TRAFFIC IMPACT STUDIES

BOWLING GREEN, KENTUCKY

Prepared For:

The City of Bowling Green
Public Works Department

Prepared By:

GRESHAM
SMITH AND
PARTNERS

June 2002

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CITY OF BOWLING GREEN
GUIDELINES FOR TRAFFIC IMPACT STUDIES

INTRODUCTION – WHY DO WE DO TRAFFIC IMPACT STUDIES

Traffic impact studies are conducted to evaluate the impacts of proposed land developments on the existing transportation network. The proposed developments could consist of new office buildings, subdivisions or shopping centers. Proposed changes in land use might include the redevelopment of an existing area into areas that include mixed uses. The studies are designed to assist the public works department and private planners in making decisions to the allowance of major land use changes or new developments. Traffic impact studies should project future transportation needs, assess impact of changes in land use, and suggest ways for mitigating the adverse effects of land use changes.

It is important to recognize that the results and recommendation of the studies are dependant on the experience and knowledge of the persons conducting the study as well as those reviewing the study.

SECTION 1. - WHEN TRAFFIC IMPACT STUDIES ARE REQUIRED

Generally a Traffic Impact Study may be required as a part of the approval process for any of the following:

- Zoning Change
- Building Permit
- Subdivision Certification

Traffic impact studies shall be submitted if a specific development will generate more than a specific number of daily trips, or when over a certain acreage is being rezoned. For most cases, if the development site 24-hour trip generation is above 500 ADT or development site peak hour trips is above 100 per hour a traffic impact study is required. These trip generation rates can be obtained from the Institute of Transportation Engineers Trip Generation Manual. A traffic impact study may also be required for a development located near a sensitive area, a high accident location or an area already suffering from congestion. In addition, a traffic impact study can be required at the discretion of the city engineer based on professional judgment, even if the above-mentioned thresholds are not met.

SECTION 2. - SCOPE OF REQUIRED TRAFFIC IMPACT STUDIES (TIS)

Traffic impact studies should be prepared under the supervision of a registered Professional Engineer in the State of Kentucky who has experience and specific training in traffic and transportation engineering with several years of experience related to preparing traffic studies for existing and proposed developments.

Prior to beginning a traffic study, the engineer must meet with the City to determine the scope of the work to be performed. The City will work with the developer and the traffic engineer to determine appropriate assumptions for the analysis. The following items should be discussed at this preliminary study meeting:

- The level of detail needed for the study.
- Trip generation rates to be used.
- If pass-by or modal split analysis is required.
- The need for internal circulation analysis.
- Reductions to trips due to internal circulation, if appropriate.
- List of approved projects close to the site to be considered.
- Assumptions for area wide growth (Background traffic calculation methods).
- Consideration of phased development and transportation improvements.
- Identification of study area and key intersections.
- Identification of high accident areas.
- If consideration of pedestrian, bicycle or transit impacts are needed.
- Analysis period and the typical peak hours for the proposed land use.
- Analysis software to be used.

Three levels of study have been identified based on the number of trips that a development is projected to generate in a 24-hour period and during peak hour. Table 1 is offered as a general guideline of typical requirements. The City Engineer may have further requirements based on site-specific conditions.

The study should incorporate all transportation and land development information that is current and available. Table 9-2 from the ITE Traffic Engineering Studies Handbook should be reviewed to determine if any additional information on background data is needed. The following is a list of items typically required for a traffic study:

- Peak-period turning movements
- Adjustment factors
- 24-hour machine counts to verify peaking characteristics
- Traffic control devices
- Signal phasing and timing
- Roadway configuration, geometric features and lane usage
- Parking regulations
- Posted speed
- Driveways across or adjacent to site
- Transit stops
- Adjacent land use
- Pedestrian volumes
- Functional classification of roadway(s)

There may be other items that must be collected and would be required on a case-by-case basis.

Table 1 – Levels of Traffic Impact Study

Project Category	Criteria	Study Horizon	Study Area
I	Projected site-generated ADT of 500-3000 OR Projected site-generated peak hour trips of 100-500 per hour AND No significant modification of traffic signals or roadway geometry proposed	Year of completion, assuming full build- out and occupancy	All site access points, adjacent roadways, and major intersections. All signalized intersections on each street serving the site within 1/4 mile
II	Projected site-generated ADT of 3000-6000 OR Projected site-generated peak hour trips of 500-1000 per hour OR Installation or modification of traffic signals or roadway geometry proposed, regardless of project size	Year of completion, assuming full build- out and occupancy AND Five years after completion	Same as 1 and 2 in category I. All signalized and major unsignalized intersections on each street serving the site within 1/4 mile
III	Projected site-generated ADT > 6000 OR Projected site-generated peak hour trips > 1000 per hour OR Installation or modification of two or more traffic signals, addition of travel lanes, or modification of interchange proposed, regardless of project size	Year of completion, assuming full build- out and occupancy AND Five years after completion	Same as 1 and 2 in category I. All signalized and major unsignalized intersections on each street serving the site within ½ mile

SECTION 3 - SUBMISSION AND REVIEW PROCEDURES FOR TRAFFIC IMPACT STUDIES

1. The City should be consulted to determine if a traffic impact study is warranted even if the trip generation does not meet the required thresholds for a study.

2. A preliminary trip generation assessment of proposed development should be conducted to determine if a traffic study would be required. If the preliminary assessment indicates that a traffic study will be required, the applicants should immediately consult with City of Bowling Green, Public Works Department to verify a development's projected trip generation, and to confirm whether or not a study will be required. If a study is required, the required level can be determined at that time along with other necessary parameters.

