AFTER RECORDING, RETURN TO:

City Secretary
City of McKinney
P.O. Box 517
222 N. Tennessee Street
McKinney, Texas 75069

City of McKinney, Texas
FACILITIES AGREEMENT
For
Property Situated at and about the Southeast Quadrant of the Intersection Between Existing Custer Road (F.M. 2478) and F.M. 1461 Owned by Haggard Rhea Mills, LLC

This FACILITIES AGREEMENT for certain Property (as defined below) situated at and about the southeast quadrant of the intersection between existing Custer Road (F.M. 2478) and F.M. 1461 (this "Agreement"), entered into effective the _____ day of _____, 2010, by and between the *CITY OF McKINNEY*, a Texas municipal corporation and home-rule city ("CITY"), and **HAGGARD RHEA MILLS, LLC, a Texas limited liability company,** whose address is 800 Central Parkway East, Ste 100, Plano, TX 75074, and who is the present owner of the Property at the time of annexation into the City of McKinney, ("OWNER"), witnesseth that:

WHEREAS, OWNER owns the property described on Exhibit "A" attached hereto (the "ETJ Property") that is located within the extraterritorial jurisdiction of CITY; and

WHEREAS, OWNER also owns the property described on Exhibit "B" attached hereto (the "McKinney Property") that is located within the corporate limits of CITY (the ETJ Property and McKinney Property are collectively referred to as the "Property"); and

WHEREAS, OWNER has requested the City Council to approve the annexation of the ETJ Property and the zoning of the Property; and

WHEREAS, the physical location of the Property and the lack of adequate roadway and utility facilities to serve the Property demonstrate that infrastructure improvements will likely be required as a condition to development of the Property in the future; and

WHEREAS, OWNER understands that prior to record platting of the Property the CITY's development standards and ordinances will require the then Owner or any Developer to fund and construct certain roadway and utility improvements,

as set forth in the CITY's Subdivision Ordinance, that are necessitated by the development of the Property and a general statement of such required public improvements (based on existing conditions) is outlined herein; and

WHEREAS, an Agreement specific to the Property or a portion thereof may be executed at such time as development begins on all or a portion of the Property that would supersede or amend, in whole or in part, this Agreement, setting forth in detail the public improvements that will be required for the Property or the applicable portion of the Property being so developed; otherwise, all then applicable ordinances and the terms of this Agreement shall govern development of the Property and provide notice to OWNER of CITY development requirements; and

WHEREAS, OWNER agrees and enters into this Agreement which shall operate as a covenant running with the land and shall be binding upon and inure to the benefit of OWNER, its successors and assigns, and all others holding a fee interest in the Property, or any part or portion thereof, now or in the future.

NOW THEREFORE, in consideration of the mutual covenants and agreements contained herein the OWNER and CITY agree as follows:

A. PROPERTY

This Agreement is for approximately one hundred thirty-four and forty-four-one hundredths (134.44) acres of land composed of the ETJ Property, which is the subject of a pending annexation proceeding, and the McKinney Property. The ETJ Property and the McKinney Property are described in Exhibits "A" and "B," respectively, attached hereto and incorporated herein by reference for all purposes allowed by law and are referred to herein collectively and in whole or in part as the Property.

B. ZONING & PLATTING

The Property shall be zoned and platted, if required by applicable ordinance or state law, in accordance with the CITY's Zoning Ordinance and Subdivision Ordinance, then in force, before any development permit or building permit will be issued for the development of the Property.

C. PUBLIC IMPROVEMENTS

All public improvements, including utilities, drainage structures and easements, sidewalks, hike and bike trails, street lighting, street signage, park land dedication and all other improvements and dedications required in connection with the development of the Property, or portion thereof, shall be constructed and provided by OWNER, at no cost to CITY, in accordance with the CITY's Ordinances which

are then in effect. Exhibit "C" attached to this Agreement identifies certain of the public improvements that must be constructed, at no cost to the CITY, to serve the proposed development of the Property. Exhibit "C" also identifies certain conditions that must be met regarding the provision of public improvements which may be required to serve the Property. The following, including Exhibit "C," provides a general description of the minimum construction requirements for roadways and utilities which, under current conditions, would be required as a condition to development of the Property or portion thereof (subject to the City's approval of phases or partial development).

1. THOROUGHFARES

OWNER acknowledges that the Traffic Impact Analysis ("TIA") attached as Exhibit "D" to this Agreement reflects that there currently does not exist sufficient capacity in and on the roadways in the vicinity of the Property to support the traffic that will be generated by the proposed development of the Property. OWNER further acknowledges that the TIA identifies certain roadway improvements that must be constructed at a minimum to serve the proposed development of the Property.

OWNER shall dedicate at no cost to CITY that amount of right-of-way along perimeter roadways adjacent to the Property, and each portion or phase of the Property, which will yield at least one-half (½) of the ultimate right-of-way width, or that amount of right-of-way which may be necessary to provide a complete installation of the roadway or bridge section, that is not already dedicated by plat or legal instrument as road right-of-way, including intersection flows and the Custer Road realignment at such time as development occurs. OWNER shall dedicate all right-of-way for the interior streets serving the Property, or portion thereof, at the time of development. Owner shall further dedicate all necessary right-of-way adjacent to the Property for the realignment of existing F.M. 2478 (Custer Road) as described in Exhibit "C." If platting or development of the Property is delayed and the F.M. 2478 (Custer Road) right-of-way described in Exhibit "C" has not previously been dedicated, the OWNER shall dedicate the right-of-way and related easements along such described F.M. 2478 (Custer Road) segment upon receipt of the written request of the CITY's Engineer.

OWNER shall construct, at no cost to CITY, all required roadway improvements adjacent to the Property in accordance with the CITY's Subdivision Ordinance and Street Design Standards, then in effect. OWNER shall, at no cost to CITY, also acquire and dedicate the necessary right-of-way for and construct the off-site roadway improvements that are identified on the TIA as being necessary to serve the proposed development of the Property in accordance with the CITY's Street Design Standards, then in effect, or as may be agreed by the CITY. All roadway construction plans shall be approved by the CITY's Engineer or his agent prior to approval of a Development Permit for any portion of the Property. The final

alignment of right-of-way dedications shall be consistent with the CITY's Thoroughfare Development Plan and as approved by the CITY Engineer.

OWNER's obligation to construct required roadway improvements described in this Agreement shall only be triggered by OWNER's development of any part, portion or phase or the entirety of said Property. In the event the Property is developed in phases or parts less than the entirety OWNER shall construct all such roadways as may be required to serve the part, portion or phase of the Property then being developed including any roadways that extend beyond the boundaries of such part, portion or phase being developed which the CITY Engineer determines to be reasonably required to navigate through the subdivision and provide sufficient ingress and egress to property owners as well as at least two points of access for emergency vehicles.

2. UTILITIES

OWNER shall dedicate, at no cost to CITY, that amount of easement across the Property as deemed necessary by the CITY Engineer for the construction of water and wastewater utilities as shown on the CITY's Master Plans for Water and Wastewater (hereafter referred to collectively as the "Master Plans") and as approved by the CITY Engineer. The final alignment of easement right-of-way dedications shall be consistent with the City's Master Plans and as approved by the City Engineer.

OWNER shall construct, at his sole cost, all necessary utility lines up to twelve inches (12") in diameter to serve the Property in accordance with CITY standards and the Master Plans, at such time as demand on the Property requires or concurrent with the development of the Property, as determined by CITY. OWNER shall construct all necessary utility lines to serve the interior of the Property; said lines shall be at least eight inches (8") in diameter or larger as demand of the development on the Property requires. Said utility lines shall be constructed of materials of a quality and grade at least meeting the minimum standards specified by the CITY Engineering Department. All utility plans and improvements are subject to the approval of the CITY Engineer. In addition to the requirements stated herein, OWNER shall construct any off-site and oversize utility improvements up to the sizes shown on Master Plans and as per City of McKinney standards.

3. HIKE AND BIKE TRAIL

To the extent that the CITY's Master Trail Plan shows a hike and bike trail along, across or adjacent to the Property, the OWNER shall, at no cost to the CITY, dedicate the easement or right-of-way for and construct all required concrete hike and bike trail improvements in accordance with the CITY's Subdivision Ordinance and Master Trail Plan in connection with the filing of the first record plat for development of any part, portion or phase of the Property. The hike and bike trail

shall be tied in or connected to the CITY's trail system or to the location(s)/area(s) identified as planned future extensions of the trail system specifically including, but not limited to, school sites, parkland sites and planned connections to creek and river greenways. Final location and all hike and bike trail construction plans shall be subject to review and approval by the Director of Parks and Recreation. All hike and bike trail construction plans must be approved by CITY's Parks Director or his agent prior to approval of a Development Permit for any portion of the Property being developed.

D. PARK LAND

OWNER shall dedicate required park land, if any, concurrent with platting and development of the residential portion(s) of the Property to provide for the recreational needs created by such development in accordance with the Subdivision Ordinance then in effect, or such other ordinance as may hereafter be adopted by the CITY regarding park land dedication, and as determined by the CITY Parks Department.

The above-described dedication of park land shall occur by dedication deed to CITY as the residential portion(s) and/or proposed school site(s), if any, adjacent to the particular park land areas are platted. The conveyance of such park land shall be by general warranty deed with an owner's title insurance policy in accordance with section 142-153, *et seq.*, of the CITY's Subdivision Ordinance. The valuation of the park land for purposes of such owner's title insurance policy shall be based on the use of said property as open space or for park purposes rather than a highest and best use valuation.

E. AVAILABILITY OF WATER AND WASTEWATER SERVICE IN THE FUTURE

The CITY makes no guarantee that water supply or wastewater treatment capacity will be available at any particular time or place, it being fully understood by both parties hereto that the ability of the CITY to supply water and wastewater services is subject to its contract with the North Texas Municipal Water District, a governmental agency and body politic and corporate, hereinafter referred to as "N.T.M.W.D.", and that this Agreement will only allow utilization of the CITY's water and wastewater system capacity when and if same is present and available from the N.T.M.W.D. Notwithstanding the foregoing, the CITY will supply the Development with water supply and wastewater treatment capacity if such capacity is present and available from N.T.M.W.D. The CITY shall be the sole judge of the availability of such capacity of water supply and/or wastewater services, provided, however, that the CITY will attempt to insure that said water supply and wastewater treatment capacity is available.

F. CITY DEVELOPMENT ORDINANCES

The Property shall be developed in accordance with the standards as set forth in the City of McKinney's Zoning, Subdivision and other land development ordinances, including but not limited to provisions regarding drainage, erosion control, pro-rata payments, tree preservation, park land dedication, hike and bike trails, impact fees, Street Design Standards, Public Improvements Policy and construction standards. OWNER expressly acknowledges that by entering into this Agreement, OWNER shall not construe any language contained herein or in any exhibits attached hereto as waiving any of the requirements of the CITY's Zoning Ordinance or Subdivision Ordinance or any other ordinance of the CITY, as applicable.

G. TREE ORDINANCE

OWNER expressly acknowledges the McKinney Tree Preservation Ordinance and the duty to develop the Property in accordance with the standards contained therein and any amendments to those standards.

H. STORMWATER

OWNER agrees to abide by all terms of the McKinney Storm Water Ordinance No. 2006-12-145, as amended by Ordinance No. 2009-05-027 and as it may further be amended.

I. PRO-RATA FEES

Off-site water and sewer facilities may be subject to either pro-rata payments paid to third parties or reimbursements collected from third parties in accordance with CITY Ordinances. For existing facilities, OWNER shall be responsible to pay applicable pro-rata fees in the amount of one-half (½) of the actual construction and engineering costs of up to a twelve-inch (12") diameter pipe if off-site facilities are constructed adjacent to the Property. Should OWNER construct off-site water and sewer facilities such that pro-rata fees are due to OWNER, CITY agrees to collect any fees due to OWNER related to the construction of the line(s) as those properties utilizing such facilities are developed during the period of ten (10) years after the date of construction and acceptance of each such off-site water and sewer facility constructed by OWNER. OWNER shall submit final construction costs to CITY prior to final acceptance of any pro-rata eligible improvements for use in determining pro-rata fees to be owed to OWNER. OWNER shall not be required to pay pro-rata fees for any major transmission line(s) that may be constructed upon, through, under, across or adjacent to the Property that merely transport(s) water or wastewater to or from a treatment facility and to which line(s) Owner is not permitted any right to tap or tie in to or otherwise utilize for the Property's benefit.

J. PROPORTIONALITY FEE

OWNER shall pay to CITY a Proportionality Fee ("FEE") for development of the ETJ Property, which FEE represents a roughly proportional amount necessary to offset the roadway and water and wastewater infrastructure capacity needs of the ETJ Property. Regarding roadway infrastructure capacity needs, the FEE shall be the equivalent of the roadway impact fee assessed in the adjacent (abutting) roadway impact fee service area (or that service area nearest to the ETJ Property if not adjacent) in effect at the time of building permit and shall be paid at the time of issuance of any building permits for any improvements on the ETJ Property. In accordance with the methodology and provisions of the CITY'S roadway impact fee ordinance, OWNER shall receive credits which credits are subject to future reimbursements, payable after full development of the ETJ Property, for excess vehicle miles contributed by the ETJ Property for the construction of adjacent roadways, as such compare to the amount of vehicle miles of demand created by the entirety of the ETJ Property. However, OWNER shall receive reimbursement only if such roadways become eligible impact fee system roadways as defined by CITY Ordinance. The Fee paid by OWNER shall be included in any computations for credits or reimbursements for the construction of system roadways. However, if roadway impact fees become applicable to the ETJ Property due to a revision of service area maps or otherwise such that impact fees are applicable, the provisions of the impact fee ordinances regarding roadway impact fees will prevail over this paragraph.

Regarding water and wastewater infrastructure capacity needs, the FEE shall be the equivalent of the then existing fee charged for a particular use in accordance with the CITY's water and wastewater impact fee ordinance at the time of building permit and shall be paid at the time of issuance of any building permits for any improvements on the ETJ Property. However, if water and wastewater impact fees become applicable to the ETJ Property due to a revision of service area maps or otherwise such that impact fees are applicable, the provisions of the impact fee ordinances regarding sewer and water impact fees will prevail over this paragraph.

K. IMPACT FEES

Impact fees for the McKinney Property and if applicable to the ETJ Property, as discussed in Paragraph J above, shall be charged in accordance with Ordinance No. No. 97-10-54, as amended by Ordinance Nos. 2000-03-20, 2001-08-091, 2003-05-055, 2003-07-062, 2005-11-116 and 2008-11-102 (Roadway), and Ordinance No. 96-03-13, as amended by Ordinance Nos. 2001-08-092, 2003-05-056 and 2008-11-103 (Utility), and as these ordinances may be amended in the future, including any schedules or exhibits attached thereto. These fees shall be due upon the time established by these Ordinances save and except only to the extent any waiver of or variance from said Ordinances has previously been granted

by the CITY and is contained in this Agreement or a separate agreement between the OWNER and CITY which agreement shall supersede and control.

L. DEFAULT

In the event the OWNER fails to comply with any of the provisions of this Agreement, the CITY shall be authorized to issue stop work orders, halt the issuance of further building permits, withhold the granting of Certificates of Occupancy and in the event that such failure creates a threat to the public health, safety and welfare revoke any and all Certificates of Occupancy that may have been previously issued in relation to the subdivision and/or development of the Property or any part thereof other than with respect to any portion of the Property previously released from this Agreement; and the CITY shall be further authorized to file this instrument in the records of Collin County as a Mechanic's Lien against the Property, and in the alternative, the CITY shall be authorized to levy an assessment against the Property for public improvements to be held as a tax lien against the Property by CITY.

M. ROUGH PROPORTIONALITY AND WAIVER OF CLAIMS

OWNER has been represented by legal counsel in the negotiation of this Agreement and been advised, or has had the opportunity to have legal counsel review this Agreement and advise OWNER, regarding the OWNER'S rights under Texas and federal law. The OWNER hereby waives any requirement that the CITY retain a professional engineer, licensed pursuant to Chapter 1001 of the Texas Occupations Code, to review and determine that the exactions required by the CITY as a condition of approval for the development of this Property are roughly proportional or roughly proportionate to the proposed development's anticipated impact. (These exactions may include but are not limited to the making of dedications or reservations of land, the payment of fees, the construction of facilities, and the payment of construction costs for public facilities.) The OWNER specifically reserves its right to appeal the apportionment of municipal infrastructure costs in accordance with Tex. Loc. Gov't Code § 212.904. However, notwithstanding the foregoing, the OWNER hereby releases the CITY from any and all liability under Tex. Loc. Gov't Code § 212.904 regarding or related to the cost of those municipal infrastructure improvements required for the development of the Property.

It is the intent of this Agreement that the provision for roadway and water, wastewater and stormwater infrastructure described in Paragraph C, above, made herein constitutes a proportional allocation of the OWNER'S responsibility for roadway and water and wastewater and stormwater infrastructure for the Property. The obligation of the OWNER herein set forth shall upon the OWNER'S completion of the Required Improvements (defined in Exhibit "C") and the CITY's final acceptance of the Required Improvements result in the granting of roadway impact

fee credits to the OWNER against its obligation to CITY for roadway impact fees for qualifying roadway improvements necessary to serve the Property and may also result in the granting of utility impact fee credits for oversizing water and sanitary sewer lines identified in the CITY's Impact Fee Capital Improvement Plan. The OWNER hereby waives any federal constitutional claims and any statutory or state constitutional takings claims under the Texas Constitution and Chapter 395 of the Tex. Loc. Gov't. Code. The OWNER further releases CITY from any and all claims based on excessive or illegal exactions; it being agreed that the OWNER'S infrastructure contribution(s) (after receiving all contractual offsets, credits and reimbursements) is roughly proportional or roughly proportionate to the demand that is placed on the roadway and utility systems by the PROPERTY. The OWNER further acknowledges that the benefits of zoning and platting have been accepted with full knowledge of potential claims and causes of action related thereto which may be raised now and in the future, and the OWNER acknowledges the receipt of good and valuable consideration for the release and waiver of such claims. **The OWNER shall indemnify and hold CITY harmless from any claims and suits of third parties, including but not limited to the OWNER'S respective successors, assigns, grantees, vendors, trustees or representatives brought against the CITY pursuant to this Agreement.**

N. CONTINUITY AND ASSIGNMENT

This Agreement shall be a covenant running with the land, and be binding upon and inure to the benefit of OWNER and its successors and assigns and any person owning a fee interest in the Property. However, this Agreement shall not be assignable by OWNER without the prior written consent of the CITY, and such consent shall not be unreasonably withheld, conditioned or delayed. If CITY approves the assignment of this Agreement in writing and in advance of any such assignment for a part or all of the Property, the approval of such assignment shall release the OWNER from further liability for only that portion of the Property to which the assignment so approved applies. Owner shall continue to be responsible for all other obligations hereunder as may apply to the remaining portions of the Property.

O. TERMINATION AND RELEASE

Upon satisfactory completion and final acceptance by CITY of all public improvements required by this Agreement as well as the payment of any funds required by this Agreement or the CITY'S Code of Ordinances, the CITY will execute a release of covenant to the OWNER, its successors and assigns, and all others holding any interest now or in the future, confirming that OWNER'S obligations hereunder have been satisfied and the Property has been released herefrom. This Agreement shall not terminate until the requirements of all parties have been fulfilled.

Notwithstanding the foregoing, in the event of phased development of the Property the CITY will, upon the request of the OWNER, after satisfactory completion by the OWNER or its agents and final acceptance by the CITY of all public improvements required by this Agreement for a specific portion or phase of the Property, execute a release of covenant to the OWNER with respect to such portion or phase of the Property. The release will confirm with respect to such portion or phase of the Property that the OWNER'S obligations hereunder have been satisfied and that such portion or phase of the Property has been released from this Agreement. The grant of such a release for any portion or phase of the Property shall be subject to OWNER'S satisfaction of the following requirements:

1. The OWNER shall have satisfactorily completed and the CITY finally accepted all Required Improvements and other public improvements necessary to serve the portion or phase of the Property for which a release is sought plus any thoroughfares identified in Exhibit "C," the thresholds for which are triggered by the development of said portion or phase of the Property.

2. Any part or parcel of the portion or phase of the Property for which a release is sought shall not be the subject of any additional, amended, secondary, separate, supplemental or other agreement with the CITY that has not been fully, finally and completely performed as determined in the sole discretion of the CITY.

3. All fees, costs and expenses then due and owing and required to be paid to the CITY by the CITY'S Code of Ordinances and/or this Agreement shall have been paid in full with respect to the portion or phase to be released.

4. OWNER shall agree to indemnify and hold the CITY harmless from all third-party claims, suits, judgments, and demands, including its reasonable attorney's fees, brought against the CITY as a result of or arising out of the CITY's release of portions or phases of the Property prior to such time as the OWNER has satisfactorily completed and the CITY has finally accepted all Required Improvements and other public improvements necessary to serve the entirety of the Property including, but not limited to, the Required Improvements and the thoroughfares identified in Exhibit "C."

P. GENERAL PROVISIONS

1. OWNER agrees that construction shall not begin on any proposed improvements to Property prior to City Council approval of this Agreement.

2. OWNER agrees that all coordination required with public and/or private utility agencies to eliminate conflicts with proposed street grades or underground improvements shall be the responsibility of OWNER. Likewise, coordination with agencies requiring special conditions (i.e., railroads and

the Texas Department of Transportation) shall be the responsibility of OWNER.

3. It is understood that any obligation on the part of CITY to make any refunds with respect to infrastructure improvements constructed within the Property shall cease, with respect to such improvements, on the 10th anniversary after the improvements are completed, inspected, and accepted by CITY. Such 10-year period may be extended for good cause and agreed to in writing by CITY and OWNER.

4. This Agreement does not constitute a "permit" under Chapter 245, Texas Local Government Code and no "rights" are vested by this Agreement; however, nothing in this Agreement shall constitute a waiver by OWNER of any rights of OWNER under said Chapter 245.

5. The Agreement is conditioned upon the annexation of the ETJ Property and zoning of the Property as contemplated by this Agreement. If the ETJ Property is not annexed or the Property is not zoned as contemplated by this Agreement, then OWNER or CITY shall have the right to terminate this Agreement; whereupon, neither party shall have any further duties, obligations, rights, or remedies under this Agreement. If this Agreement is terminated by either party pursuant to this paragraph, the Property shall be developed in accordance with the standards as set forth in City of McKinney Zoning, Subdivision and land development ordinances, including but not limited to provisions regarding drainage, erosion control, pro rata payments, tree preservation, park land dedication, hike and bike trails, impact fees, Street Design Standards, Public Improvements Policy and construction standards.

6. In the event of any conflict between the main body of this Agreement and any of the Exhibits attached to this Agreement, the Exhibits shall control.

CITY OF McKINNEY

By: _____
FRANK RAGAN
City Manager

Date Signed: _____

ATTEST:

SANDY HART, TRMC, MMC
City Secretary

***HAGGARD RHEA MILLS, LLC*, a Texas limited liability company**

By: _____
RUTLEDGE HAGGARD
Manager

Date Signed: 7/1/10

THE STATE OF TEXAS §
COUNTY OF COLLIN §

BEFORE ME, the undersigned authority, in and for said County, Texas, on this day personally appeared **Frank Ragan**, City Manager of the City of McKinney, a Texas Municipal Corporation, known to me to be the person who's name is subscribed to the foregoing instrument, and acknowledged to me that he has executed the same on CITY's behalf.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, this the ___day of _____, 20___.

_____

Notary Public _____ County, Texas
My commission expires _____

THE STATE OF TEXAS §
COUNTY OF COLLIN §

BEFORE ME, the undersigned authority, in and for said County, Texas, on this day personally appeared **Rutledge Haggard**, in his capacity as Manager of Haggard Rhea Mills, LLC, a Texas limited liability company, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same on behalf of and as the act of the limited liability company.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, this the 15 day of July, 20 10.

