Peak Hour Enter	0.22	0.00	1.00	110
Sunday Peak Hour Exit	0.23	0.00	1.00	115
Sunday Peak Hour Total	0.45	0.70	1.00	225

Note: A zero indicates no data available.
 Source: Institute of Transportation Engineers
 Trip Generation, 7th Edition, 2003.

TRIP GENERATION BY MICROTRANS