Notary Public Charla Fletcher County, Texas
My commission expires 11/24/2013

CHARLA FLETCHER
Notary Public State of Texas
My Commission Expires
November 24, 2013

EXHIBIT A

DESCRIPTION OF ETJ PROPERTY

LEGAL DESCRIPTION
WESTERLY 67.22 ACRES
L.C. SEARCY SURVEY, ABSTRACT NO. 816
GEORGE HORN SURVEY, ABSTRACT NO. 412
CITY OF MCKINNEY, COLLIN COUNTY, TEXAS

SITUATED in the State of Texas, County of Collin, being part of the L.C. Searcy Survey, Abstract No. 816 and the George Horn Survey, Abstract No. 412, being the westerly portion of an originally called 137.812 acre tract as recorded in Volume 265, Page 194 of the Collin County Land Records, being the westerly one-half of a 134.44 acre tract surveyed on this date with said premises being more particularly described as follows;

BEGINNING at a PK nail in a shiner in a wood fence corner post in the east right-of-way line of F.M. Road 2478 (Custer Road) marking the southwest corner of said 134.44 acre tract and the northwest corner of a Danville Water Supply Corporation 0.5824 acre tract as recorded in Volume 1977, Page 12 of the Collin County Land Records;

THENCE with the east right-of-way line of F.M. Road 2478 (Custer Road), the west line of said 134.44 acre tract and the west line of said premises, North 02°29'02" West, 2021.29 feet to a 5/8-inch iron rod found marking a corner-clip at the intersection of the east right-of-way line of F.M. Road 2478 (Custer Road) with the south right-of-way line of F.M. Road 1461;

THENCE with said right-of-way corner-clip, the northwest line of said premises and said 134.44 acre tract, North 40°15'13" East, 97.67 feet to a concrete right-of-way monument found marking the end of said corner-clip in the south right-of-way line of F.M. Road 1461 and the north line of said 134.44 acre tract;

THENCE with the south right-of-way line of F.M. Road 1461, the north line of said 134.44 acre tract and said premises, North 88°27'09" East, 1349.36 feet to the northeast corner of said premises from which a 3/8-inch iron rod found marking the northeast corner of said 134.44 acre tract bears North 88°27'09" East, 1394.39 feet;

THENCE crossing an open field along the east line of said premises, South 01°32'51" East, 2093.04 feet to the southeast corner of said premises in the south line of said 134.44 acre tract, the south line of the original 137.812 acre tract and also being in a north line of a 388.054 acre tract as recorded under County Clerk No. 92-0053214 of the Collin County Land Records, from said corner a ½-inch iron rod found marking the southeast corner of said 134.44 acre tract bears North 88°14'24" East, 1406.18 feet;

THENCE with a south line of said premises, a south line of said 134.44 acre tract, a south line of said 137.812 acre tract and a north line of said 388.054 acre tract, South 88°14'24" West, 1279.08 feet to a ½-inch iron rod found marking the most northerly northwest corner of said 388.054 acre tract and the northeast corner of the aforementioned Danville Water Supply Corporation 0.5824 acre tract;

THENCE with a south line of said premises, a south line of said 134.44 acre tract, a south line of said 137.812 acre tract, and the north line of said 0.5824 acre tract, North 89°20'11" West, 102.44 feet to the **POINT OF BEGINNING** and containing 67.22 acres of land.

This document was prepared under 22 TAC §663.21, does not reflect the results of an on the ground survey, and is not to be used to convey or establish interests in real property except those rights and interests implied or established by the creation or reconfiguration of the boundary of the political subdivision for which it was prepared.

EXHIBIT B

DESCRIPTION OF McKINNEY PROPERTY

LEGAL DESCRIPTION
EASTERLY 67.22 ACRES
L.C. SEARCY SURVEY, ABSTRACT NO. 816
GEORGE HORN SURVEY, ABSTRACT NO. 412
CITY OF MCKINNEY, COLLIN COUNTY, TEXAS

SITUATED in the State of Texas, County of Collin, being part of the L.C. Searcy Survey, Abstract No. 816 and the George Horn Survey, Abstract No. 412, being the westerly portion of an originally called 137.812 acre tract as recorded in Volume 265, Page 194 of the Collin County Land Records, and being more particularly described as follows;

COMMENCING at a PK nail in a shiner in a wood fence corner post in the east right-of-way line of F.M. Road 2478 (Custer Road) marking the southwest corner of said 134.44 acre tract and the northwest corner of a Danville Water Supply Corporation 0.5824 acre tract as recorded in Volume 1977, Page 12 of the Collin County Land Records;

THENCE with a south line of said 134.44 acre tract and the north line of said 0.5824 acre tract, South 89°20'11" East, 102.44 feet to a 1/2-inch iron rod found marking the most northerly northwest corner of said 388.054 acre tract and the northeast corner of the aforementioned Danville Water Supply Corporation 0.5824 acre tract;

THENCE with a south line of said 134.44 acre tract, a south line of said 137.812 acre tract and a north line of said 388.054 acre tract, North 88°14'24" East, 1279.08 feet to the **POINT OF BEGINNING**;

THENCE crossing an open field, North 01°32'51" East, 2093.04 feet to the northwest corner of premises, from which a concrete right-of-way monument found marking the end of said corner-clip in the south right-of-way line of F.M. Road 1461 and the north line of said 134.44 acre tract bears South 88°27'09" West, 1349.36 feet;;

THENCE with the south right-of-way line of F.M. Road 1461 and the north line of said 134.44 acre tract, North 88°27'09" East, 1395.27 feet to the northeast corner of said tract from which a 3/8-inch iron rod found marking the northeast corner;

THENCE crossing an open field along the east line of said tract, South 01°50'48" East, 2087.85 feet to the southeast corner of said tract, the south line of the original 137.812 acre tract and also being in a north line of a 388.054 acre tract as recorded under County Clerk No. 92-0053214 of the Collin County Land Records, from said corner a ½-inch iron rod found marking the southeast corner;

THENCE with a south line of said 134.44 acre tract, a south line of said 137.812 acre tract and a north line of said 388.054 acre tract, South 88°14'24" West, 1406.18 feet to a to the **POINT OF BEGINNING** and containing 67.22 acres of land.

This document was prepared under 22 TAC §663.21, does not reflect the results of an on the ground survey, and is not to be used to convey or establish interests in real property except those rights and interests implied or established by the creation or reconfiguration of the boundary of the political subdivision for which it was prepared.

EXHIBIT C

PUBLIC IMPROVEMENTS

OWNER is responsible for the construction of the public improvements detailed below in conjunction with development of the Property, which specifically enumerated public improvements are the "Required Improvements" for this Agreement. Those public improvements required for each particular portion or phase of the Property then being developed, whether installed by the OWNER or a third party on behalf of the OWNER, must be complete and accepted by CITY prior to the issuance of a Final Acceptance letter for the Required Improvements. No Certificate of Occupancy shall be issued for any building on, about or in any phase of development of the Property until Final Acceptance of the public improvements necessary to serve that particular phase of development of the Property.

A. **THOROUGHFARES.** Construction of required thoroughfare improvements in conjunction with development of the Property includes paving, drainage, striping, street lighting, sidewalks, electrical and irrigation conduits, erosion control and all other necessary appurtenances thereto required for a complete installation pursuant to the CITY Code.

1. OWNER shall acquire, at no cost to CITY, all necessary right-of-way for and construct the on-site and off-site roadway improvements identified in the Traffic Impact Analysis ("TIA"), attached as Exhibit "D" to this Agreement, or as otherwise necessary to serve the portion or phase of the Property then being platted and developed, in the widths set forth on the CITY's Transportation Plan together with all appurtenances necessary thereto if such roadways and intersections, together with all necessary appurtenances thereto, have not been constructed prior to the filing of OWNER'S record plat.

2. OWNER shall construct, as part of the Public Improvements and at no cost to CITY, the following thoroughfare improvements identified in the TIA together with all appurtenances necessary thereto, concurrent with the development and platting of the adjacent portion(s) of the Property or as otherwise determined by the CITY Engineer to serve the Property if such roadways and intersections together with all necessary appurtenances thereto have not been constructed and accepted by the CITY prior to the filing of OWNER'S record plat:

   a. a westbound right turn lane on US 380 at its intersection with Custer Road (F.M. 2478); and

   b. separate north-bound and west-bound left turn lanes adjacent to the site at the intersection of Custer Road (F.M. 2478) and F.M. 1461.

Adjacent to the Property boundary, the OWNER shall construct through lanes at the intersection of Custer Road (F.M. 2478) and F.M. 1461 per the City Participation (Sec. 142-40) provision of the City's Subdivision Ordinance if improvements at this intersection have not been provided by others.

3. OWNER shall participate in the cost of installing the signal lights at the intersection of Custer Road (F.M. 2478) and F.M. 1461 when said signalization is warranted. OWNER's participation shall be thirty-five percent (35 %) of the cost of said signalization.

4. In conjunction with the improvements of Custer Road (by others), the OWNER shall dedicate, at no cost to CITY, all right-of-way necessary for the realignment of existing F.M. 2478 (Custer Road) to remove the offset of said roadway at and approaching F.M. 1461. OWNER shall also dedicate, at no cost to CITY, all easements necessary to construct the pubic infrastructure related to the realignment of F.M. 2478 including, but not limited to, construction easements, slope easements and drainage easements.

5. Prior to the issuance of the first building permit for development within the Property, OWNER shall update the attached TIA if conditions reflected in the current TIA do not match future conditions when the Property develops. The updated TIA shall reflect the traffic anticipated to be generated by such development and shall identify changes, if any, to on-site and off-site roadway improvements required to support the development of the Property. In such event the OWNER shall implement, at no cost to CITY, the new recommendations as well as and in addition to the improvements recommended in the current TIA.

6. OWNER shall acquire all necessary right-of-way for and construct the on-site and off-site roadway improvements identified in the current TIA and any updated TIA in the widths set forth on the CITY's Transportation Plan if such roadways and intersections, together with all necessary appurtenances thereto, have not been constructed prior to the filing of OWNER'S record plat.

7. Access for Prosper properties along the "existing" or "old" alignment of Custer Road (F.M. 2478) must be maintained with a connection of "existing" or "old" Custer Road (F.M. 2478) to the new alignment when constructed.

B. UTILITIES.

1. OWNER shall construct water and wastewater improvements in conjunction with the development and platting of the adjacent portion(s) of the Property as necessary to support development of that portion of the Property.

2. OWNER shall also construct in conjunction with development of the Property the following water lines in accordance with the CITY's Master Water Plan:

   a. a thirty-six inch (36") diameter water line along Custer Road; and

   b. a thirty inch (30") diameter water line along FM 1461.

3. OWNER shall, at the time of development and at no cost to the CITY, perform a water analysis to ensure that adequate flow is provided to the development. OWNER shall also verify the existence of and provide, at the time of development and at no cost to the CITY, at least two sources of water in the appropriate pressure plane for the development in accordance with the CITY's Master Water Plan.

4. The water lines constructed along Custer Road (F.M. 2478) shall be constructed outside of the future ROW and easements of the roadway within a separate water easement.

5. Sanitary sewer will be designed to drain to the appropriate basins in accordance with the CITY's Master Sewer Plan using gravity flow only.

EXHIBIT D

TRAFFIC IMPACT ANALYSIS

TRAFFIC IMPACT OVERVIEW

for

The Haggard Tract

at

FM 2478 / FM 1461

McKinney, Texas

Submitted to:

The City of McKinney

Prepared for:

Double H Realty Services

Prepared by:

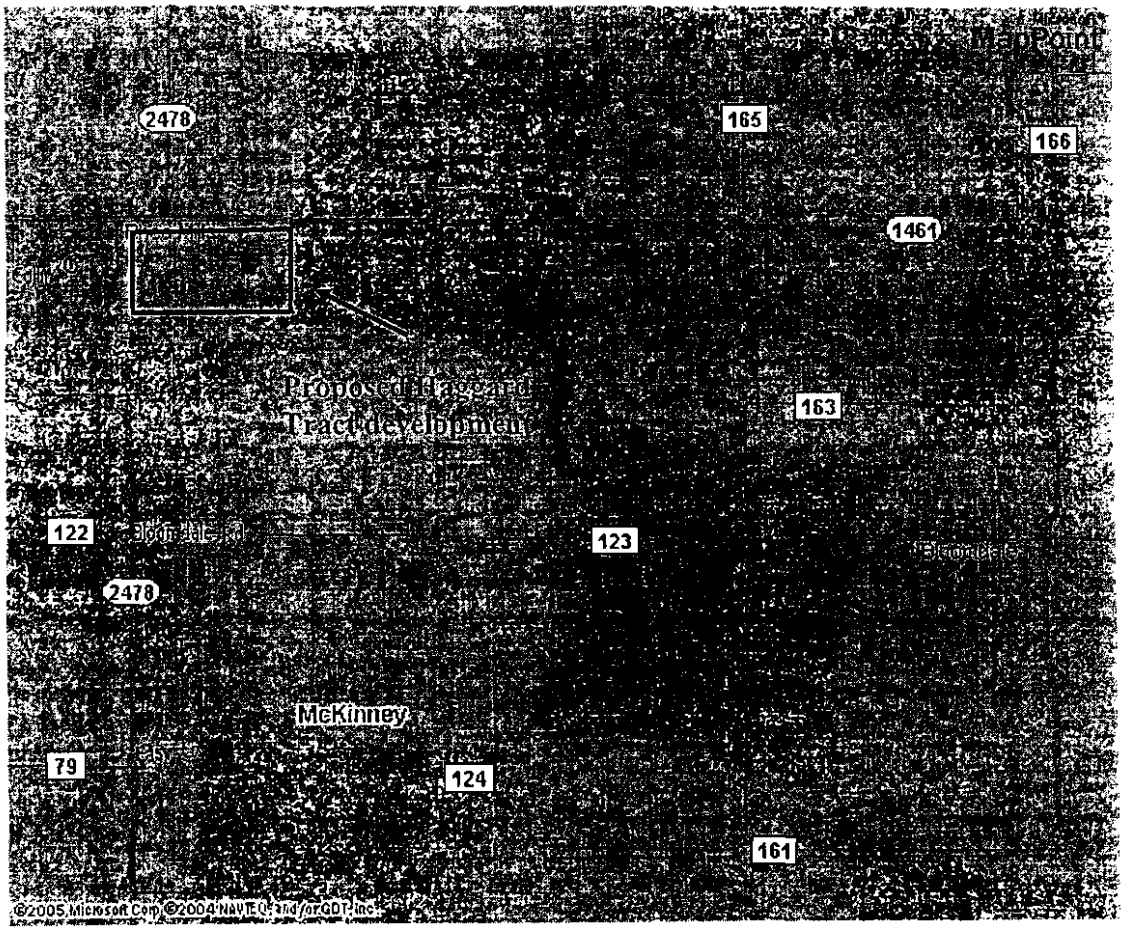
Innovative Transportation Solutions, Inc.
2701 Valley View Lane
Farmers Branch, Texas 75234

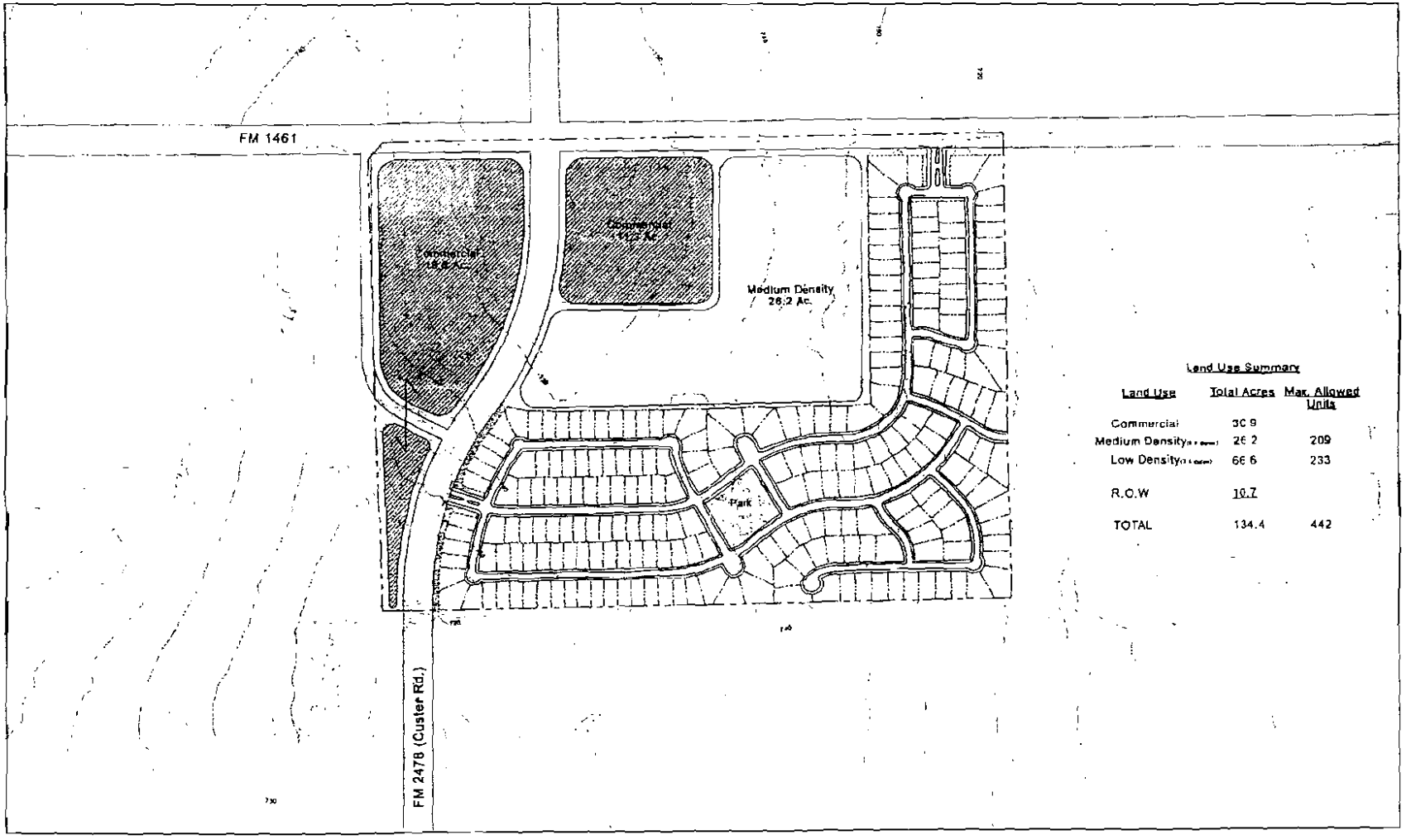
August 2005

I. INTRODUCTION

Innovative Transportation Solutions, Inc. (ITS) conducted a Traffic Impact Overview for the proposed Haggard Tract development, located at the southeast corner of the FM 2478 (Custer Road) FM 1461 intersection in McKinney, Texas (refer to **Figure 1 – Area Map**). A conceptual site plan for the proposed development has been prepared and is provided as **Figure 2**.

FIGURE 1
Area Map





Land Use Summary

Land Use	Total Acres	Max. Allowed Units
Commercial	30.9	
Medium Density	26.2	209
Low Density	66.6	233
R.O.W	10.7	
TOTAL	134.4	442

HAGGARD TRACT

GENERAL DEVELOPMENT PLAN- 134.4 Acres in Collin County, Texas

DECEMBER 14, 2004

Prepared By:
HUITT-ZOLLARS
Dallas

Figure 2
Site Plan

II. PURPOSE AND METHODOLOGY OF STUDY

ITS conducted a Traffic Impact Overview for the proposed Haggard Tract development at the request of the City of McKinney. The study focuses on the projected operations of the following major intersections:

- FM 2478 (Custer Road) at FM 1461
- US 380 at FM 2478 (Custer Road)

The study also focuses on the link capacity FM 2478 (Custer Road).

ITS used standard transportation engineering practices in conducting the traffic impact overview for the proposed development. ITS conducted AM (7:00 – 9:00 am) and PM (4:00 – 6:00 pm) peak period turning movement counts at the FM 1461 intersections with FM 2478 (Custer Road) on Tuesday – Thursday, February 15 – 17, 2005. ITS acquired a peak period turning movement traffic count at the US 380 / FM 2478 (Custer Road) intersection from the City of McKinney. (This count was conducted on Tuesday, March 2, 2004.) ITS conducted a 24-hour directional traffic count on FM 2478 just south of FM 1461 on Tuesday, February 22, 2205. ITS also acquired from the Texas Department of Transportation (TxDOT) 2002 traffic count map a traffic volume on FM 2478 just north of US 380.

Background traffic volumes were estimated by applying a five (5) percent annual growth rate, based on information provided by the City of McKinney, to the existing traffic volumes at the study intersections.

ITS then generated trips for the proposed development, assuming full build out of the residential portion of the development. Current plans, which are preliminary, include 233 single-family residential lots and 209 condominium / townhouse units. ITS utilized data from the *Institute of Transportation Engineers' Trip Generation Manual, 7th Edition*, to generate trips for the proposed development. The proposed development plan includes potential commercial development; for this study, only the residential component of the development was analyzed.

The trips were distributed at the two (2) major intersections identified by the City (US 380 at FM 2478, FM 1461 at FM 2478). The trips were then added to the background traffic volumes at the aforementioned intersections to give an estimate of the total traffic volumes at the study intersections.

ITS conducted peak hour intersection analyses for two (2) scenarios. Since the development straddles the future realignment of FM 2478, both scenarios assume FM 2478 is realigned to remove the existing offset intersections at FM 1461. The first scenario, designated **Case 1**, is for the year 2007, assuming build out of the residential portion of the development and assuming two (2) lanes of FM 2478 are in place from FM 1461 to US 380. **Case 2** examines the year 2009, and assumes FM 2478 (Custer Road) is

improved to a four-lane divided road. Further explanation on the study assumptions will be given later in the report.

For purposes of this report, ITS, the developer, and the City of McKinney agreed to examine the 2007 and 2009 study years with the residential component of the development fully built out.

Based on the results of the peak hour intersection and link analyses, ITS developed a set of improvements that would accommodate the traffic related to the residential component of the proposed Double H development.

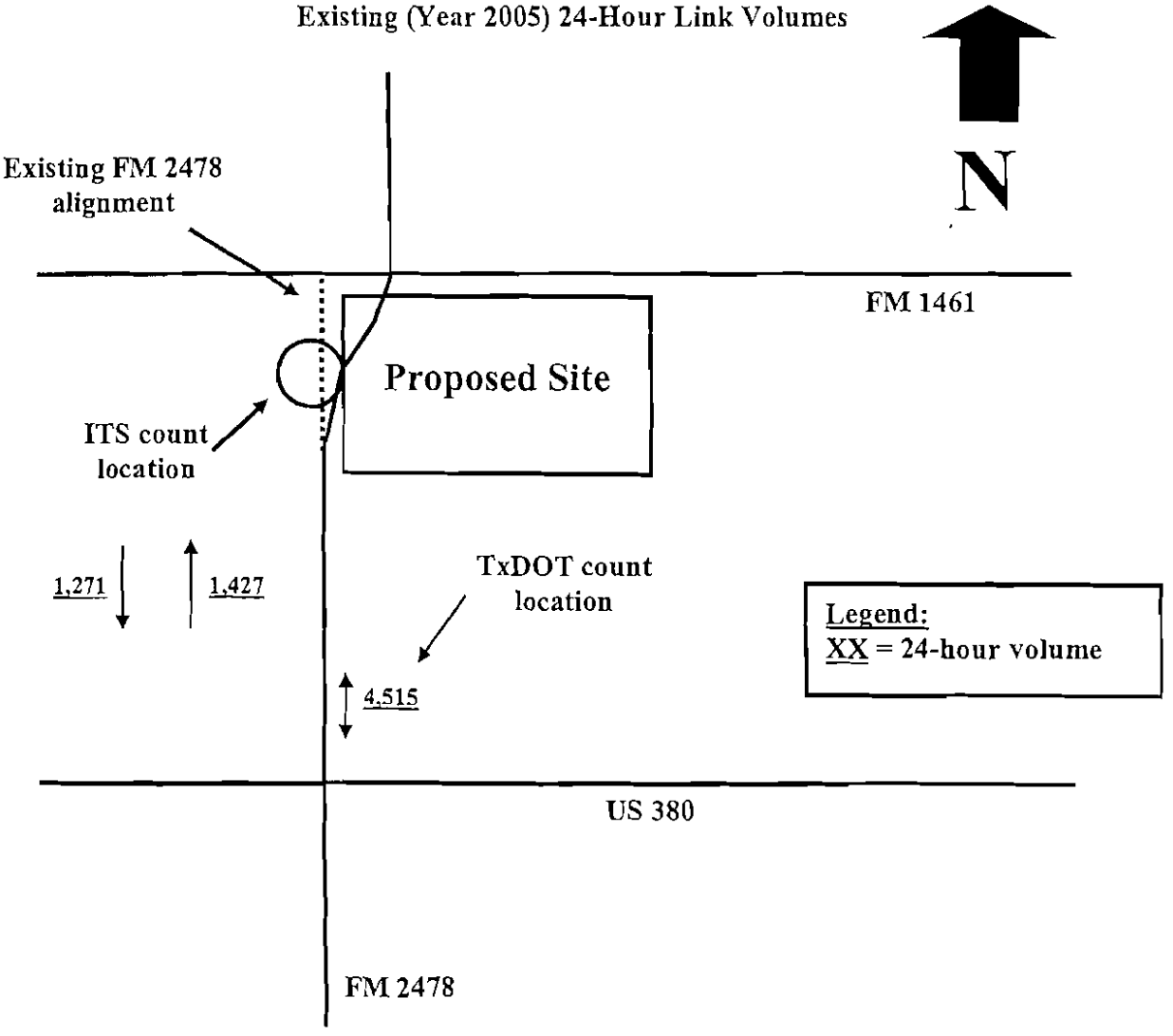
III. EXISTING TRAFFIC PATTERNS

ITS conducted AM and PM peak hour turning movement traffic counts at FM 2478 (Custer Road) / FM 1461 intersections on Tuesday – Thursday, February 15 – 17, 2005. An AM and PM peak hour turning movement traffic count at the US 380 / FM 2478 (Custer Road) intersection was acquired from the City of McKinney (this count was conducted on Tuesday, March 4, 2004). In order to estimate the existing (year 2005) traffic volumes at the US 380 / FM 2478 (Custer Road) intersection ITS applied a five (5) percent annual growth rate, provided by the City of McKinney, to the year 2004 volumes.

ITS conducted a 24-hour directional traffic count on FM 2478 just south of FM 1461 on Tuesday, February 22, 2005. ITS also acquired from the TxDOT 2002 traffic count map a traffic volume for FM 2478 just north of US 380. In order to estimate the existing (year 2005) traffic volumes at this location, ITS applied a five (5) percent annual growth rate, provided by the City of McKinney, to the year 2005 volumes.

The traffic count data may be found in the Appendix. The existing (year 2005) AM and PM peak hour turning movement traffic volumes at the three (3) existing study intersections are shown in **Figures 3 and 4** in the Appendix. The existing (year 2005) link volumes along FM 2478 are shown in **Figure 5.** (Note: the traffic volumes shown on TxDOT's traffic count maps are total volumes, not directional counts)

FIGURE 5
Existing (Year 2005) 24-Hour Link Volumes



IV. LAND USES AND TRIP GENERATION

As previously mentioned, the land use for the residential component of the proposed development includes the following, as shown in **Table 1**.

TABLE 1
Land Use and Density of Proposed Development Expansion

Land Use	ITE Code	Density
Single-Family Detached Housing	210	233 lots
Condo / Townhouse	230	209 units

Traffic projections for the respective land uses outlined in **Table 1** were prepared based upon historical data provided in the *Institute of Transportation Engineers' Trip Generation Manual, 7th Edition*. **Table 2** shows the projected trip generation for the residential component of the proposed development at build out. ITS generated trips for the the AM and PM peak hours and for the typical 24-hour weekday period.

TABLE 2
Estimated Site-Generated One-Way Trips

Land Use (density)	AM Peak Hour of Adjacent Street Traffic			PM Peak Hour of Adjacent Street Traffic			24-Hour
	In	Out	Total	In	Out	Total	Total
Single-Family Detached Housing (233 lots)	43	130	173	145	85	230	2,264
Condo / Townhouse (209 units)	16	77	93	74	36	110	1,202
Total	59	207	266	219	121	340	3,466

V. SITE-GENERATED TRAFFIC DISTRIBUTIONS

Trip distribution for the proposed development was determined based upon the existing traffic patterns in the area. The general trip distribution assumptions are as follows:

- To / from the east via US 380 – 40%
- To / from the west via US 380 – 25%
- To / from the west via FM 1461 – 10%
- To / from the south via FM 2478 (Custer Road) – 20%
- To / from the north via FM 2478 (Custer Road) – 5%

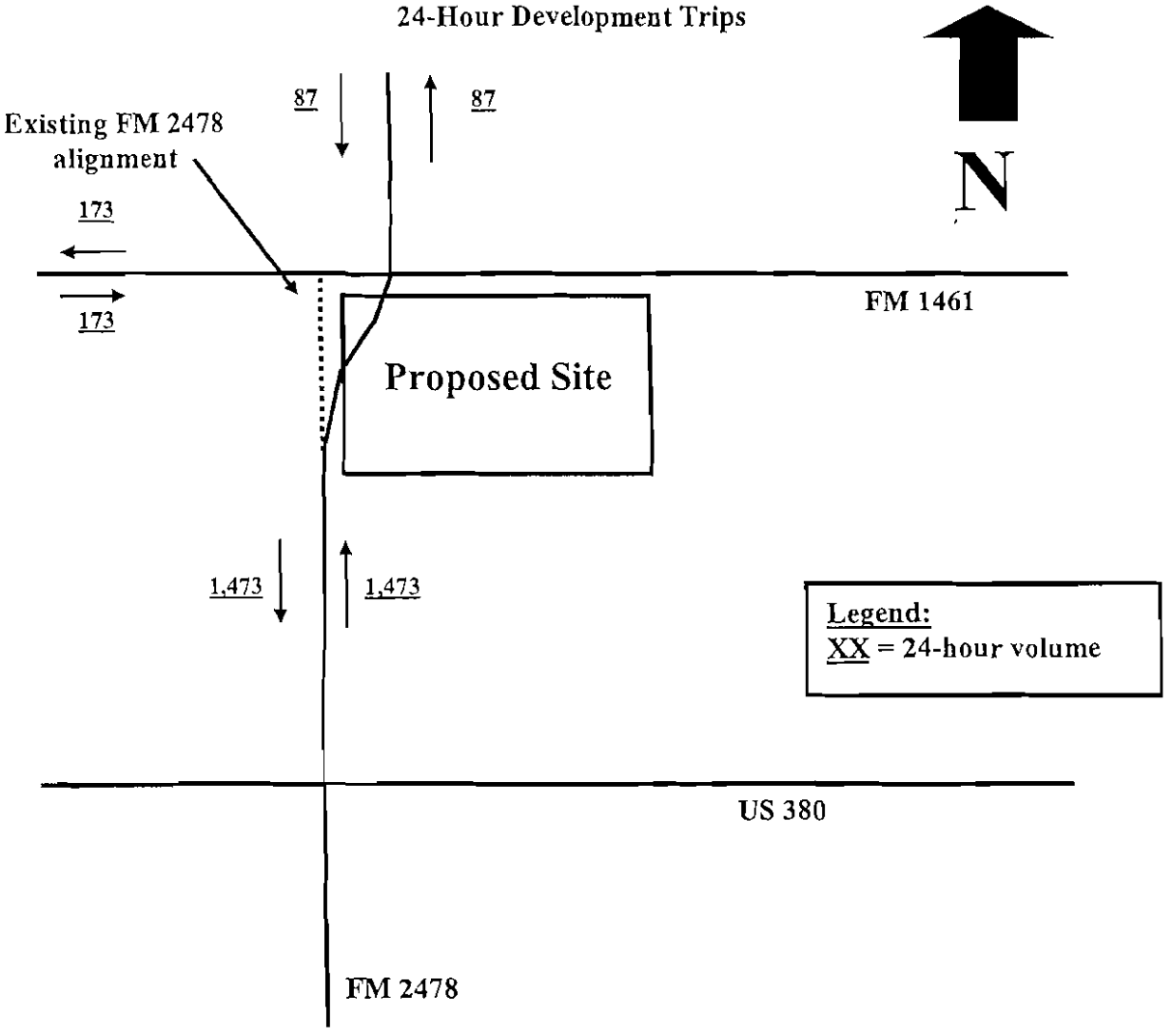
Based on information provided by the City of McKinney, FM 1461 is at or above capacity at the intersection with US 380 with existing traffic and near-term development. Because of this information, ITS chose not to route any of the trips from the Double H development along this section of FM 1461. (Because of the development's location at the intersection of FM 2478 and FM 1461 it is likely that few vehicles from the development would use FM 1461 to access the site to / from US 380.)

VI. SITE-GENERATED TRAFFIC ASSIGNMENTS

ITS distributed the AM and PM peak hour development trips at the study intersections utilizing the trip distribution percentages shown above. **Figures 6 and 7** in the Appendix show the AM and PM peak hour generated trips distributed at the study intersections for both **Case 1**, which assumes FM 2478 (Custer Road) is a two-lane road, and **Case 2**, which assumes FM 2478 is improved to a four-lane divided road between FM 1461 and US 380. (Since the development straddles the ultimate alignment of FM 2478 at FM 1461, ITS assumed the realignment of FM 2478 would be constructed as part of the Double H development.)

ITS also distributed the 24-hour development trips along FM 2478. These volumes are shown in **Figure 8**.

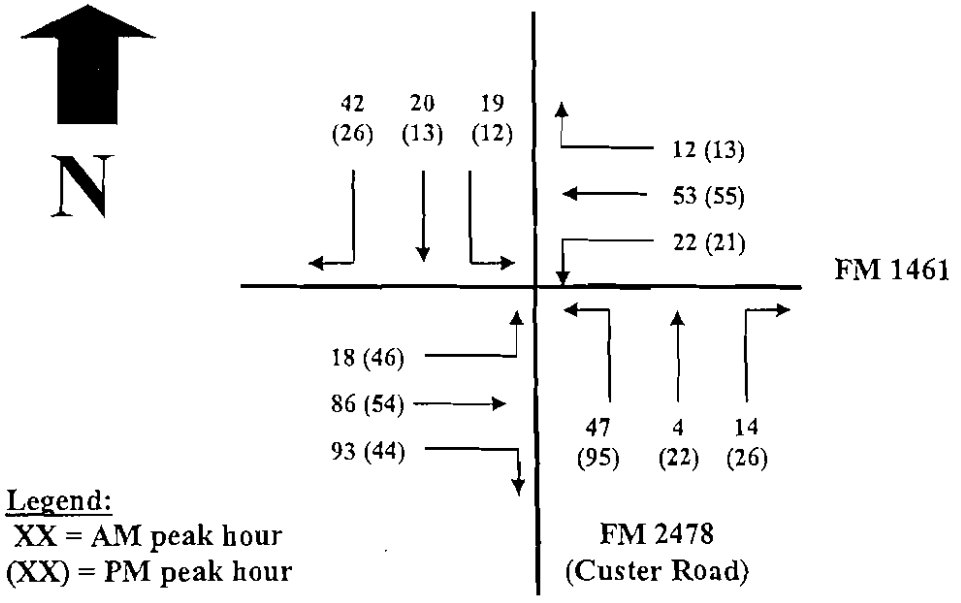
FIGURE 8
24-Hour Development Trips



VII. PROJECTED INTERSECTION VOLUMES

In order to estimate the background traffic volumes at the study intersections, ITS first modified the existing traffic volumes at the FM 2478 (Custer Road) intersections with FM 1461, assuming FM 2478 (Custer Road) has been realigned to remove the offset between the north and south legs, forming a typical four-leg intersection. The modified 2005 peak hour volumes at the intersection are shown in **Figure 9** below.

FIGURE 9
Modified 2005 Traffic Volumes
FM 1461 / realigned FM 2478 (Custer Road)



ITS increased the existing (year 2005) traffic volumes (shown in **Figures 3 and 4** for the US 380 intersection with FM 2478, and in **Figure 9** for the realigned FM 1461 / FM 2478 intersection) by a five (5) percent annual growth factor (provided by the City of McKinney). The **Case 1** (year 2007) background traffic volumes at the study intersections are shown in **Figures 10 and 11** in the Appendix. The **Case 2** (year 2009) background traffic volumes at the study intersections are shown in **Figures 12 and 13** in the Appendix.

ITS then added the development trips (**Figures 6 and 7**) to the **Case 1** (year 2007) and **Case 2** (year 2009) background traffic volumes (**Figures 10 - 13**) in order to estimate the total traffic volumes at the study intersections. These projected volumes are shown in **Figures 14 - 17** in the Appendix.

VIII. PROJECTED LINK VOLUMES

In order to estimate the background traffic volumes along FM 2478, ITS increased the existing (year 2005) volumes by a five (5) percent annual growth rate for two (2) and four (4) years, respectively. This gives the estimated background traffic volumes for the **Case 1** (year 2007) and **Case 2** (year 2009) scenarios. These volumes are shown in **Figures 18 and 19**.

FIGURE 18
Case 1 (Year 2007) Background Link Volumes

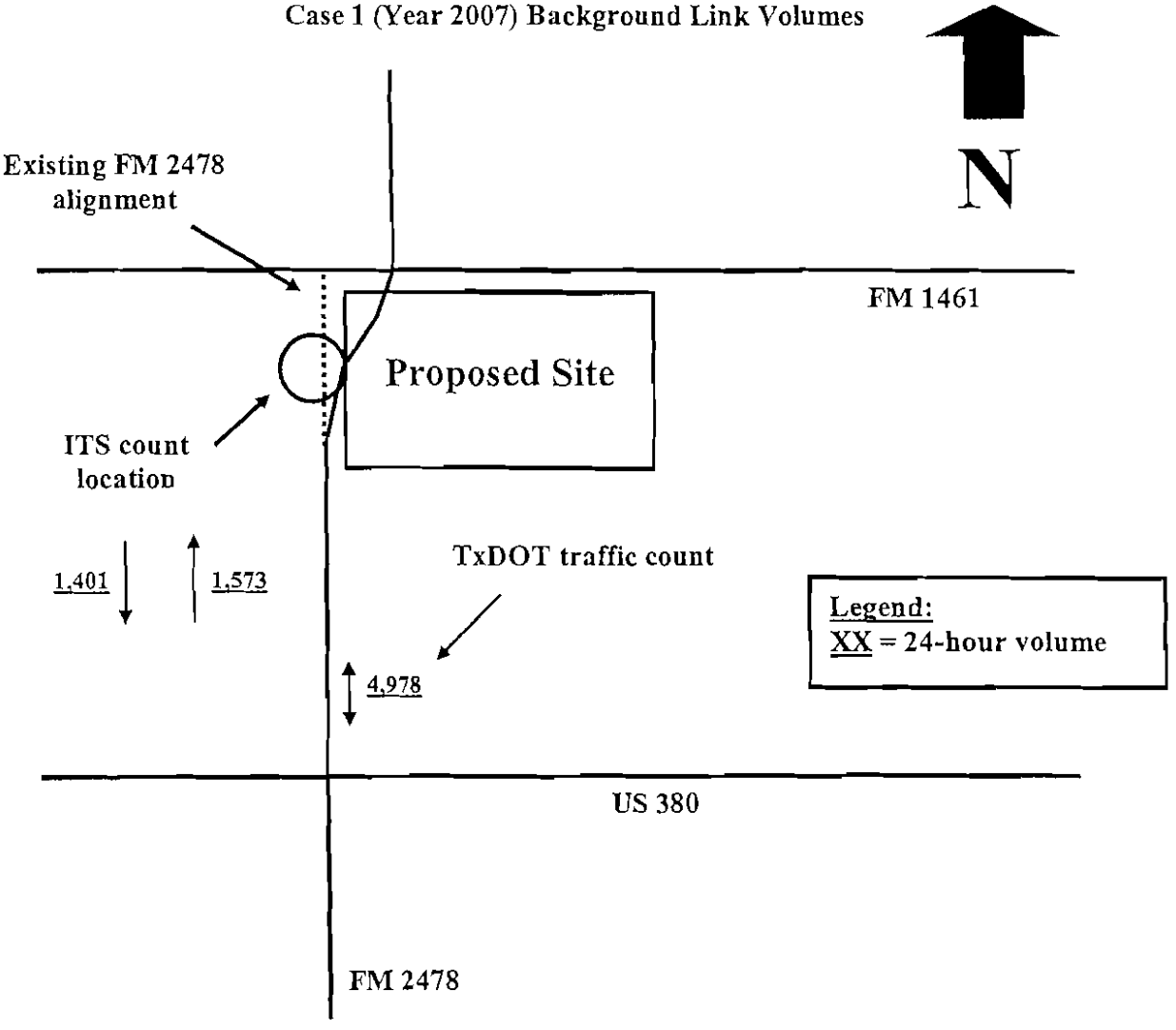
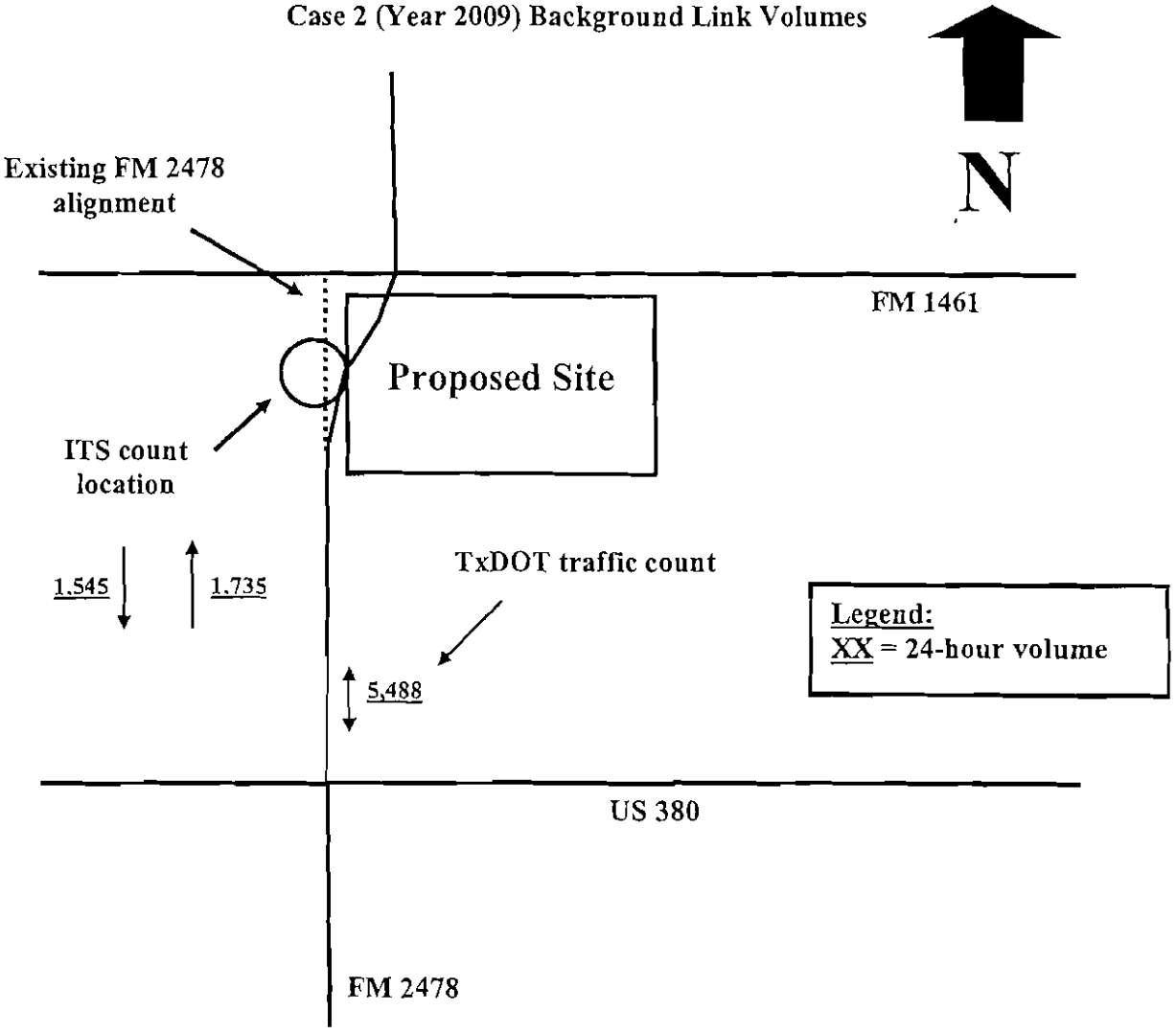


FIGURE 19
Case 2 (Year 2009) Background Link Volumes



ITS then added the development generated trips (**Figure 8**) to the **Case 1** (year 2007) and **Case 2** (year 2009) background traffic volumes (**Figures 18 – 19**) to estimate the total traffic volumes for the two analysis scenarios. These volumes are shown in **Figures 20 – 21**.

FIGURE 20
Case 1 (Year 2007) Total Link Volumes

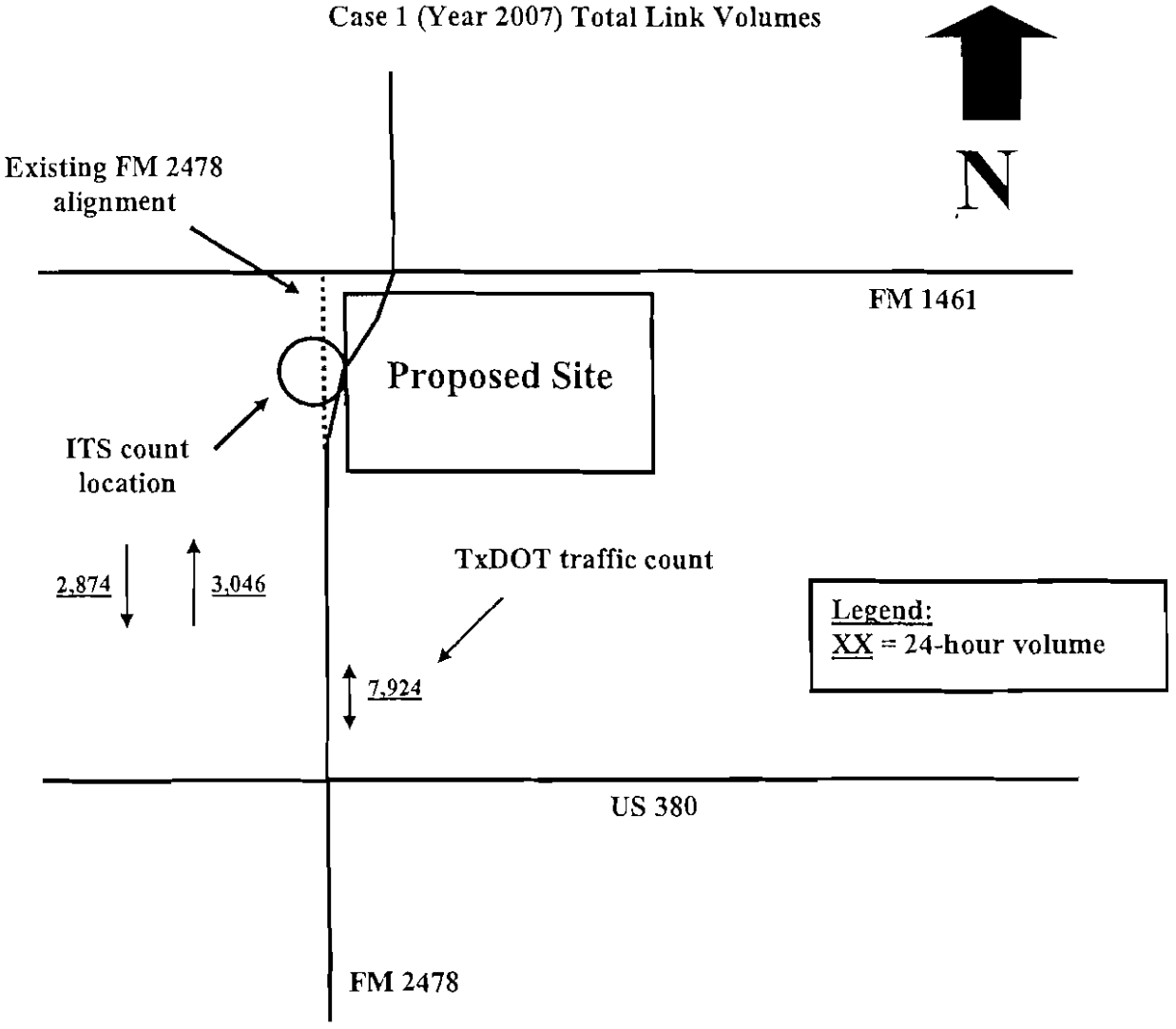
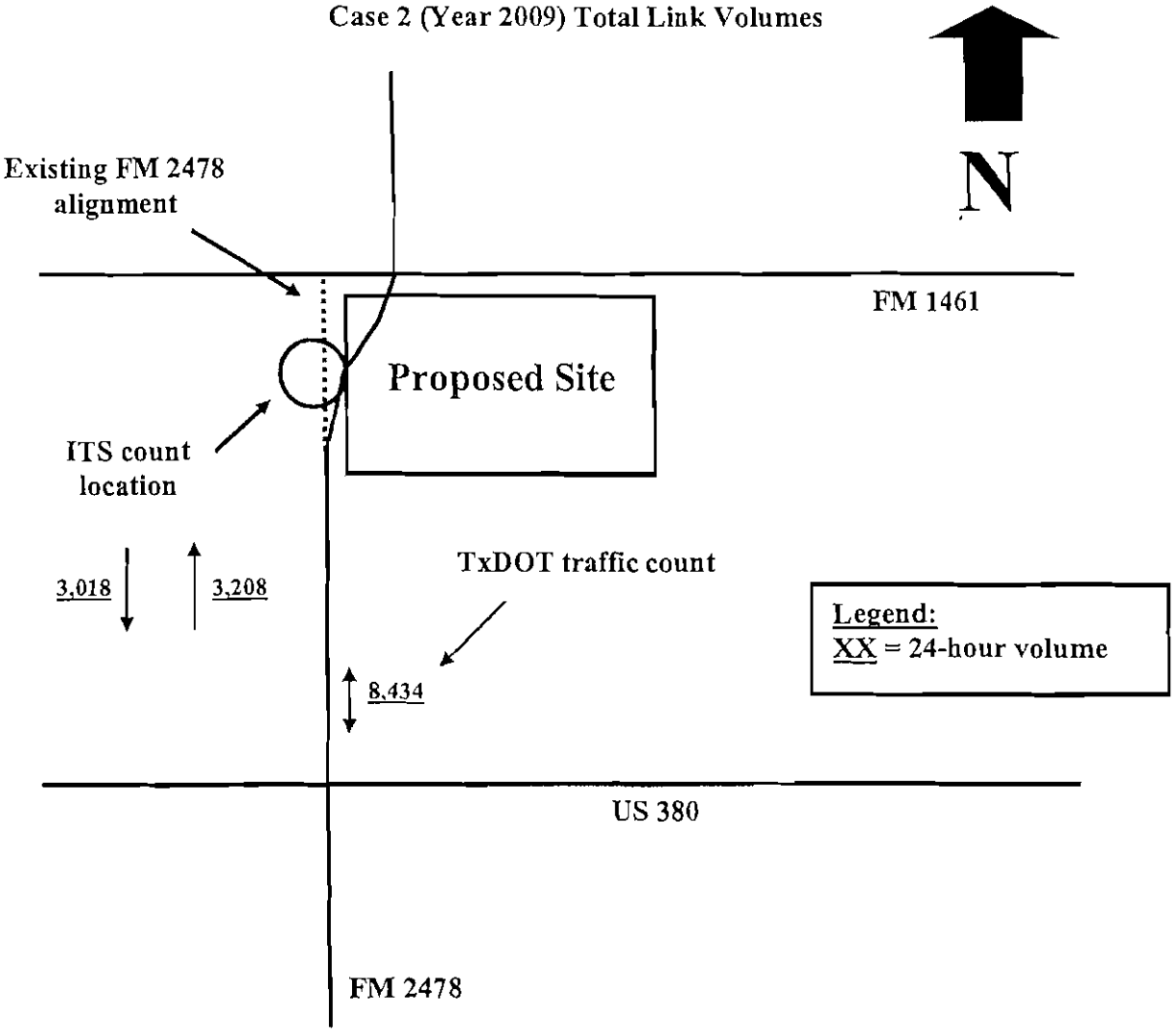


FIGURE 21
Case 2 (Year 2009) Total Link Volumes



IX. INTERSECTION ANALYSES

Analysis Scenarios

ITS conducted AM and PM peak hour (7:00 – 8:00 am, 5:00 – 6:00 pm) intersection analyses for the following scenarios:

- Existing (year 2005) traffic volumes
- **Case 1** (year 2007) background volumes (year 2005 volumes plus 5% annual growth)
- **Case 1** (year 2007) total volumes (**Case 1** background volumes plus development generated trips)
- **Case 2** (year 2009) background volumes (year 2005 volumes plus 5% annual growth)
- **Case 2** (year 2009) total volumes (**Case 2** background volumes plus development generated trips)

Intersection Geometrics

The existing (year 2005) analyses were conducted assuming existing geometrics and traffic control at the study intersections, as shown below:

US 380 / FM 2478 (Custer Road)

- Northbound – shared left turn / through / right turn lane (one lane approach)
- Southbound – shared left turn / through / right turn lane (one lane approach)
- Eastbound – left turn lane, two through lanes, right turn lane* (four lane approach)
- Westbound – left turn lane, two through lanes, right turn lane* (four lane approach)
- Signalized intersection
- * existing 10-foot shoulders along both sides of US 380 act as defacto right turn lanes, even though they are not explicitly marked as such

FM 1461 / FM 2478 (Custer Road) south leg

- Northbound – shared left turn / right turn lane (one lane approach)
- Eastbound – shared through / right turn lane (one lane approach)
- Westbound – shared left turn / through lane (one lane approach)
- Two-way stop-control - northbound FM 2478 (Custer Road) is stopped at FM 1461

FM 1461 / FM 2478 (Custer Road) north leg

- Southbound – shared left turn / right turn lane (one lane approach)
- Eastbound – shared left turn / through lane (one lane approach)
- Westbound – shared through / right turn lane (one lane approach)
- Two-way stop-control - southbound FM 2478 (Custer Road) is stopped at FM 1461

For the **Case 1** (year 2007) analyses, ITS assumed that FM 2478 (Custer Road) would be realigned at FM 1461, forming a typical four-leg intersection. ITS assumed that the realigned portion of FM 2478 would be a two-lane undivided cross-section, and that all four (4) approaches at the improved FM 2478 / FM 1461 intersection would have dedicated left turn lanes (two-lane approaches). ITS also assumed the intersection would be signalized. ITS assumed no improvements to the US 380 / FM 2478 intersection would be in place for the **Case 1** (year 2007) scenario, nor would FM 2478 be widened.

For the **Case 2** (year 2009) analyses, ITS assumed that FM 2478 (Custer Road) would be realigned at FM 1461, forming a typical four-leg intersection. ITS also assumed that FM 2478 (Custer Road) would be improved to four-lane divided cross-section between FM 1461 and US 380. For both major study intersections (US 380 at FM 2478, FM 1461 at FM 2478), ITS assumed the following geometrics and traffic control for the **Case 2** (year 2009) analyses:

Both Study Intersections

- Northbound – left turn lane, two through lanes, right turn lane (four lane approach)
- Southbound – left turn lane, two through lanes, right turn lane (four lane approach)
- Eastbound – left turn lane, two through lanes, right turn lane (four lane approach)
- Westbound – left turn lane, two through lanes, right turn lane (four lane approach)
- Signalized intersection

Results of the peak hour intersection analyses were generated using standard procedures outlined in the Highway Capacity Manual (HCM) through the use of the Synchro software package. For reference, all Synchro output / worksheets are provided in the Appendix. Level-of-Service (LOS) and delay have been set by the nation's transportation officials based upon the amount of delay motorists will tolerate before reaching various degrees of frustration. The LOS criteria for unsignalized intersections may be found in **Table 3**. The LOS criteria for signalized intersections may be found in **Table 4**.

TABLE 3
Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Description	Average Stopped Delay (seconds per vehicle)
A	Completely free-flow conditions	≤ 10.0
B	Indicative of free-flow conditions, although the presence of other vehicles is noticeable	> 10.0 and ≤ 15.0
C	A range in which the influence of traffic density on operations becomes marked	> 15.0 and ≤ 25.0
D	A range in which the ability to maneuver is severely restricted due to congestion	> 25.0 and ≤ 35.0
E	Operations are at or near capacity and are unstable	> 35.0 and ≤ 50.0
F	Forced flow or breakdown characterized by queues	> 50.0

TABLE 4
Level-of-Service Criteria for Signalized Intersections

Level of Service	Description	Average Stopped Delay (seconds per vehicle)
A and B	No delays at intersection with smooth progression of traffic. Uncongested operations; all vehicles clear in a single signal cycle.	≤ 10.0 > 10.0 and ≤ 20.0
C	Moderate delays at intersections with satisfactory to good progression of traffic. Light congestion; occasional backups on critical approaches.	> 20.0 and ≤ 35.0
D	40-percent probability of delays of one cycle or more at every intersection. No progression of traffic along the roadway with 90 percent probability of being stopped at every intersection experiencing "D" condition. Significant congestion on eritical approaches, but intersections are functional. Vehicles required to wait through more than one cycle during short peaks. No long standing lines formed.	> 35.0 and ≤ 55.0
E	Heavy traffic flow condition. Delays of two or more cycles are probable. No progression. 100 percent probability of stopping at intersection. Blockage of intersection may occur if traffic signal does not provide for protected turning movements.	> 55.0 and ≤ 75.0
F	Unstable flow. Heavy congestion. Traffic moves in forced flow condition. Three or more cycles to pass through intersection. Total breakdown with stop-and-go operations.	> 75.0

Existing (Year 2005) Conditions

Tables 5 – 7 show the results of the existing (year 2005) intersection analyses for the study intersections.

TABLE 5
Existing (Year 2005) Volumes
US 380 / FM 2478 (Custer Road) intersection
Signalized Intersection Analysis

Approach and Movement	EXISTING (2005) AM (PM) Delay (sec/veh)	LOS
Eastbound		
Left	14.2 (21.7)	B (C)
Thru	24.0 (35.4)	C (D)
Right	13.7 (18.5)	B (B)
Westbound		
Left	24.6 (27.2)	C (C)
Thru	24.2 (20.1)	C (C)
Right	13.4 (12.7)	B (B)
Northbound		
Left/Thru/Right	21.4 (30.2)	C (C)
Southbound		
Left/Thru/Right	143.4 (26.1)	B (C)
Intersection	22.1 (26.9)	C (C)

As shown in **Table 5**, above, the signalized US 380 intersection with FM 2478 (Custer Road) currently operates at an acceptable overall LOS C during both peak periods.

TABLE 6
Existing (Year 2005) Volumes
FM 1461 / FM 2478 (Custer Road) South Leg Intersection
Unsignalized Intersection Analysis

Approach and Movement	EXISTING (2005) AM (PM) Delay (sec/veh)	LOS
Westbound		
Left/Thru	2.6 (2.4)	A (A)
Northbound		
Left/Right	10.9 (11.1)	B (B)

TABLE 7
Existing (Year 2005) Volumes
FM 1461 / FM 2478 (Custer Road) North Leg Intersection
Unsignalized Intersection Analysis

Approach and Movement	EXISTING (2005) AM (PM) Delay (sec/veh)	LOS
Eastbound		
Left/Thru	1.4 (3.6)	A (A)
Southbound		
Left/Right	9.4 (9.4)	A (A)

As shown in **Tables 6 and 7**, above, the minor movements at the FM 1461 intersections with FM 2478 (Custer Road) currently operate at an acceptable LOS (LOS B or better) during both the AM and PM peak hours.

Case 1 (Year 2007) Conditions

Tables 8 – 9 show the results of the **Case 1** (year 2007) intersection analyses (background and total) for the study intersections.

TABLE 8
Case 1 (Year 2007) Volumes
US 380 / FM 2478 (Custer Road) intersection
Signalized Intersection Analysis

Approach and Movement	CASE 1 (YEAR 2007) BACKGROUND		CASE 1 (YEAR 2007) TOTAL	
	AM (PM)		AM (PM)	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	14.4 (21.4)	B (C)	15.1 (26.5)	B (C)
Thru	26.2 (37.9)	C (D)	26.2 (37.9)	C (D)
Right	13.8 (18.0)	B (B)	13.8 (18.0)	B (B)
Westbound				
Left	27.3 (33.4)	C (C)	27.3 (33.4)	C (C)
Thru	26.4 (20.9)	C (C)	26.4 (20.9)	C (C)
Right	13.5 (12.8)	B (B)	13.6 (13.3)	B (B)
Northbound				
Left/Thru/Right	25.2 (35.6)	C (D)	31.3 (43.6)	C (D)
Southbound				
Left/Thru/Right	15.3 (27.8)	B (C)	27.1 (38.7)	C (D)
Intersection	24.3 (29.2)	C (C)	26.5 (30.9)	C (C)

TABLE 9
Case 1 (Year 2007) Volumes
FM 1461 / FM 2478 (Custer Road) intersection
Signalized Intersection Analysis

Approach and Movement	CASE 1 (YEAR 2007) BACKGROUND		CASE 1 (YEAR 2007) TOTAL	
	AM (PM)		AM (PM)	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	9.3 (9.8)	A (A)	9.4 (9.8)	A (A)
Thru/Right	10.5 (9.9)	B (A)	10.6 (10.0)	B (B)
Westbound				
Left	9.5 (9.4)	A (A)	9.5 (9.4)	A (A)
Thru/Right	9.6 (9.7)	A (A)	9.8 (9.8)	A (A)
Northbound				
Left	12.6 (12.0)	B (B)	11.8 (12.1)	B (B)
Thru/Right	12.5 (10.6)	B (B)	10.8 (10.6)	B (B)
Southbound				
Left	10.5 (10.4)	B (B)	10.5 (10.5)	B (B)
Thru/Right	10.7 (10.5)	B (B)	10.7 (10.5)	B (B)
Intersection	10.6 (10.4)	B (B)	10.5 (10.5)	B (B)

As shown in **Tables 8 and 9** above, the proposed development is projected to have very little impact to the study intersections in the year 2007 **(Case 1)** scenario. The overall LOS for both intersections does not change from the background to total volume

scenarios. In addition, all movements at both intersections are projected to operate at acceptable LOS D or better for both peak periods.

Case 2 (Year 2009) Conditions

As previously mentioned, the **Case 2** (year 2009) analyses assume FM 2478 (Custer Road) is improved to a four-lane divided road (through projects by TxDOT, the City of McKinney, and / or others) between US 380 and FM 1461. For ITS' **Case 2** (year 2009) analyses, all approaches at both study intersections were assumed to be improved to provide the following geometrics:

- Left turn only lane
- Two (2) through lanes
- Right turn only lane

As with the **Case 1** (year 2007) scenario, the FM 2478 / FM 1461 intersection was assumed to be signalized for the **Case 2** (year 2009) analysis scenario.

Tables 10 – 11 show the results of the **Case 2** (year 2009) intersection analyses (background and total) for the study intersections.

TABLE 10
Case 2 (Year 2009) Volumes
US 380 / FM 2478 (Custer Road) intersection
Signalized Intersection Analysis

Approach and Movement	CASE 2 (YEAR 2009) BACKGROUND		CASE 2 (YEAR 2009) TOTAL	
	AM (PM)		AM (PM)	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	13.6 (18.5)	B (B)	14.3 (18.4)	B (B)
Thru	26.4 (32.9)	C (C)	26.4 (32.9)	C (C)
Right	16.1 (19.6)	B (B)	16.1 (19.6)	B (B)
Westbound				
Left	20.1 (31.1)	C (C)	20.1 (31.1)	C (C)
Thru	22.1 (16.1)	C (B)	22.1 (19.3)	C (B)
Right	14.2 (11.3)	B (B)	14.3 (14.0)	B (B)
Northbound				
Left	18.4 (33.7)	B (C)	18.8 (34.0)	B (C)
Thru	15.7 (30.2)	B (C)	15.8 (30.9)	B (C)
Right	16.8 (30.1)	B (C)	16.8 (30.1)	B (C)
Southbound				
Left	14.0 (28.6)	B (C)	17.0 (31.8)	B (C)
Thru	15.6 (29.9)	B (C)	16.6 (30.3)	B (C)
Right	14.5 (29.0)	B (C)	16.4 (29.3)	B (C)
Intersection	21.2 (25.6)	C (C)	21.0 (26.4)	C (C)

TABLE 11
Case 2 (Year 2009) Volumes
FM 1461/ FM 2478 (Custer Road) intersection
Signalized Intersection Analysis

Approach and Movement	CASE 2 (YEAR 2009) BACKGROUND		CASE 2 (YEAR 2009) TOTAL	
	AM (PM)		AM (PM)	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Eastbound				
Left	12.4 (14.4)	B (B)	12.4 (14.4)	B (B)
Thru	16.2 (16.6)	B (B)	16.2 (16.7)	B (B)
Right	16.1 (16.5)	B (B)	16.1 (16.5)	B (B)
Westbound				
Left	12.4 (13.8)	B (B)	12.5 (13.8)	B (B)
Thru	15.9 (16.6)	B (B)	15.9 (16.7)	B (B)
Right	15.5 (16.2)	B (B)	15.5 (16.3)	B (B)
Northbound				
Left	17.5 (11.8)	B (B)	15.7 (11.9)	B (B)
Thru	19.4 (13.5)	B (B)	17.9 (13.5)	B (B)
Right	26.7 (13.5)	C (B)	23.0 (13.5)	C (B)
Southbound				
Left	12.4 (11.6)	B (B)	12.4 (11.7)	B (B)
Thru	15.6 (14.1)	B (B)	15.6 (14.1)	B (B)
Right	15.7 (14.2)	B (B)	15.7 (14.2)	B (B)
Intersection	16.0 (14.4)	B (B)	15.7 (14.5)	B (B)

The results of the **Case 2** (year 2009) analyses, as shown in **Tables 14 – 16**, indicate that with the study intersections improved to provide four-lane approaches in each direction (left turn lane, two through lanes, right turn lane), both intersections will operate at acceptable overall LOS (LOS C or better) during both peak periods with the residential component of the proposed development fully built out. In addition, the analysis results indicate the proposed development will have very little impact on the study intersections. The LOS of each movement at both intersections is projected to remain the same in the background and total volume scenarios.

X. LINK ANALYSES along FM 2478 (Custer Road)

FM 2478 (Custer Road) is currently a two-lane undivided road with a posted speed limit of 50 miles per hour (mph) between US 380 and FM 1461. ITS estimates the capacity of FM 2478 in its current condition at approximately 10,000 vehicles ped day (vpd). Using the City of McKinney's standard of level-of-service (LOS) D operation, the acceptable capacity of FM 2478 is currently 8,000 vpd.

Existing (Year 2005) Volumes

As previously mentioned, ITS conducted a traffic count on FM 2478 just south of FM 1461 in February 2005. ITS also acquired a TxDOT year 2002 traffic count on FM 2478 just north of US 380 and increased this volume by a five (5) percent annual growth rate to give the estimated year 2005 traffic volume. These volumes, and the corresponding LOS, are:

- Just south of FM 1461 = 2,698 vpd – LOS B
- Just north of US 380 = 4,515 vpd – LOS C

Case 1 (Year 2007) Volumes

For purposes of this report, ITS assumed in the year 2007 the residential component of the proposed development would be fully built out, FM 2478 would be realigned through the development to remove the existing offset intersections at FM 1461, but would not be widened from its existing two-lane undivided cross-section. Thus the "allowable capacity," based on City of McKinney standards, would remain 8,000 vpd (LOS D operation).

Case 1 (Year 2007) Background Volumes

The **Case 1** (Year 2007) background volumes along FM 2478 are:

- Just south of FM 1461 = 2,974 vpd – LOS B
- Just north of US 380 = 4,978 vpd – LOS C

Case 1 (Year 2007) Total Volumes

The **Case 1** (Year 2007) total volumes along FM 2478 are:

- Just south of FM 1461 = 5,920 vpd – LOS C
- Just north of US 380 = 7,924 vpd – LOS D

The results of the link analyses indicate there is adequate capacity on FM 2478 to accommodate full build out of the residential component of the proposed development in the year 2007 with no capacity improvements to the road. There is projected to be a surplus capacity of 2,080 vpd on the section just south of FM 1461 and 76 vpd on the section just north of US 380, based on the City's LOS D (8,000 vpd) standard.

Case 2 (Year 2009) Volumes

For the **Case 2** (Year 2009) scenario, ITS assumed FM 2478 would be improved to a four-lane divided cross-section between FM 1461 and US 380. This would increase the capacity of the road to approximately 28,000 vpd. At LOS D operation, this equates to an allowable daily volume of 22,400 vpd.

Case 2 (Year 2009) Background Volumes

The **Case 2** (Year 2009) background volumes along FM 2478 are:

- Just south of FM 1461 = 3,280 vpd – LOS A
- Just north of US 380 = 5,488 vpd – LOS B

Case 2 (Year 2009) Total Volumes

The **Case 2** (Year 2009) total volumes along FM 2478 are:

- Just south of FM 1461 = 6,226 vpd – LOS B
- Just north of US 380 = 8,434 vpd – LOS B

The results of the link analyses indicate that with FM 2478 improved to a four-lane divided road between FM 1461 and US 380 there is significant surplus capacity to accommodate background traffic plus development trips.

XI. SUMMARY

ITS conducted a Traffic Impact Overview for the proposed Haggard Tract development, to be located along the south side of FM 1461 at FM 2478 (Custer Road), at the request of the City of McKinney. The traffic study addressed the projected AM and PM peak hour operations at the following major intersections, as identified by the City of McKinney:

- US 380 / FM 2478 (Custer Road)
- FM 1461 / FM 2478 (Custer Road)

The traffic study also addresses link capacity along FM 2478.

ITS developed two (2) analysis scenarios for this project. The first scenario, **Case 1**, examines the operations of the intersections in the year 2007. This scenario assumed the residential component of the development, 233 single-family lots and 209 condo / townhouse units, was fully built out. In addition, FM 2478 was realigned at FM 1461 in order to form a typical four-leg intersection, removing the existing offset intersections. (This assumption was made because of the location of the proposed development, which straddles the ultimate FM 2478 alignment. ITS assumed the realigned section of FM 2478 would be constructed before or during construction of the development.) The intersection would be signalized, with each approach having a dedicated left turn lane and a shared through / right turn lane (two-lane approach). No improvements were assumed for the US 380 / FM 2478 intersection or along FM 2478 (the road remains a two-lane undivided road between US 380 and FM 1461).

The second scenario, **Case 2**, examines the operations of the intersections in the year 2009, and assumed FM 2478 (Custer Road) was improved to a four-lane divided road between US 380 and FM 1461 (through projects by TxDOT, the City of McKinney, and / or others). In addition, the **Case 2** scenario assumes all approaches to all study intersections are improved to provide a left turn only lane, two (2) through lanes, and a right turn only lane (four-lane approaches).

ITS generated trips for the residential component of the proposed development, which includes 233 single-family lots and 209 condo / townhouse units. Development trips were distributed at the study intersections and combined with background volumes (estimated by applying a five percent annual growth factor to the existing volumes) to produce the projected total volumes at the study intersections and along FM 2478. The AM and PM peak hour operations at the study intersections were then analyzed using the Synchro software package. Based on information provided by the City of McKinney regarding the lack of capacity on FM 1461 at US 380, and due to the location of the proposed development at the intersection of FM 2478 and FM 1461, ITS did not route any development trips along FM 1461 towards US 380. 85 percent of the development trips were routed south along FM 2478 towards US 380, 10 percent of the trips were routed to the west via FM 1461, and the remaining five (5) percent were routed to the north via FM 2478.

The results of the peak hour intersection analyses indicate that with the aforementioned geometric assumptions in place, the study intersections can accommodate the background and development traffic and maintain acceptable LOS operations (LOS D or better) for all analysis scenarios. Furthermore, the impact that the proposed development trips has on the operations of the study intersections is minimal; there is very little difference in the delays for the total volume scenario (which includes development trips) versus the background scenario (which does not).

The results of the link analyses along FM 2478 indicate the road is projected to have adequate surplus capacity to accommodate the year 2007 background traffic (year 2005 volumes plus 5 percent annual growth) and the residential component of the development on the road's existing two-lane undivided cross-section. (The 85 percent of development trips routed along FM 2478 corresponds to 2,946 daily weekday trips.) The widening of FM 2478 to a four-lane divided cross-section will accommodate year 2009 background traffic plus development trips, while also providing significant reserve capacity on the road.

APPENDIX

Traffic Count Data

24-Hour Directional Count

FM 2478 just south of FM 1461

AM and PM Peak Hour Turning Movement Counts

US 380 / FM 2478 (Custer Road)

FM 1461 / FM 2478 (Custer Road) north leg

FM 1461 / FM 2478 (Custer Road) south leg

Traffic Data of Texas, Inc.

413 Bronco Circle
Denton, TX 76208
Phone & FAX: 940.321.0888

Weather: Clear
Project Name:
Count: 24-Hour Volume
Comments:

Site Code: 7733-022105
Station ID: 7733
FM 2478 - Custer Rd
South of FM 1461

Start Time	22-Feb-0 Tue	South Bound Morning	South Bound Afternoon	Hour Totals Morning	Hour Totals Afternoon	North Bound Morning	North Bound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		0	13			1	32				
12:15		[illegible]	[illegible]			[illegible]	[illegible]				
12:30		0	13			0	14				
12:45		[illegible]	[illegible]			[illegible]	[illegible]				
01:00		0	15			1	22				
01:15		[illegible]	[illegible]			[illegible]	[illegible]				
01:30		0	11			0	25				
01:45		[illegible]	[illegible]			[illegible]	[illegible]				
02:00		0	24			1	26				
02:15		[illegible]	[illegible]			[illegible]	[illegible]				
02:30		0	14			0	19				
02:45		[illegible]	[illegible]			[illegible]	[illegible]				
03:00		1	16			1	34				
03:15		[illegible]	[illegible]			[illegible]	[illegible]				
03:30		0	30			0	23				
03:45		[illegible]	[illegible]			[illegible]	[illegible]				
04:00		1	24			1	28				
04:15		[illegible]	[illegible]			[illegible]	[illegible]				
04:30		0	[illegible]			1	35				
04:45		[illegible]	[illegible]			[illegible]	[illegible]				
05:00		5	[illegible]			1	[illegible]				
05:15		[illegible]	[illegible]			[illegible]	[illegible]				
05:30		9	14			6	[illegible]				
05:45		[illegible]	[illegible]			[illegible]	[illegible]				
06:00		19	20			4	25				
06:15		[illegible]	[illegible]			[illegible]	[illegible]				
06:30		25	23			11	31				
06:45		[illegible]	[illegible]			[illegible]	[illegible]				
07:00		29	5			17	16				
07:15		[illegible]	[illegible]			[illegible]	[illegible]				
07:30		[illegible]	5			24	16				
07:45		[illegible]	[illegible]			[illegible]	[illegible]				
08:00		[illegible]	8			23	18				
08:15		[illegible]	[illegible]			[illegible]	[illegible]				
08:30		35	4			18	11				
08:45		[illegible]	[illegible]			[illegible]	[illegible]				
09:00		27	6			[illegible]	13				
09:15		[illegible]	[illegible]			[illegible]	[illegible]				
09:30		25	4			[illegible]	10				
09:45		[illegible]	[illegible]			[illegible]	[illegible]				
10:00		15	1			19	7				
10:15		[illegible]	[illegible]			[illegible]	[illegible]				
10:30		19	1			13	8				
10:45		[illegible]	[illegible]			[illegible]	[illegible]				
11:00		12	0			24	2				
11:15		[illegible]	[illegible]			[illegible]	[illegible]				
11:30		17	1			10	3				
11:45		[illegible]	[illegible]			[illegible]	[illegible]				
Peak		07:15	04:15			09:00	04:45				
Vol.		182	99			99	133				
P.H.F.		0.875	0.825			0.884	0.853				
Total		696	575			482	945			1178	1520
Percent											

Combined Total		1271				1427				2698	
Total		696	575			482	945			1178	1520
Report Percent		54.8%	45.2%			33.8%	66.2%			43.7%	56.3%

City:	McKinney	Intersection:	Custer & US 380
County:	Collin	Date:	Tuesday March 2, 2004

Location:	Custer & US 380											
Approach:	Northbound			Southbound			Eastbound			Westbound		
Street:	Custer			Custer			US 380			US 380		
Direction:	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Designation:	1	2	3	4	5	6	7	8	9	10	11	12
Time Starts												
7:00 AM	36	5	29	17	18	3	1	114	11	31	183	6
7:15 AM	58	12	47	27	19	4	1	152	25	39	153	6
7:30 AM	43	7	56	18	21	7	7	167	31	32	130	6
7:45 AM	33	9	37	21	22	6	1	142	22	21	113	9
8:00 AM	18	6	25	14	15	2	3	122	20	26	115	10
8:15 AM	27	8	23	13	11	1	2	120	24	24	121	12
8:30 AM	25	10	21	21	13	3	2	88	9	26	98	12
8:45 AM	26	6	22	11	14	2	1	101	17	16	82	8
9:00 AM	14	8	19	10	8	0	0	96	11	14	97	13
9:15 AM	20	8	21	17	6	1	4	98	13	23	82	10
A.M. Peak Hour (7:00-9:00)	170	33	169	83	80	20	10	575	87	123	579	27
PHF	0.73	0.69	0.75	0.77	0.91	0.71	0.36	0.86	0.70	0.79	0.79	0.75
Trucks	0	0	0	2	0	3	3	112	0	0	115	5
% Trucks	0%	0%	0%	2%	0%	15%	30%	19%	0%	0%	20%	19%
Time Starts												
11:30 AM	14	15	16	4	9	1	1	58	13	27	82	24
11:45 AM	5	4	17	24	12	4	0	94	13	20	77	10
12:00 PM	13	10	22	20	7	3	3	75	14	30	101	12
12:15 PM	10	20	21	12	26	0	6	105	25	42	111	15
12:30 PM	15	12	21	14	11	2	2	76	20	35	98	7
12:45 PM	10	14	15	12	27	5	6	67	25	18	111	18
1:00 PM	11	15	17	20	25	1	7	133	13	24	103	7
1:15 PM	20	11	18	10	8	1	1	93	8	20	86	8
1:30 PM	4	10	14	13	11	3	2	69	10	33	80	4
1:45 PM	14	15	38	15	11	1	3	85	11	27	96	11
2:00 PM	11	12	19	14	9	3	1	71	15	26	102	9
2:15 PM	11	15	20	10	8	1	0	70	10	29	82	13
M.D. Peak Hour (12:30-1:30)	55	52	71	56	71	9	16	369	66	97	398	40
PHF	0.70	0.87	0.83	0.70	0.66	0.45	0.57	0.69	0.66	0.69	0.90	0.56
Trucks	0	0	0	0	0	0	4	92	0	0	91	3
% Trucks	0%	0%	0%	0%	0%	0%	25%	25%	0%	0%	23%	8%
Time Starts												
4:00 PM	21	14	22	15	16	2	4	111	26	21	159	16
4:15 PM	16	9	14	19	9	5	15	146	30	34	143	19
4:30 PM	32	17	38	15	10	3	2	165	15	39	191	10
4:45 PM	35	27	34	16	18	6	26	155	21	46	131	14
5:00 PM	37	7	24	26	20	5	11	270	55	75	216	24
5:15 PM	22	20	30	15	11	4	25	166	27	54	172	14
5:30 PM	31	16	35	4	16	8	12	149	45	53	158	17
5:45 PM	31	39	29	13	19	3	31	204	40	57	164	26
6:00 PM	54	31	44	25	30	1	33	214	86	79	149	26
6:15 PM	37	22	27	16	21	3	19	188	53	52	121	23
P.M. Peak Hour (5:00-6:00)	121	82	118	58	66	20	79	789	167	239	710	81
PHF	0.82	0.53	0.84	0.56	0.83	0.63	0.64	0.73	0.76	0.80	0.82	0.78
Trucks	0	0	0	2	0	2	0	89	0	0	66	1
% Trucks	0%	0%	0%	3%	0%	10%	0%	11%	0%	0%	9%	1%

City:	McKinney	Intersection:	Custer & US 380
County:	Collin	Date:	Tuesday March 2, 2004

Location:	Custer & US 380											
Approach:	Northbound			Southbound			Eastbound			Westbound		
Street:	Custer			Custer			US 380			US 380		
Direction:	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Designation:	1	2	3	4	5	6	7	8	9	10	11	12
Time Starts												
7:00 AM	0	0	0	2	0	1	0	39	0	0	30	3
7:15 AM	0	0	0	2	0	2	0	35	0	0	31	0
7:30 AM	0	0	0	0	0	0	0	28	0	0	30	2
7:45 AM	0	0	0	0	0	0	0	32	0	0	37	4
8:00 AM	0	0	0	0	0	0	0	19	0	0	24	2
8:15 AM	0	0	0	1	0	1	0	31	0	0	36	1
8:30 AM	0	0	0	1	0	1	3	24	0	0	33	2
8:45 AM	0	0	0	0	0	1	0	31	0	0	24	2
9:00 AM	0	0	0	0	0	0	0	26	0	0	23	0
9:15 AM	0	0	0	0	0	0	0	30	0	0	16	2
A.M. Peak Hour (8:15-9:15)	0	0	0	2	0	3	3	112	0	0	115	5

PHF				0.50		0.75	0.25	0.90			0.80	0.63
Trucks												
% Trucks												

Time Starts												
11:30 AM	0	0	0	1	0	1	2	18	0	0	10	3
11:45 AM	0	0	0	0	0	0	0	28	0	0	16	1
12:00 PM	0	0	0	0	0	0	1	30	0	0	19	2
12:15 PM	0	0	0	0	0	0	2	25	0	0	27	2
12:30 PM	0	0	0	0	0	0	1	28	0	0	18	0
12:45 PM	0	0	0	0	0	0	1	27	0	0	16	1
1:00 PM	0	0	0	0	0	0	0	15	0	0	29	1
1:15 PM	0	0	0	0	0	0	2	22	0	0	28	1
1:30 PM	0	0	0	0	0	1	1	22	0	0	23	0
1:45 PM	0	0	0	0	0	0	1	28	0	0	25	4
2:00 PM	0	0	0	0	0	0	0	26	0	0	19	2
2:15 PM	0	0	0	0	0	0	2	16	0	0	23	0
M.D. Peak Hour (12:30-1:30)	0	0	0	0	0	0	4	92	0	0	91	3

PHF							0.50	0.82			0.78	0.75
Trucks												
% Trucks												

Time Starts												
4:00 PM	0	0	0	1	0	0	1	24	0	0	13	1
4:15 PM	0	0	0	1	0	0	1	21	0	0	22	1
4:30 PM	0	0	0	0	0	1	2	24	0	0	13	1
4:45 PM	0	0	0	1	0	0	0	24	0	0	15	3
5:00 PM	0	0	0	1	0	1	0	29	0	0	16	0
5:15 PM	0	0	0	0	0	0	0	26	0	0	13	1
5:30 PM	0	0	0	0	0	0	0	16	0	0	12	0
5:45 PM	0	0	0	1	0	1	0	18	0	0	25	0
6:00 PM	0	0	0	1	0	0	0	20	0	0	10	1
6:15 PM	0	0	0	0	0	0	0	10	0	0	11	0
P.M. Peak Hour (5:00-6:00)	0	0	0	2	0	2	0	89	0	0	66	1

PHF				0.50		0.50		0.77			0.66	0.25
Trucks												
% Trucks												

TMC3801.VOL
15 Minute Turning Movement Count
eference # 3801 - Custer at US 380: 05/22/04
US 380 @ Custer

TIME	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1200	28	34	46	19	34	4	6	127	22	41	87	17
1215	26	19	41	17	11	3	4	139	19	29	143	28
1230	21	11	31	17	27	1	4	117	22	26	120	16
1245	19	13	41	20	8	2	3	102	25	31	150	17
1300	30	10	34	11	16	0	4	122	20	21	154	11
1315	21	7	30	27	16	2	3	141	27	43	215	17
1330	17	13	45	9	14	2	4	144	21	34	168	22
1345	37	21	33	24	19	1	3	146	30	30	151	17

TMC3801.VOL
15 Minute Turning Movement Count
Reference # 3801 - CUSTER at US 380: 03/02/04
US 380 @ CUSTER

TIME	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
0700	36	5	29	17	18	3	1	114	11	31	183	6
0715	58	12	47	27	19	4	1	152	23	39	153	6
0730	43	7	56	18	21	7	7	167	31	32	130	6
0745	33	9	37	21	22	6	1	142	22	21	113	9
0800	18	6	25	14	15	2	3	122	20	26	115	10
0815	27	8	23	13	11	1	2	120	24	24	121	12
0830	25	10	21	21	13	3	2	88	9	26	98	12
0845	26	6	22	11	14	2	1	101	17	16	82	8
0900	14	8	19	10	8	0	0	96	11	14	97	13
0915	20	8	21	17	6	1	4	98	13	23	82	10
0930	0	0	0	0	0	0	0	0	0	0	0	0
0945	0	0	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0	0	0
1015	0	0	0	0	0	0	0	0	0	0	0	0
1030	0	0	0	0	0	0	0	0	0	0	0	0
1045	0	0	0	0	0	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0	0	0	0	0	0
1115	0	0	0	0	0	0	0	0	0	0	0	0
1130	14	15	16	4	9	1	1	58	13	27	82	24
1145	5	4	17	24	12	4	0	94	13	20	77	10
1200	13	10	22	20	7	3	3	75	14	30	101	12
1215	10	20	21	12	26	0	6	106	25	42	111	15
1230	15	12	21	14	11	2	2	76	20	35	98	7
1245	10	14	15	12	27	5	6	67	25	18	111	18
1300	11	15	17	20	25	1	7	133	13	24	103	7
1315	20	11	18	10	8	1	1	93	8	20	86	8
1330	4	10	14	13	11	3	2	69	10	33	80	4
1345	14	15	38	15	11	1	3	85	11	27	96	11
1400	11	12	19	14	9	3	1	71	15	26	102	9
1415	11	15	20	10	8	1	0	70	10	29	82	13
1430	0	0	0	0	0	0	0	0	0	0	0	0
1445	0	0	0	0	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0	0	0	0	0	0
1515	0	0	0	0	0	0	0	0	0	0	0	0
1530	0	0	0	0	0	0	0	0	0	0	0	0
1545	0	0	0	0	0	0	0	0	0	0	0	0
1600	21	14	22	15	16	2	4	111	26	21	159	16
1615	16	9	14	19	9	5	15	146	30	34	143	19
1630	32	17	30	15	10	3	2	165	15	39	191	10
1645	35	27	34	16	18	6	26	155	21	46	135	14
1700	37	7	24	26	20	5	11	270	55	75	216	24
1715	22	20	30	15	11	4	25	166	27	54	172	14
1730	31	16	35	4	16	8	12	149	45	53	158	17
1745	31	39	29	13	19	3	31	204	40	57	164	26
1800	54	31	44	25	30	1	33	214	86	79	149	26
1815	37	22	27	16	21	3	19	188	53	52	121	23

QUALITY COUNTS, INC
DATA COLLECTION & ANALYSIS
214-349-4861

CUSTER NORTH @ FM 1461
McKINNEY, TX
MILD
CK

File Name : CUSTER NORTH @ FM 1461
Site Code : 00000003
Start Date : 02/17/2005
Page No : 1

Groups Printed- Unshifted

	Southbound					Westbound					Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	2	0	14	0	16	0	17	0	0	17	0	0	0	0	0	3	26	0	0	29	62
07:15 AM	4	0	19	0	23	0	11	5	0	16	0	0	0	0	0	2	17	0	0	19	58
07:30 AM	4	0	15	0	19	0	28	3	0	31	0	0	0	0	0	12	34	0	0	46	96
07:45 AM	9	0	14	0	23	0	15	4	0	19	0	0	0	0	0	5	23	0	0	28	70
Total	19	0	62	0	81	0	71	12	0	83	0	0	0	0	0	22	100	0	0	122	286
08:00 AM	7	0	19	0	26	0	20	5	0	25	0	0	0	0	0	11	30	0	0	41	92
08:15 AM	6	0	3	0	9	0	20	0	0	20	0	0	0	0	0	8	19	0	0	27	56
08:30 AM	5	0	18	0	23	0	9	3	0	12	0	0	0	0	0	7	12	0	0	19	54
08:45 AM	4	0	11	0	15	0	11	4	0	15	0	0	0	0	0	10	11	0	0	21	51
Total	22	0	51	0	73	0	60	12	0	72	0	0	0	0	0	36	72	0	0	108	253
04:00 PM	4	0	7	0	11	0	8	3	0	11	0	0	0	0	0	7	23	0	0	30	52
04:15 PM	1	0	11	0	12	0	13	4	0	17	0	0	0	0	0	17	25	0	0	42	71
04:30 PM	7	0	11	0	18	0	18	7	0	25	0	0	0	0	0	15	13	0	0	28	71
04:45 PM	6	0	10	0	16	0	18	5	0	23	0	0	0	0	0	14	15	0	0	29	68
Total	18	0	39	0	57	0	57	19	0	76	0	0	0	0	0	53	76	0	0	129	262
05:00 PM	3	0	7	0	10	0	12	5	0	17	0	0	0	0	0	12	17	0	0	29	56
05:15 PM	4	0	11	0	15	0	21	1	0	22	0	0	0	0	0	17	23	0	0	40	77
05:30 PM	5	0	10	0	15	0	11	3	0	14	0	0	0	0	0	18	17	0	0	35	64
05:45 PM	0	0	11	0	11	0	16	4	0	20	0	0	0	0	0	21	23	0	0	44	75
Total	12	0	39	0	51	0	60	13	0	73	0	0	0	0	0	68	80	0	0	148	272
Grand Total	71	0	191	0	262	0	248	56	0	304	0	0	0	0	0	179	328	0	0	507	1073
Apprch %	27.1	0.0	72.9	0.0		0.0	81.6	18.4	0.0		0.0	0.0	0.0	0.0		35.3	64.7	0.0	0.0		
Total %	6.6	0.0	17.8	0.0	24.4	0.0	23.1	5.2	0.0	28.3	0.0	0.0	0.0	0.0	0.0	16.7	30.6	0.0	0.0	47.3	

QUALITY COUNTS, INC
DATA COLLECTION & ANALYSIS
214-349-4861

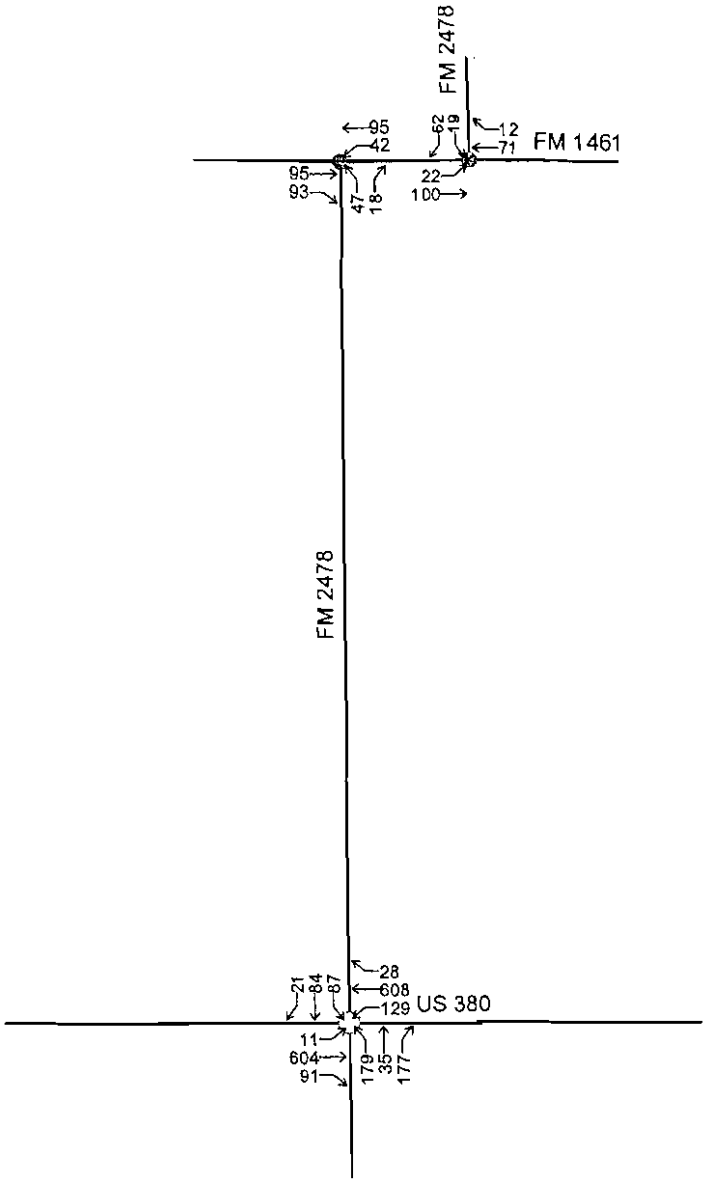
CUSTER SOUTH AT FM 1461
McKINNEY, TX
MILD
CK

File Name : CUSTER SOUTH @ FM 1461
Site Code : 00000002
Start Date : 02/16/2005
Page No : 1

Groups Printed- Unshifted

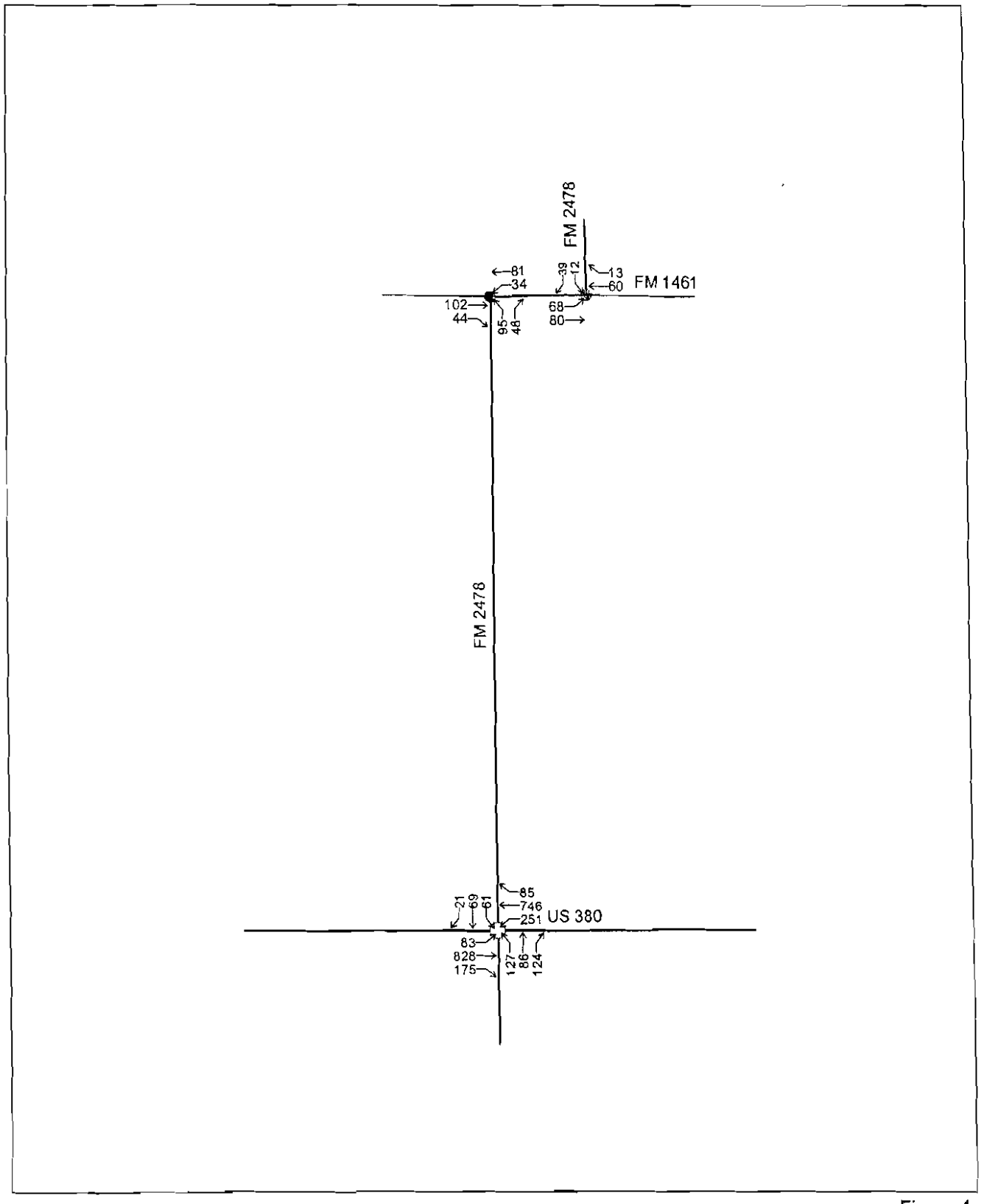
	Southbound					Westbound					Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	0	0	0	0	0	12	14	0	0	26	9	0	3	0	12	0	19	17	0	36	74
07:15 AM	0	0	0	0	0	8	27	0	0	35	14	0	3	0	17	0	23	22	0	45	97
07:30 AM	0	0	0	0	0	10	28	0	0	38	13	0	7	0	20	0	30	33	0	63	121
07:45 AM	0	0	0	0	0	12	26	0	0	38	11	0	5	0	16	0	23	21	0	44	98
Total	0	0	0	0	0	42	95	0	0	137	47	0	18	0	65	0	95	93	0	188	390
08:00 AM	0	0	0	0	0	11	25	0	0	36	19	0	9	0	28	0	26	31	0	57	121
08:15 AM	0	0	0	0	0	14	20	0	0	34	17	0	5	0	22	0	28	21	0	49	105
08:30 AM	0	0	0	0	0	6	17	0	0	23	16	0	2	0	18	0	16	20	0	36	77
08:45 AM	0	0	0	0	0	10	11	0	0	21	11	0	3	0	14	0	25	25	0	50	85
Total	0	0	0	0	0	41	73	0	0	114	63	0	19	0	82	0	95	97	0	192	388
04:00 PM	0	0	0	0	0	6	17	0	0	23	19	0	13	0	32	0	20	12	0	32	87
04:15 PM	0	0	0	0	0	6	13	0	0	19	12	0	9	0	21	0	18	12	0	30	70
04:30 PM	0	0	0	0	0	8	17	0	0	25	23	0	10	0	33	0	18	5	0	23	81
04:45 PM	0	0	0	0	0	9	21	0	0	30	19	0	13	0	32	0	23	11	0	34	96
Total	0	0	0	0	0	29	68	0	0	97	73	0	45	0	118	0	79	40	0	119	334
05:00 PM	0	0	0	0	0	7	16	0	0	23	19	0	12	0	31	0	16	14	0	30	84
05:15 PM	0	0	0	0	0	7	27	0	0	34	28	0	5	0	33	0	30	10	0	40	107
05:30 PM	0	0	0	0	0	9	20	0	0	29	22	0	19	0	41	0	33	8	0	41	111
05:45 PM	0	0	0	0	0	11	18	0	0	29	26	0	12	0	38	0	23	12	0	35	102
Total	0	0	0	0	0	34	81	0	0	115	95	0	48	0	143	0	102	44	0	146	404
Grand Total	0	0	0	0	0	146	317	0	0	463	278	0	130	0	408	0	371	274	0	645	1516
Apprch %	0.0	0.0	0.0	0.0		31.5	68.5	0.0	0.0		68.1	0.0	31.9	0.0		0.0	57.5	42.5	0.0		
Total %	0.0	0.0	0.0	0.0	0.0	9.6	20.9	0.0	0.0	30.5	18.3	0.0	8.6	0.0	26.9	0.0	24.5	18.1	0.0	42.5	

Figures



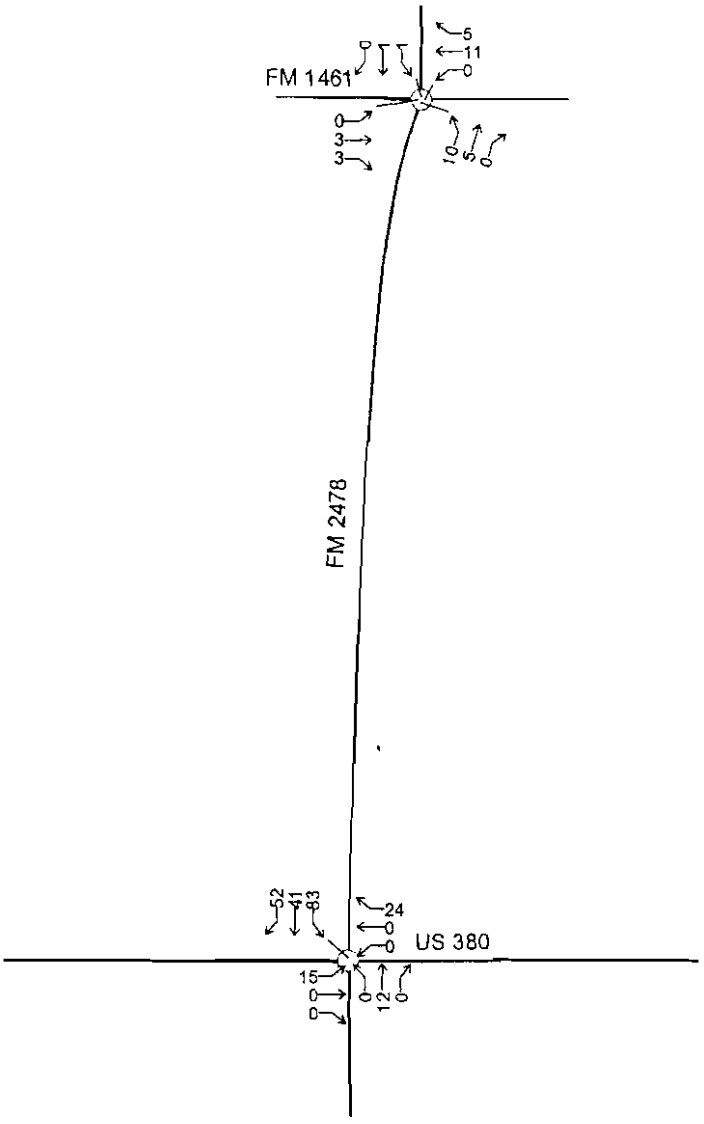
Existing (Year 2005) Volumes

Figure 3
AM Peak



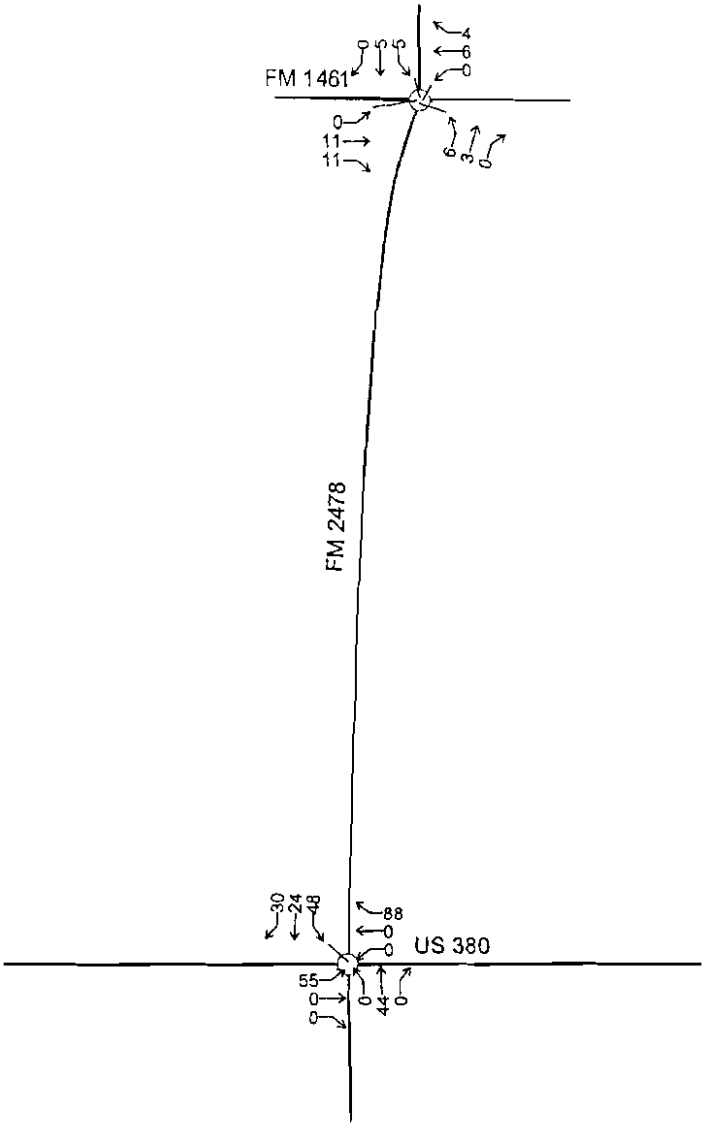
Existing (Year 2005) Volumes

Figure 4
PM Peak



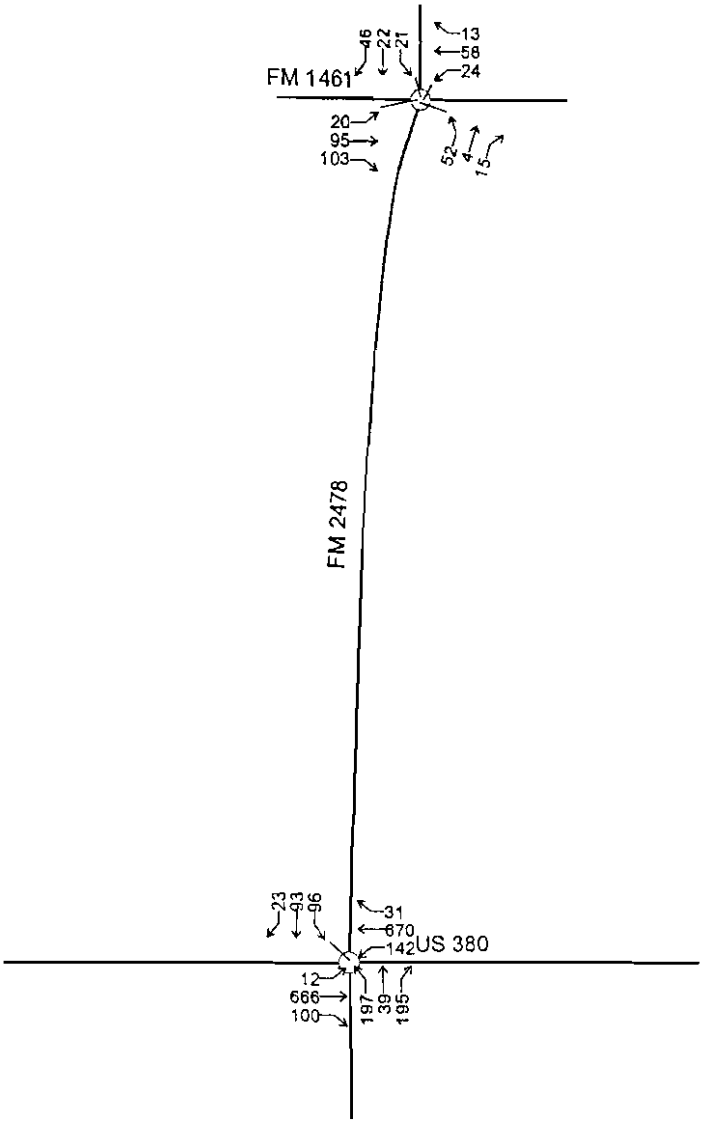
Development Trips

Figure 6
AM Peak



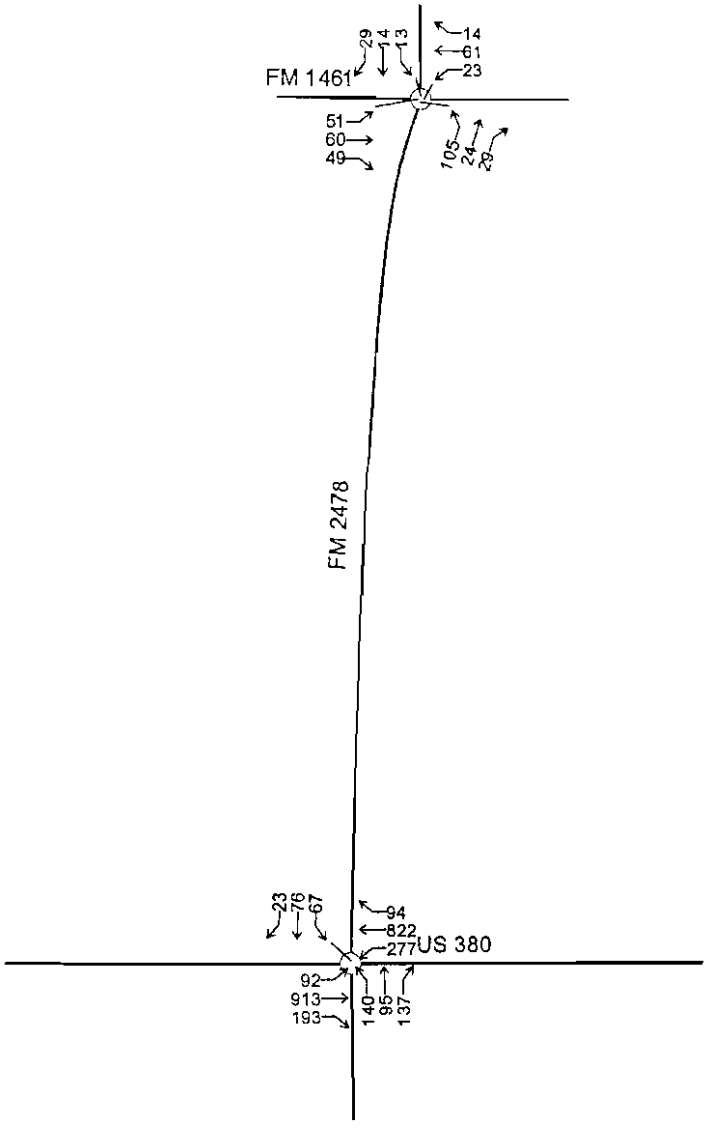
Development Trips

Figure 7
PM Peak



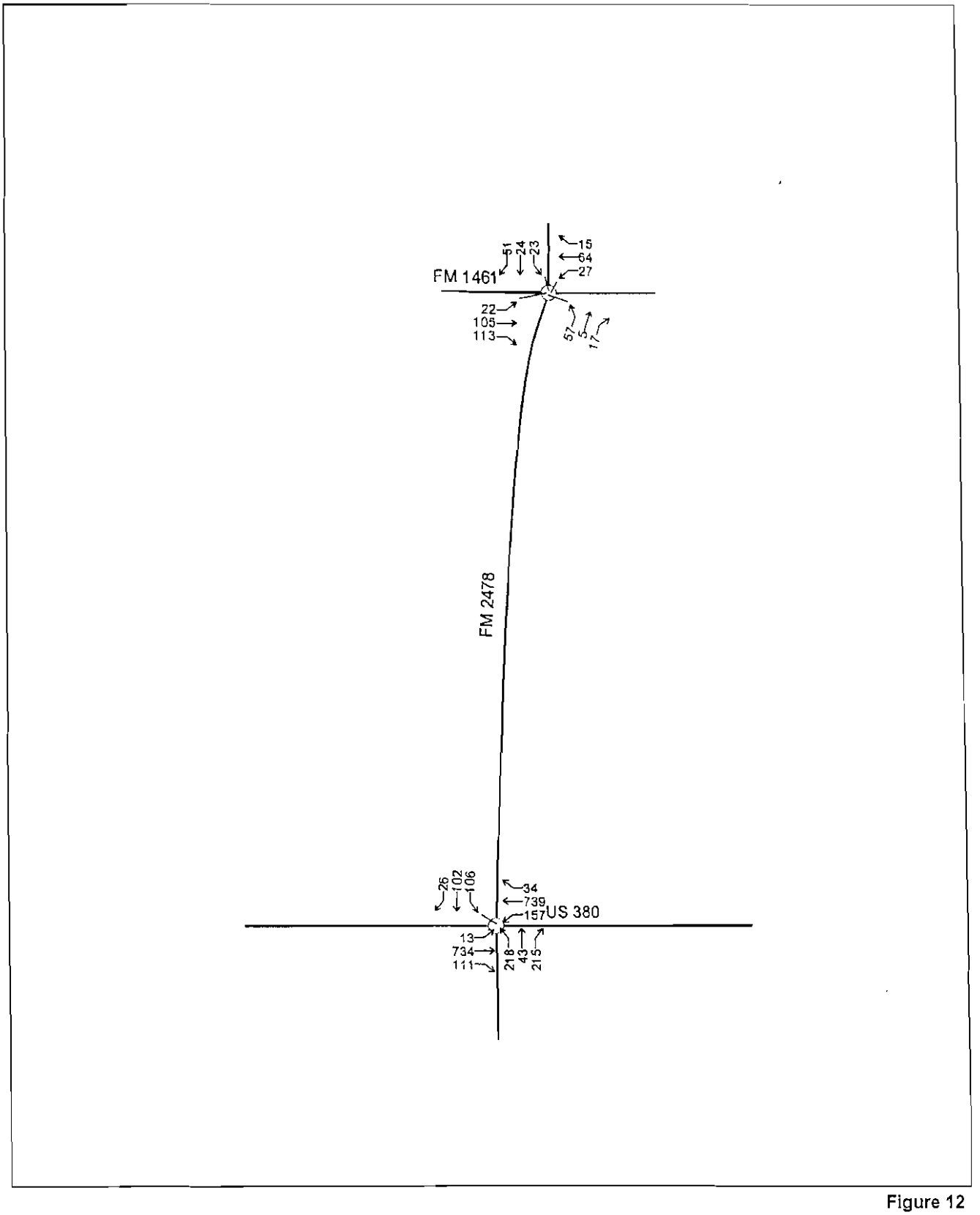
Case 1 (Year 2007) Background

Figure 10
AM Peak



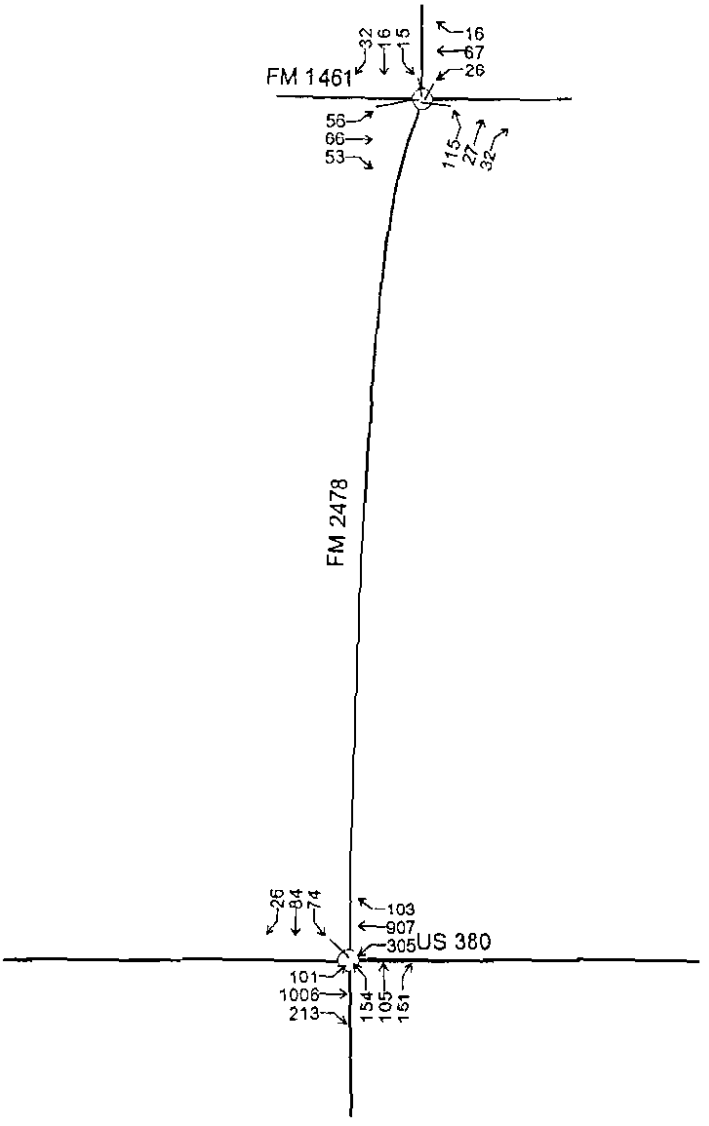
Case 1 (Year 2007) Background

Figure 11
PM Peak



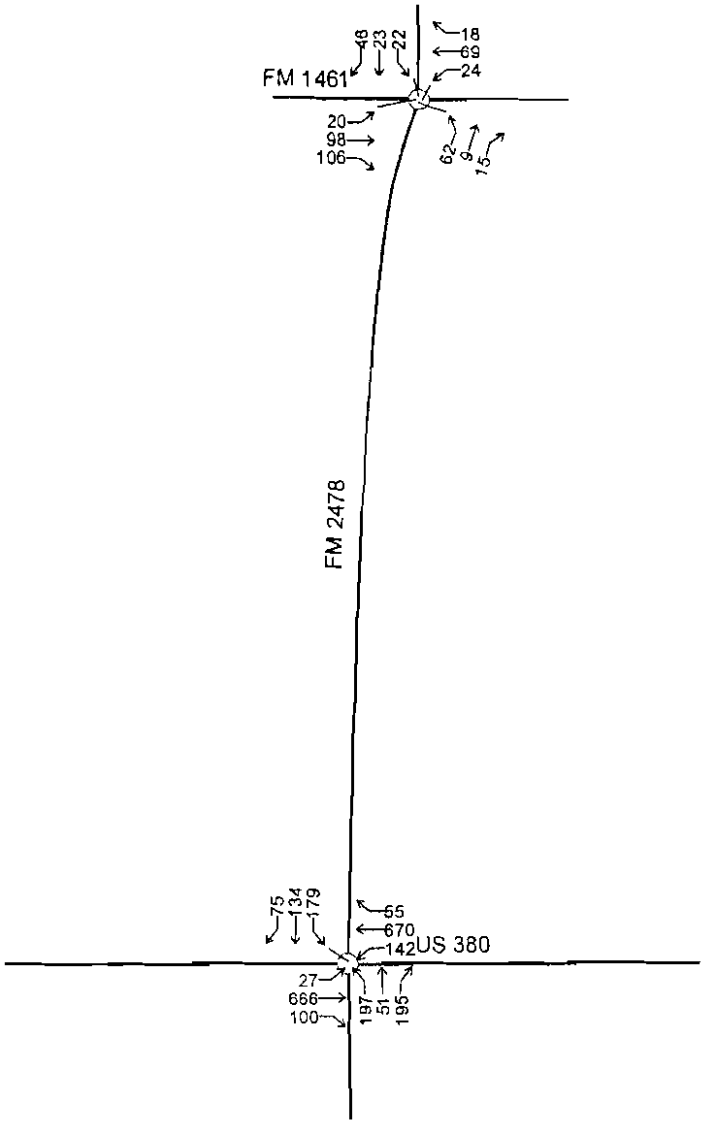
Case 2 (Year 2009) Background

Figure 12
AM Peak



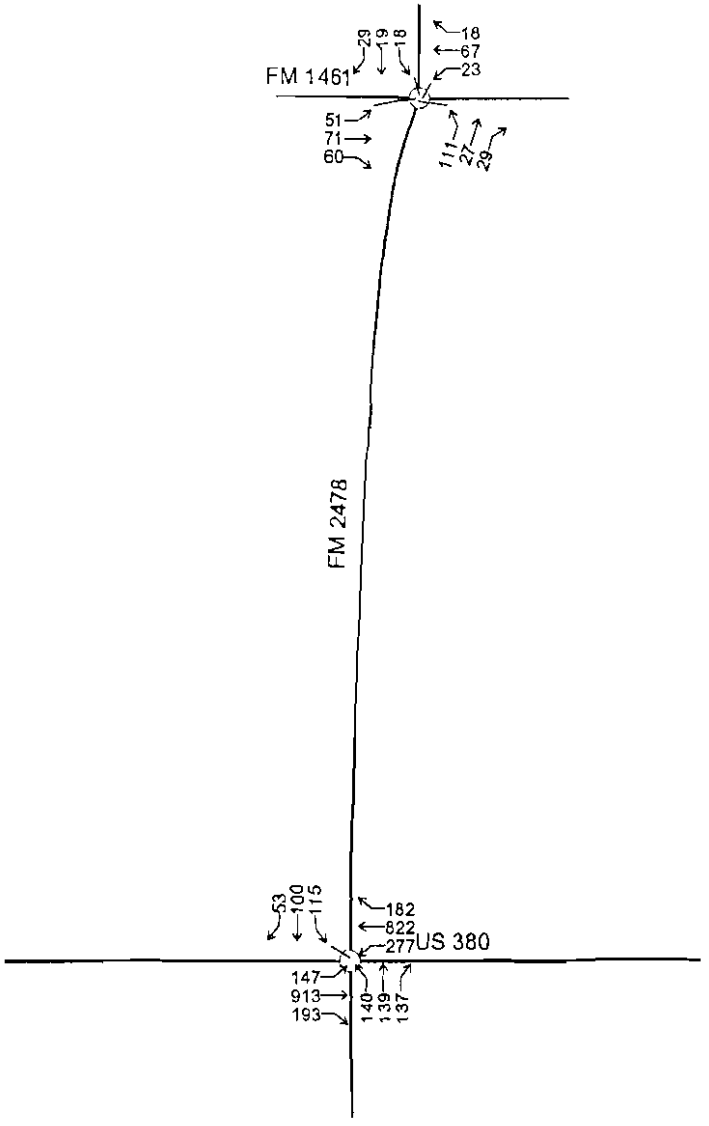
Case 2 (Year 2009) Background

Figure 13
PM Peak



Case 1 (Year 2007) Total

Figure 14
AM Peak



Case 1 (Year 2007) Total

Figure 15
PM Peak

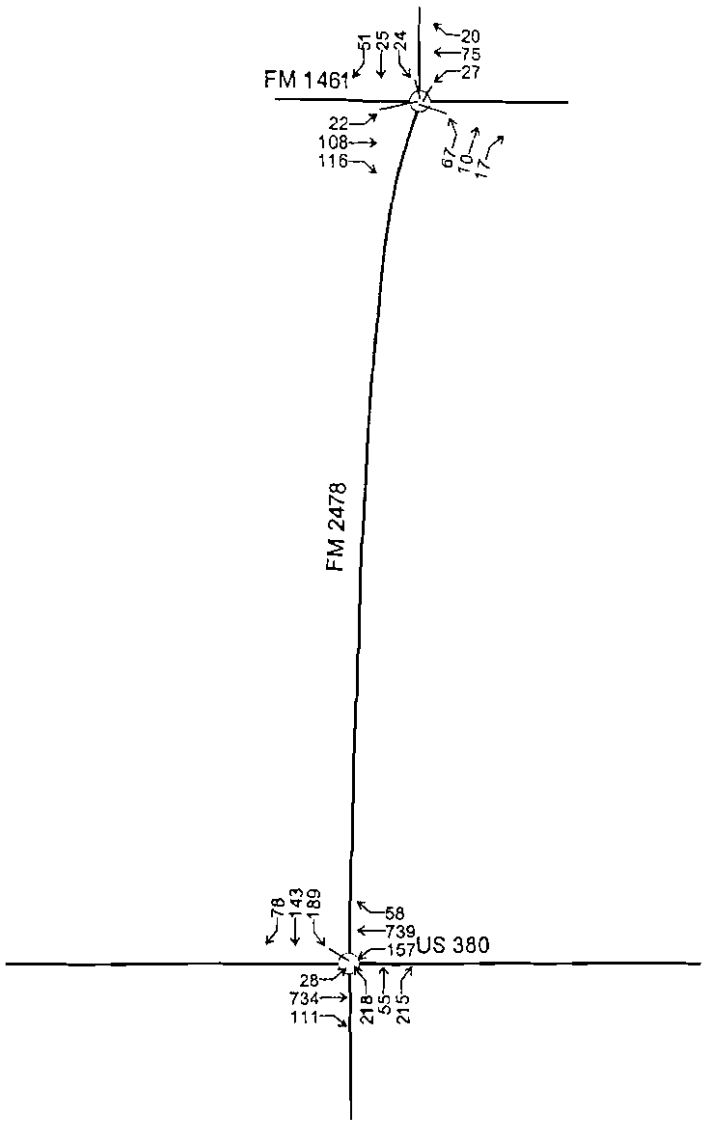
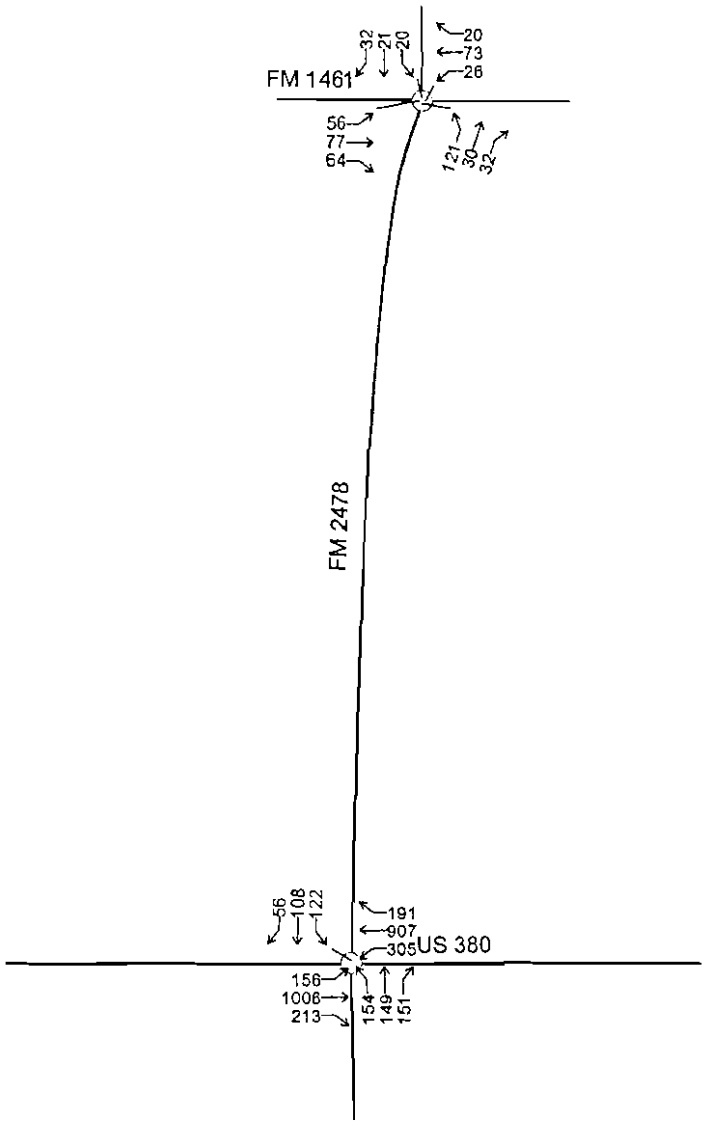


Figure 16
AM Peak

Case 2 (Year 2009) Total



Case 2 (Year 2009) Total

Figure 17
PM Peak

Synchro Output

US 380 / FM 2478 (Custer Road)

Existing (2005) volumes

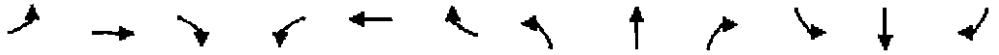
Case 1 (Year 2007) background volumes
Case 1 (Year 2007) total volumes

Case 2 (Year 2009) background volumes
Case 2 (Year 2009) total volumes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.94			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98			0.98	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1710			1794	
Flt Permitted	0.25	1.00	1.00	0.95	1.00	1.00		0.75			0.98	
Satd. Flow (perm)	466	3539	1583	466	3539	1583		1317			1324	
Volume (vph)	45	541	604	291	602	29	19	35	187	28	321	23
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	588	657	316	654	32	21	38	203	30	349	25
RTOR Reduction (vph)	0	0	66	0	0	20	0	49	0	0	7	0
Lane Group Flow (vph)	49	588	591	316	654	12	0	213	0	0	397	0
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	pm+pt			pm+pt		
Protected Phases	5	2	3	1	6	8		8			4	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	20.0	16.0	20.0	20.0	16.0	20.0		24.0			24.0	
Effective Green, g (s)	20.0	16.0	20.0	20.0	16.0	20.0		24.0			24.0	
Actuated g/C Ratio	0.33	0.27	0.33	0.33	0.27	0.33		0.40			0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Grp Gap (vph)	242	944	633	242	944	638		553			661	
v/s Ratio Prot	0.00	0.19	0.00	c0.04	c0.19	0.00		c0.05			0.02	
v/s Ratio Perm	0.09		0.02	0.30		0.01					0.23	
v/c Ratio	0.05	0.70	0.05	0.58	0.70	0.02		0.68			0.36	
Uniform Delay, d1	13.0	19.8	13.6	16.9	19.8	13.4		21.8			16.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	1.2	4.2	0.2	7.7	4.4	0.0		3.6			0.8	
Delay (s)	14.2	24.0	13.7	24.6	24.2	13.4		21.4			14.4	
Level of Service	B	C	B	C	C	B		C			B	
Approach Delay (s)		22.6			23.8			21.4			14.4	
Approach LOS		C			C			C			B	

Intersection Summary					
HCM Average Control Delay	22.1	HCM Level of Service		C	
HCM Volume to Capacity ratio	0.68				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)		16.0	
Intersection Capacity Utilization	62.7%	ICU Level of Service		B	
Analysis Period (min)	15				

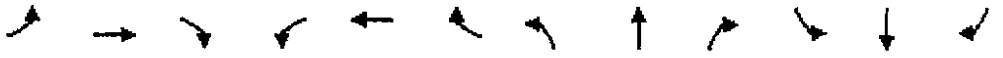
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.95			0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98			0.98	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1737			1791	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.98			0.97	
Satd. Flow (perm)	624	3539	1583	233	3539	1583		1440			1400	
Volume (vph)	83	828	176	261	46	8	12	86	124	91	269	27
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	900	191	284	50	9	13	93	135	99	292	29
RTOR Reduction (vph)	0	0	118	0	0	48	0	23	0	0	6	0
Lane Group Flow (vph)	90	900	73	284	50	0	0	93	0	0	414	0
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	pm+pt			pm+pt		
Protected Phases	7	4	5	3	8	1	2			1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	33.0	28.0	34.0	48.0	39.0	43.0		32.0			28.0	
Effective Green, g (s)	33.0	28.0	34.0	48.0	39.0	43.0		32.0			28.0	
Actuated g/C Ratio	0.31	0.26	0.32	0.45	0.36	0.40		0.30			0.26	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Grp Cap (vph)	299	910	503	398	1263	630		421			456	
v/s Ratio Prot	0.02	c0.25	0.01	c0.12	0.23	0.00		c0.04			0.02	
v/s Ratio Perm	0.10		0.03	0.22		0.01					0.09	
v/c Ratio	0.31	0.82	0.11	0.69	0.53	0.05		0.64			0.35	
Uniform Delay, d1	34.9	29.6	24.2	26.4	28.6	23.2		34.2			29.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.2	5.8	0.2	3.4	0.6	0.0		1.0			0.3	
Delay (s)	21.7	35.4	18.5	27.7	20.1	12.7		30.2			26.1	
Level of Service	C	D	B	C	C	B		C			C	
Approach Delay (s)		31.6			21.2			30.2			26.1	
Approach LOS		C			C			C			C	

Intersection Summary					
HCM Average Control Delay	26.9	HCM Level of Service		C	
HCM Volume to Capacity ratio	0.74				
Actuated Cycle Length (s)	150.0	Sum of lost time (s)		16.0	
Intersection Capacity Utilization	70.9%	ICU Level of Service		C	
Analysis Period (min)	15				

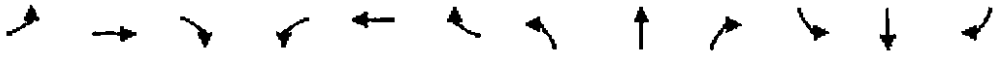
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.94			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00			0.98	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1710			1795	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		1.00			0.98	
Satd. Flow (perm)	466	3539	1583	466	3539	1583		1302			1282	
Volume (vph)	5	1145	65	1	1000	24	19	1	50	90	1	723
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1245	71	1	1087	26	21	1	54	98	1	786
RTOR Reduction (vph)	0	0	73	0	0	23	0	50	0	0	7	0
Lane Group Flow (vph)	5	1245	36	1	1087	3	0	26	0	0	878	0
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	pm+pt				pm+pt	
Protected Phases	7	4	5	3	8	1	5	2			6	
Permitted Phases	4		4	8		8	2				6	
Actuated g/C Ratio	0.33	0.32	0.33	0.33	0.32	0.33		0.30			0.40	
Effective Green, g (s)	20.0	16.0	20.0	20.0	16.0	20.0		24.0			24.0	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Grp Cap (vph)	154	1141	510	154	1141	510		390			513	
v/s Ratio Prot	0.00	0.20	0.00	c0.04	c0.21	0.00		c0.05			0.03	
v/s Ratio Perm	0.01		0.02	0.01		0.00					0.14	
v/c Ratio	0.05	0.77	0.06	0.64	0.77	0.02		0.76			0.41	
Uniform Delay, d1	14.0	20.3	13.6	15.0	20.0	13.5		18.8			13.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.02	
Incremental Delay, d2	0.4	5.9	0.2	12.2	6.4	0.0		6.4			2.0	
Delay (s)	14.4	26.2	13.8	27.3	26.4	13.5		25.2			15.3	
Level of Service	B	C	B	C	C	B		C			B	
Approach Delay (s)		24.4			26.1			25.2			15.3	
Approach LOS		C			C			C			B	

Intersection Summary					
HCM Average Control Delay	24.3	HCM Level of Service	C		
HCM Volume to Capacity ratio	0.75				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0		
Intersection Capacity Utilization	67.8%	ICU Level of Service	C		
Analysis Period (min)	15				

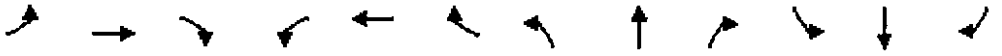
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.95			0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.95			0.96	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1737			1792	
Flt Permitted	0.72	1.00	1.00	0.12	1.00	1.00		0.80			0.76	
Satd. Flow (perm)	511	3539	1583	226	3539	1583		1419			1394	
Volume (vph)	92	908	128	22	892	53	24	95	17	6	6	23
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	987	139	24	970	58	26	103	18	7	7	25
RTOR Reduction (vph)	0	0	128	0	0	53	0	24	0	0	6	0
Lane Group Flow (vph)	100	987	11	24	970	5	0	120	0	0	33	0
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	pm+pt				pm+pt	
Protected Phases	7	4	1	3	8	5		2			6	
Permitted Phases	4		4	8		8	2				6	
Actuated g/C Ratio	0.50	0.29	0.50	0.49	0.39	0.43		0.31			0.27	
Effective Green, g (s)	35.0	29.0	35.0	49.0	39.0	43.0		31.0			27.0	
Actuated g/C Ratio	0.35	0.29	0.35	0.49	0.39	0.43		0.31			0.27	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Grp Cap (vph)	285	1040	466	298	1353	627		570			435	
v/s Ratio Prot	0.02	c0.28	0.01	c0.13	0.25	0.00		c0.05			0.02	
v/s Ratio Perm	0.11		0.04	0.28		0.00					0.01	
v/c Ratio	0.35	0.87	0.12	0.76	0.58	0.06		0.75			0.40	
Uniform Delay, d1	22.9	28.7	17.6	20.8	19.5	15.9		26.0			25.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.4	11.4	0.2	4.4	2.6	1.8		7.6			1.7	
Delay (s)	21.4	37.9	18.0	33.4	20.9	12.8		35.6			27.8	
Level of Service	C	D	B	C	C	B		D			C	
Approach Delay (s)		33.4			23.2			35.6			27.8	
Approach LOS		C			C			D			C	

Intersection Summary					
HCM Average Control Delay	27.2	HCM Level of Service		C	
HCM Volume to Capacity ratio	0.82				
Actuated Cycle Length (s)	100.0	Sum of lost time (s)		12.0	
Intersection Capacity Utilization	77.2%	ICU Level of Service		D	
Analysis Period (min)	15				

c Critical Lane Group

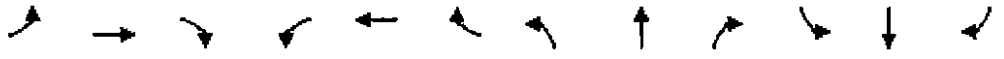


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		0.95			0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.94			0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00			0.99	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1714			1773	
Flt Permitted	0.26	1.00	1.00	0.95	1.00	1.00		1.00			0.96	
Satd. Flow (perm)	466	3539	1583	466	3539	1583		1209			1215	
Volume (vph)	24	766	100	142	1000	40	20	1	90	179	1	175
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	833	109	154	1087	43	22	1	98	195	1	190
RTOR Reduction (vph)	0	0	73	0	0	40	0	47	0	0	14	0
Lane Group Flow (vph)	26	833	36	154	1087	3	0	74	0	0	372	0
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	pm+pt			pm+pt		
Protected Phases	7	4	5	3	8		2			6		
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	24.0	16.0	20.0	20.0	16.0	20.0		24.0			24.0	
Effective Green, g (s)	20.0	16.0	20.0	20.0	16.0	20.0		24.0			24.0	
Actuated g/C Ratio	0.33	0.27	0.33	0.33	0.27	0.33		0.40			0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Grp Cap (vph)	242	941	526	242	941	526		485			483	
v/s Ratio Prot	0.01	0.20	0.00	c0.04	c0.21	0.00		c0.06			0.05	
v/s Ratio Perm	0.05		0.02	0.17		0.00					0.26	
v/c Ratio	0.12	0.77	0.06	0.64	0.77	0.03		0.84			0.78	
Uniform Delay, d1	14.1	20.3	13.5	19.2	19.5	13.5		18.3			18.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.02	
Incremental Delay, d2	1.0	5.9	0.3	7.4	6.9	0.1		13.0			9.0	
Delay (s)	15.1	26.2	13.8	27.3	26.4	13.6		31.3			27.1	
Level of Service	B	C	B	C	C	B		C			C	
Approach Delay (s)		24.3			25.7			31.3			27.1	
Approach LOS		C			C			C			C	

Intersection Summary	
HCM Average Control Delay	26.0
HCM Volume to Capacity ratio	0.80
Actuated Cycle Length (s)	60.0
Intersection Capacity Utilization	68.2%
Analysis Period (min)	15

Sum of lost time (s)	8.0
ICU Level of Service	C

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.96			0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98			0.98	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583		1750			1775	
Flt Permitted	0.28	1.00	1.00	0.81	1.00	1.00		0.98			0.98	
Satd. Flow (perm)	511	3539	1583	226	3539	1583		1408			1234	
Volume (vph)	58	29	113	22	82	22	10	130	15	15	100	53
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	63	32	123	24	89	24	11	141	16	16	109	58
RTOR Reduction (vph)	0	0	128	0	0	103	0	20	0	0	10	0
Lane Group Flow (vph)	63	32	32	24	89	24	0	132	0	0	273	0
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	pm+pt				pm+pt	
Protected Phases	7	4	8	3	8	1	2				1	
Permitted Phases	4		4	8		8	2				6	
Actuated Green, G (s)	31.0	29.0	35.0	49.0	39.0	43.0		31.0			27.0	
Effective Green, g (s)	35.0	29.0	35.0	49.0	39.0	43.0		31.0			27.0	
Actuated g/C Ratio	0.35	0.29	0.35	0.49	0.39	0.43		0.31			0.27	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Grp Cap (vph)	228	1040	686	396	1054	682		435			334	
v/s Ratio Prot	0.04	c0.28	0.01	c0.13	0.25	0.01		c0.06			0.03	
v/s Ratio Perm	0.08		0.01	0.02		0.01					0.18	
v/c Ratio	0.57	0.87	0.12	0.76	0.58	0.11		0.85			0.72	
Uniform Delay, d1	26.0	32.8	22.6	22.0	26.8	19.0		34.4			28.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.5	5.1	0.1	11.4	1.5	0.2		9.2			10.1	
Delay (s)	26.5	37.9	18.0	33.4	20.9	13.3		43.6			38.7	
Level of Service	C	D	B	C	C	B		D			D	
Approach Delay (s)		33.5			22.5			43.6			38.7	
Approach LOS		C			C			D			D	

Intersection Summary						
HCM Average Control Delay	30.9	HCM Level of Service		C		
HCM Volume to Capacity ratio	0.86					
Actuated Cycle Length (s)	100.0	Sum of lost time (s)		8.0		
Intersection Capacity Utilization	78.4%	ICU Level of Service		D		
Analysis Period (min)	15					

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.24	1.00	1.00	0.21	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	438	3539	1583	392	3539	1583	1270	3539	1583	1350	3539	1583
Volume (vph)	14	736	110	57	1	2	23	2	25	100	0	26
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	800	120	62	1	2	25	2	27	109	0	28
RTOR Reduction (vph)	0	0	87	0	0	25	0	0	168	0	0	20
Lane Group Flow (vph)	15	798	34	62	3	0	25	2	0	109	0	8
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		1	2		5	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	21.0	17.0	17.0	25.0	19.0	19.0	21.0	17.0	17.0	21.0	17.0	17.0
Effective Green, g (s)	21.0	17.0	17.0	25.0	19.0	19.0	21.0	17.0	17.0	21.0	17.0	17.0
Actuated g/C Ratio	0.35	0.28	0.28	0.42	0.32	0.32	0.35	0.28	0.28	0.35	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	242	1003	449	301	1126	503	448	1003	449	301	1003	449
v/s Ratio Prot	0.00	0.23		c0.06	c0.23		c0.03	0.01		0.02	0.03	
v/s Ratio Perm	0.02		0.02	0.13		0.00	0.02		0.02	0.04		0.01
v/c Ratio	0.06	0.80	0.08	0.57	0.72	0.02	0.50	0.05	0.15	0.23	0.11	0.02
Uniform Delay, d1	13.1	19.9	15.1	12.2	18.1	14.0	15.0	17.1	16.6	12.5	15.9	15.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.97	0.93
Incremental Delay, d2	0.1	6.5	0.9	7.9	4.0	0.2	3.4	0.1	0.3	1.5	0.2	0.1
Delay (s)	13.6	26.4	16.1	20.1	22.1	14.2	18.4	15.7	16.8	14.0	15.6	14.5
Level of Service	B	C	B	C	C	B	B	B	B	B	B	B
Approach Delay (s)		24.9			21.4			17.4			14.7	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	21.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor												
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected												
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted												
Satd. Flow (perm)	528	3539	1583	201	3539	1583	1295	3539	1583	1266	3539	1583
Volume (vph)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)												
RTOR Reduction (vph)	0	0	147	0	0	55	0	0	131	0	0	22
Lane Group Flow (vph)												
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases												
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)												
Effective Green, g (s)	39.0	33.0	33.0	56.0	46.0	46.0	22.0	18.0	18.0	22.0	18.0	18.0
Actuated g/C Ratio												
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)												
v/s Ratio Prot	0.02	c0.31		c0.15	0.28		c0.02	0.03		0.01	0.03	
v/s Ratio Perm			0.05			0.00			0.02			0.00
v/c Ratio	0.35	0.84	0.15	0.73	0.55	0.07	0.49	0.16	0.10	0.24	0.13	0.02
Uniform Delay, d1												
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2												
Delay (s)	18.5	32.9	19.6	31.1	16.1	11.3	33.7	30.2	30.1	28.6	29.9	29.0
Level of Service												
Approach Delay (s)		29.6			19.2			31.5			29.3	
Approach LOS												

Intersection Summary			
HCM Average Control Delay	25.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)		Sum of lost time (s)	
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)			

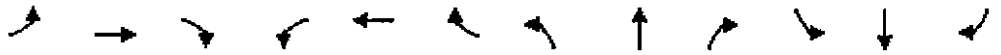
c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor												
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected												
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted												
Satd. Flow (perm)	438	3539	1583	392	3539	1583	1218	3539	1583	1333	3539	1583
Volume (vph)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)												
RTOR Reduction (vph)	0	0	87	0	0	43	0	0	168	0	0	61
Lane Group Flow (vph)												
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases												
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)												
Effective Green, g (s)	21.0	17.0	17.0	25.0	19.0	19.0	21.0	17.0	17.0	21.0	17.0	17.0
Actuated g/C Ratio												
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)												
v/s Ratio Prot	0.01	0.23		c0.06	c0.23		c0.03	0.02		0.03	0.04	
v/s Ratio Perm												
v/c Ratio	0.12	0.80	0.08	0.57	0.72	0.04	0.51	0.06	0.15	0.41	0.15	0.05
Uniform Delay, d1												
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.03
Incremental Delay, d2												
Delay (s)	14.3	26.4	16.1	20.1	22.1	14.3	18.8	15.8	16.8	17.0	16.6	16.4
Level of Service												
Approach Delay (s)		24.7			21.3			17.6			16.8	
Approach LOS												

Intersection Summary	
HCM Average Control Delay	21.0
HCM Volume to Capacity ratio	0.63
Actuated Cycle Length (s)	
Intersection Capacity Utilization	58.4%
Analysis Period (min)	

Sum of lost time (s)	
ICU Level of Service	B

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor												
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected												
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted												
Satd. Flow (perm)	436	3539	1583	201	3539	1583	1263	3539	1583	1210	3539	1583
Volume (vph)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)												
RTOR Reduction (vph)	0	0	147	0	0	111	0	0	131	0	0	49
Lane Group Flow (vph)												
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases												
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)												
Effective Green, g (s)	43.0	33.0	33.0	56.0	42.0	42.0	22.0	18.0	18.0	22.0	18.0	18.0
Actuated g/C Ratio												
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)												
v/s Ratio Prot	0.05	c0.31		c0.15	0.28		c0.02	0.05		0.02	0.03	
v/s Ratio Perm												
v/c Ratio	0.48	0.84	0.15	0.73	0.60	0.13	0.50	0.23	0.10	0.41	0.17	0.04
Uniform Delay, d1												
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Del.												
Delay (s)	18.4	32.9	19.6	31.1	19.3	14.0	34.0	30.9	30.1	31.8	30.3	29.3
Level of Service												
Approach Delay (s)		29.2			21.2			31.7			30.7	
Approach LOS												

Intersection Summary	
HCM Average Control Delay	HCM Level of Service
HCM Volume to Capacity ratio	0.71
Actuated Cycle Length (s)	Sum of lost time (s)
Intersection Capacity Utilization	69.9% ICU Level of Service C
Analysis Period (min)	

c Critical Lane Group

FM 1461 / FM 2478 (Custer Road)

Existing (2005) volumes

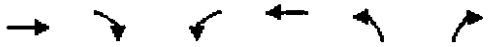
Case 1 (Year 2007) background volumes
Case 1 (Year 2007) total volumes

Case 2 (Year 2009) background volumes
Case 2 (Year 2009) total volumes

Movement	EBT	EBR	WBL	WBT
Lane Configurations				
Sign Control	Free		Free	Stop
Grade	0%		0%	0%
Volume (veh/h)				
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)				
Pedestrians				
Lane Width (ft)				
Walking Speed (ft/s)				
Percent Blockage				
Right turn flare (veh)				
Median type				None
Median storage veh)				
Upstream signal (ft)				
pX, platoon unblocked				
vC, conflicting volume			1204	
vC1, stage 1 conf vol				
vC2, stage 2 conf vol				
vCu, unblocked vol			204	348	154
tC, single (s)				
tC, 2 stage (s)				
tF (s)				
p0 queue free %			97	92	98
cM capacity (veh/h)			1367		836

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total				
Volume Left	0	46	51	
Volume Right				
cSH	1700	1367	683	
Volume to Capacity	0.00	0.03	0.07	
Queue Length 95th (ft)	0	3	9	
Control Delay (s)	0.0	2.6	10.5	
Lane LOS		A	B	
Approach Delay (s)	0.0	2.6	10.5	
Approach LOS			B	

Intersection Summary	
Average Delay	2.7
Intersection Capacity Utilization	31.7% ICU Level of Service A
Analysis Period (min)	15

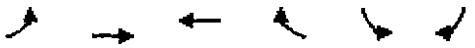


Movement	EBL	EBR	WBL	WBT	NBT	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	102	44	34	8	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	111	48	37	9	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)				864		
pX, platoon unblocked						
vC, conflicting volume			159		297	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			159		297	135
tC, single (s)			4.1		6.5	
tC, 2 stage (s)						
tF (s)			2.2		3.5	
p0 queue free %			97		85	94
cM capacity (veh/h)			1421		670	

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	159	46	0
Volume Left	0	37	0
Volume Right	48	0	0
cSH	1700	1421	741
Volume to Capacity	0.09	0.03	0.00
Queue Length 95th (ft)	0	2	0
Control Delay (s)	0.0	2.4	9.9
Lane LOS		A	A
Approach Delay (s)	0.0	2.4	9.9
Approach LOS			A

Intersection Summary	
Average Delay	4.6
Intersection Capacity Utilization	32.4%
Analysis Period (min)	15

ICU Level of Service A

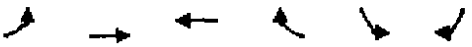


Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)						
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume						
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	90				240	84
tC, single (s)					6.4	6.2
tC, 2 stage (s)						
tF (s)						
p0 queue free %	98				97	93
cM capacity (veh/h)						

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	24	0	29
Volume Left	24	0	21
Volume Right			8
cSH	1505	1700	906
Volume to Capacity	0.02	0.00	0.03
Queue Length 95th (ft)	1	0	8
Control Delay (s)	7.4	0.0	9.1
Lane LOS	A		A
Approach Delay (s)	0.6	0.0	9.1
Approach LOS			A

Intersection Summary	
Average Delay	3.3
Intersection Capacity Utilization	24.7%
Analysis Period (min)	15

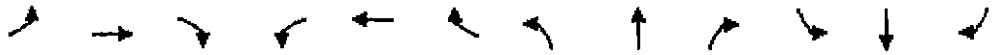
ICU Level of Service A



Movement						
Lane Configurations						
Sign Control			Free	Free		Stop
Grade			0%	0%		0%
Volume (veh/h)			80	60		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)						
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume						
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	79				307	72
tC, single (s)						
tC, 2 stage (s)						
tF (s)						
p0 queue free %	95				98	96
cM capacity (veh/h)						

Direction, Lane #						
Volume Total						
Volume Left	74	0	13			
Volume Right						
cSH	1519	1700	882			
Volume to Capacity						
Queue Length 95th (ft)	4	0	5			
Control Delay (s)						
Lane LOS	A		A			
Approach Delay (s)						
Approach LOS			A			

Intersection Summary	
Average Delay	3.7
Intersection Capacity Utilization	
Analysis Period (min)	15



Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.97		1.00	0.88		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1717		1770	1812		1770	1639		1770	1674	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1317	1717		1141	1812		1320	1639		1386	1674	
Volume (vph)	24	95	103	92	58	14	52	4	36	22	23	46
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	26	103	112	100	63	15	57	4	39	24	25	50
RTOR Reduction (vph)	0	62	0	0	8	0	0	9	0	0	29	0
Lane Group Flow (vph)	26	153	0	100	70	0	57	34	0	24	46	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		2			8			2			6	
Permitted Phases	4			8			2			6		
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.25	0.25		0.25	0.25	
Effective Green, g (s)	27.0	27.0		27.0	27.0		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	356	464		308	490		330	410		347	419	
v/s Ratio Prot		c0.09			0.04			0.01			0.03	
v/s Ratio Perm	0.02			c0.09			c0.04			0.02		
v/c Ratio	0.04	0.20		0.05	0.09		0.10	0.02		0.04	0.06	
Uniform Delay, d1	27.2	28.1		27.3	27.4		28.7	28.6		28.4	28.5	
Progression Factor	1.00	1.00		1.00	1.00		1.15	1.21		1.00	1.00	
Incremental Delay, d2	0.1	0.3		0.2	0.2		0.2	0.0		0.1	0.1	
Delay (s)	9.3	10.5		9.5	9.6		12.6	12.5		10.5	10.7	
Level of Service	A	B		A	A		B	B		B	B	
Approach Delay (s)		10.4			9.6			12.6			10.6	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.15		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.93		1.00	0.97		1.00	0.92		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1737		1770	1811		1770	1709		1770	1673	
Flt Permitted	0.70	1.00		0.68	1.00		0.70	1.00		0.70	1.00	
Satd. Flow (perm)	1312	1737		1269	1811		1353	1709		1340	1673	
Volume (vph)	45	60	49	20	30	7	24	20	3	7	29	29
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	65	53	22	33	8	26	22	3	8	32	32
RTOR Reduction (vph)	0	29	0	0	8	0	0	19	0	0	19	0
Lane Group Flow (vph)	49	89	0	22	33	0	26	6	0	8	45	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	27.0	27.0		27.0	27.0		25.0	25.0		25.0	25.0	
Effective Green, g (s)	27.0	27.0		27.0	27.0		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.45	0.45		0.45	0.45		0.42	0.42		0.42	0.42	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	590	782		571	815		564	712		558	697	
v/s Ratio Prot		c0.05			0.04			0.02			0.02	
v/s Ratio Perm	0.04			0.02			0.02			0.01		
v/c Ratio	0.09	0.11		0.04	0.04		0.05	0.01		0.01	0.06	
Uniform Delay, d1	9.3	9.6		9.3	9.3		9.7	9.4		9.4	9.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		0.1	0.0		0.1	0.0		0.0	0.1	
Delay (s)	9.8	9.9		9.4	9.3		9.8	9.4		9.4	9.6	
Level of Service	A	A		A	A		A	A		A	A	
Approach Delay (s)		9.8			9.3			9.5			9.6	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.16		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	28.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.97		1.00	0.91		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1718		1770	1804		1770	1691		1770	1676	
Flt Permitted	0.70	1.00		0.63	1.00		0.74	1.00		0.78	1.00	
Satd. Flow (perm)	1295	1718		1127	1804		1319	1691		1379	1676	
Volume (vph)	29	98	61	22	50	18	62	9	15	22	28	46
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	107	66	24	54	20	67	10	16	24	30	50
RTOR Reduction (vph)	0	63	0	0	11	0	0	9	0	0	29	0
Lane Group Flow (vph)	32	110	0	24	63	0	67	17	0	24	51	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			3			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	27.0	27.0		27.0	27.0		25.0	25.0		25.0	25.0	
Effective Green, g (s)	27.0	27.0		27.0	27.0		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.45	0.45		0.45	0.45		0.42	0.42		0.42	0.42	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	585	773		509	812		560	703		577	699	
v/s Ratio Prot		c0.09			0.05			0.01			0.03	
v/s Ratio Perm	0.02			0.02			c0.05			0.02		
v/c Ratio	0.04	0.21		0.05	0.10		0.12	0.02		0.04	0.07	
Uniform Delay, d1	9.2	10.0		9.3	9.5		10.3	10.1		10.1	10.2	
Progression Factor	1.00	1.00		1.00	1.00		1.06	1.04		1.00	1.00	
Incremental Delay, d2	0.2	0.6		0.2	0.3		1.5	0.1		0.3	0.5	
Delay (s)	9.4	10.6		9.5	9.8		11.8	10.8		10.5	10.7	
Level of Service	A	B		A	A		B	B		B	B	
Approach Delay (s)		10.5			9.7			11.5			10.6	
Approach LOS		B			A			B			B	

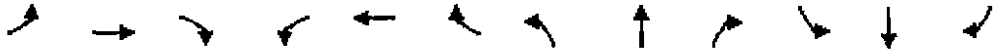
Intersection Summary			
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.17		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	35.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱		↰	↱		↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Frt		1.00	0.93		1.00	0.97		1.00	0.92		1.00	0.91
Flt Protected		0.95	1.00		1.00	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1770	1735		1770	1803		1770	1716		1770	1694
Flt Permitted		0.97	1.00		0.97	1.00		0.95	1.00		0.72	1.00
Satd. Flow (perm)		1298	1735		1241	1803		1346	1716		1336	1694
Volume (vph)	0	33	36	0	25	12	0	21	20	32	20	29
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	36	39	0	27	13	0	23	22	35	22	32
RTOR Reduction (vph)	0	36	0	0	11	0	0	19	0	0	19	0
Lane Group Flow (vph)	0	39	0	0	29	0	0	26	0	0	38	0
Turn Type		Perm			Perm			Perm			Perm	
Protected Phases												
Permitted Phases		4			8			2			6	
Actuated g/C Ratio		0.27			0.27			0.25			0.25	
Effective Green, g (s)		27.0	27.0		27.0	27.0		25.0	25.0		25.0	25.0
Actuated g/C Ratio		0.27	0.27		0.27	0.27		0.25	0.25		0.25	0.25
Clearance Time (s)		4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)		350	468		335	487		337	430		335	425
v/s Ratio Prot			c0.06			0.05			0.02			0.02
v/s Ratio Perm		0.03			0.02			0.02			0.03	
v/c Ratio		0.11	0.14		0.09	0.10		0.08	0.06		0.11	0.09
Uniform Delay, d1		17.1	17.2		17.1	17.2		16.9	16.8		17.1	17.0
Progression Factor		1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.3	0.4		0.2	0.2		0.2	0.1		0.4	0.3
Delay (s)		17.4	17.6		17.3	17.4		17.1	16.9		17.5	17.3
Level of Service		B	B		B	B		B	B		B	B
Approach Delay (s)		17.6			17.4			17.0			17.4	
Approach LOS		B			B			B			B	

Intersection Summary					
HCM Average Control Delay	17.3	HCM Level of Service	B		
HCM Volume to Capacity ratio	0.17				
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A		
Analysis Period (min)	15				

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.74	1.00	1.00	0.56	1.00	1.00	0.72	1.00	1.00	0.75	1.00	1.00
Satd. Flow (perm)	1321	3539	1583	1266	3539	1583	1377	3539	1583	1405	3539	1583
Volume (vph)	22	406	113	27	664	11	57	6	70	226	240	551
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	441	123	29	722	12	62	7	76	246	261	599
RTOR Reduction (vph)	0	0	88	0	0	11	0	0	13	0	0	39
Lane Group Flow (vph)	24	441	35	29	722	1	62	7	63	246	261	560
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	22.0	17.0	17.0	22.0	17.0	17.0	22.0	17.0	17.0	22.0	17.0	17.0
Effective Green, g (s)	22.0	17.0	17.0	22.0	17.0	17.0	22.0	17.0	17.0	22.0	17.0	17.0
Actuated g/C Ratio	0.37	0.28	0.28	0.37	0.28	0.28	0.37	0.28	0.28	0.37	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	522	1003	449	506	1003	449	519	1003	449	519	1003	449
v/s Ratio Prot	0.00	c0.03		c0.00	0.02		c0.01	0.00		0.00	0.01	
v/s Ratio Perm	0.01		0.02	0.02		0.00	0.01		0.04	0.01		c0.01
v/c Ratio	0.05	0.11	0.08	0.06	0.07	0.01	0.12	0.00	0.01	0.05	0.03	0.03
Uniform Delay, d1	12.2	15.9	15.8	12.2	15.5	15.1	15.4	15.8	15.6	12.2	15.5	15.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.37	1.26	1.73	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.3	0.1	0.4	0.0	0.4	0.0	0.0	0.2	0.0	0.1
Delay (s)	12.4	16.2	16.1	12.4	15.9	15.5	17.5	19.4	26.7	12.4	15.6	15.7
Level of Service	B	B	B	B	B	B	B	B	C	B	B	B
Approach Delay (s)		15.8			14.9			19.6			14.9	
Approach LOS		B			B			B			B	

Intersection Summary					
HCM Average Control Delay	16.0	HCM Level of Service	B		
HCM Volume to Capacity ratio	0.11				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0		
Intersection Capacity Utilization	24.7%	ICU Level of Service	A		
Analysis Period (min)	15				

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.74	1.00	1.00	0.74	1.00	1.00	0.75	1.00	1.00	0.77	1.00	1.00
Satd. Flow (perm)	1317	3539	1583	1318	3539	1583	1320	3539	1583	1373	3539	1583
Volume (vph)	30	108	53	20	67	10	10	42	25	53	162	132
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	117	58	22	73	11	11	46	27	58	176	143
RTOR Reduction (vph)	0	0	43	0	0	12	0	0	23	0	0	24
Lane Group Flow (vph)	33	117	15	22	73	0	11	46	4	58	176	119
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		1	2		5	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	20.0	16.0	16.0	20.0	16.0	16.0	25.0	20.0	20.0	23.0	19.0	19.0
Effective Green, g (s)	20.0	16.0	16.0	20.0	16.0	16.0	25.0	20.0	20.0	23.0	19.0	19.0
Actuated g/C Ratio	0.36	0.27	0.27	0.33	0.27	0.27	0.42	0.33	0.33	0.38	0.32	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	469	941	421	460	941	421	560	1180	528	553	1121	501
v/s Ratio Prot	c0.01	0.02		0.00	0.02		c0.02	0.01		0.00	0.00	
v/s Ratio Perm			0.01			0.00			0.00			0.01
v/c Ratio	0.13	0.08	0.04	0.06	0.08	0.01	0.21	0.02	0.02	0.03	0.02	0.02
Uniform Delay, d1	12.8	15.3	15.2	12.6	15.4	15.2	11.2	13.4	13.4	10.9	13.9	13.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	0.3	0.2	0.2	0.2	0.0	0.6	0.0	0.0	0.1	0.0	0.0
Delay (s)	14.4	16.6	16.5	13.8	16.6	16.2	11.8	13.5	13.5	11.6	14.1	14.2
Level of Service	B	B	B	B	B	B	B	B	B	B	B	B
Approach Delay (s)		15.9			15.9			12.4			13.6	
Approach LOS		B			B			B			B	

Intersection Summary	
HCM Average Control Delay	14.4 HCM Level of Service B
HCM Volume to Capacity ratio	0.16
Actuated Cycle Length (s)	60.0 Sum of lost time (s) 12.0
Intersection Capacity Utilization	29.5% ICU Level of Service A
Analysis Period (min)	15

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor												
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected												
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted												
Satd. Flow (perm)	1306	3539	1583	1263	3539	1583	1376	3539	1583	1397	3539	1583
Volume (vph)												
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)												
RTOR Reduction (vph)	0	0	90	0	0	16	0	0	13	0	0	39
Lane Group Flow (vph)												
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases												
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)												
Effective Green, g (s)	22.0	17.0	17.0	22.0	17.0	17.0	22.0	17.0	17.0	22.0	17.0	17.0
Actuated g/C Ratio												
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)												
v/s Ratio Prot	0.00	c0.03		c0.00	0.02		c0.01	0.00		0.00	0.01	
v/s Ratio Perm												
v/c Ratio	0.05	0.12	0.08	0.06	0.08	0.01	0.14	0.01	0.01	0.05	0.03	0.03
Uniform Delay, d1												
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.21	1.15	1.49	1.00	1.00	1.00
Incremental Delay, d2												
Delay (s)	12.4	16.2	16.1	12.5	15.9	15.5	15.7	17.9	23.0	12.4	15.6	15.7
Level of Service												
Approach Delay (s)		15.8			15.1			17.2			14.9	
Approach LOS												

HCM Average Control Delay		HCM Level of Service	
HCM Volume to Capacity ratio	0.12		
Actuated Cycle Length (s)		Sum of lost time (s)	
Intersection Capacity Utilization	25.2%	ICU Level of Service	A
Analysis Period (min)			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.70	1.00	1.00	0.70	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1309	3539	1583	1303	3539	1583	1312	3539	1583	1368	3539	1583
Volume (vph)	56	7	64	26	7	2	30	2	20	24	2	32
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	61	8	70	28	8	2	33	2	22	26	2	35
RTOR Reduction (vph)	0	0	51	0	0	16	0	0	23	0	0	24
Lane Group Flow (vph)	61	8	19	28	8	4	33	2	21	26	2	11
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated g/C Ratio	0.33	0.27	0.27	0.33	0.27	0.27	0.42	0.33	0.33	0.38	0.32	0.32
Effective Green, g (s)	20.0	16.0	16.0	20.0	16.0	16.0	25.0	20.0	20.0	23.0	19.0	19.0
Actuated g/C Ratio	0.33	0.27	0.27	0.33	0.27	0.27	0.42	0.33	0.33	0.38	0.32	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	436	944	422	433	944	422	554	1160	528	531	1121	501
v/s Ratio Prot	c0.01	0.02		0.00	0.02		c0.02	0.01		0.00	0.01	
v/s Ratio Perm	0.03		0.01	0.02		0.00			0.01			0.01
v/c Ratio	0.13	0.09	0.04	0.06	0.08	0.01	0.23	0.03	0.02	0.04	0.02	0.02
Uniform Delay, d1	13.8	16.7	16.5	13.5	16.7	16.2	11.6	13.5	13.5	11.6	14.0	14.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.1
Delay (s)	14.4	16.7	16.5	13.8	16.7	16.3	11.9	13.5	13.5	11.7	14.1	14.2
Level of Service	B	B	B	B	B	B	B	B	B	B	B	B
Approach Delay (s)		16.0			16.0			12.5			13.5	
Approach LOS		B			B			B			B	

Intersection Summary					
HCM Average Control Delay	14.5	HCM Level of Service		B	
HCM Volume to Capacity ratio	0.17				
Actuated Cycle Length (s)	60.0	Sum of lost time (s)		12.0	
Intersection Capacity Utilization	29.8%	ICU Level of Service		A	
Analysis Period (min)	15				

c Critical Lane Group