3. The City of Bowling Green shall review the draft traffic study in conjunction with the other elements of the development application. If the draft study is not of the proper scope or is executed improperly, the applicant shall be notified of the deficiencies and be required to submit corrections on the same schedule that applies to the other elements of the development application. Failure to submit corrections in a timely fashion may lead to a postponement of the application.

4. Three (3) copies of the final TIS report including all necessary backup data should be submitted no later than two weeks prior to the scheduled Planning & Zoning meeting.

5. The final TIS report must be stamped and signed by a registered professional engineer with experience in traffic and transportation engineering.

6. Any traffic study will need to be revised if the proposed land use is changed by type or size. In addition, any traffic study may need to be revised if the study is older than 2 years and the city engineer determines that the existing conditions have changed enough to invalidate the study results or if the initial study assumes an incorrect build out period.

SECTION 4. - FUNDING RESOURCES

The traffic impact study may take into account the city/state/county approved traffic improvements with dedicated funding. The City Engineer or his/her designee will determine what approved traffic improvements may be considered. The developer prior to the issuance of the occupancy permit shall complete any required traffic improvements, which have not been funded or otherwise completed by the government agencies. When it can be demonstrated that a development will only partially contribute to the need for additional off-site improvements, the city may require a pro-rated contribution according to the percentage of traffic added by the development. The City will verify that all traffic improvements to be provided by the developer or property owner have been properly bonded prior to building permit issuance and completed before a use and occupancy permit shall be issued.

SECTION 5. - TRAFFIC IMPACT STUDIES REPORT REQUIREMENTS

It is recommended that along with the requirements provided in these guidelines, the most recent version of the following resources should be referenced during the development of a traffic impact study.

- Highway Capacity Manual
- Manual of Uniform Traffic Control Devices
- Trip Generation, ITE
- Trip Generation Handbook, ITE
- Trip Generation User's Guide, ITE
- Traffic Engineering Handbook, ITE
- Manual of Transportation Engineering Studies, ITE

This section defines the elements that are required in a traffic impact study. A thorough report shall address each of the items discussed in the following section.

I. Introduction

A. Description of site location and study area including a location map identifying key intersections and other approved projects in the vicinity. (See Figure 1 for example).

B. Development Description shall include type of land use and the following information where applicable:

1. If residential, number and type of dwelling units
2. If commercial or industrial, square footage and type of development
3. Detailed site plan
4. Development phasing and timing

C. Selection of analysis period shall be based on the proposed land use and the typical peak hours listed in Table 2. Many nearby land uses may influence peak times of a particular intersection. For example an intersection near a hospital may peak during a mid-afternoon shift change rather than the typical pm peak hour. Schools, churches, hospitals or shipping centers may impact peak periods due to their individual peaking characteristics. **Care should be given to understand the surrounding land uses before scheduling peak hour counts over a limited time period. An investigation of the daily counts prior to collecting the peak-hour counts would allow a determination of a typical range of peak hour traffic movements on a roadway facility.** If land uses other than the ones shown in Table

2 are being studied, then professional judgment of the City Engineer or his/her designee will determine the appropriate times for analysis.

Table 2 – Typical Peak Flow Traffic Hours

Land Use	Typical Peak Hours
Residential	7:00-9:00 am weekday 4:00-6:00 pm weekday
Regional Shopping center	5:00-6:00 pm weekday 2:30-3:30 pm Saturday 12:30-1:30 pm Saturday
Office	7:00-9:00 am weekday 4:00-6:00 pm weekday
Industrial	Varies
Recreational	Varies
Hospital	Varies based on shift changes
School	Varies based on school release times

I. Existing Conditions

A thorough review of available data and existing conditions at the site shall include at a minimum the following items:

A. A site visit by the engineer of record.

B. Study area land use

   1. Existing land use
   2. Existing zoning

C. Site access will be shown on the plan and reviewed for sufficiency of operation and impacts to the surrounding roadway system.

D. Posted speed on all existing roads that may be significantly impacted by the development.

E. Transit stops along the existing roads in the area.

F. Distances from existing streets, driveways, and/or median cuts to development access.

G. Alignment with existing streets, driveways, and/or median cuts to development access.

H. Intersection layout, lane usage and roadway configuration.

I. Traffic control devices such as traffic signals or stop signs.

J. Traffic signal timing and phasing – Offset times should be shown if any coordination with adjacent signals is being used.

K. Right of way width(s) all existing roads that may be significantly impacted by the development.

L. Lane width(s) for all lanes

M. Daily and peak-hour traffic counts should be collected for use in the traffic impact study. At a minimum a 24-hour count should be taken on a typical Tuesday, Wednesday or Thursday for all roadways in the study area. However, the type of development or local conditions may require counts be taken on weekends. Peak-hour intersection turning movement counts (15 min. increment) at key intersections should also be taken. Peak-hour counts shall usually be 7-9 AM and 4-6 PM on a typical Tuesday, Wednesday, or Thursday (See Table 2 for suggested typical peak hour times based on land use). As with the daily counts, peak-hour counts may vary. Traffic counts used in a study should be less than one year old. The City reserves the right to request more counts if they are deemed necessary based on specific conditions. The existing counts should be presented in a diagram form similar to that in Figure 2 for each intersection counted (Also see Appendix).

N. Pedestrian facilities and volumes (If appropriate)

O. Level of service of roadway sections and intersections - The latest edition of Highway Capacity Manual (HCM) shall be used. Traffic analysis software may be used. The latest edition of Highway Capacity Software shall be used or prior approval of alternate software may be requested from the City Engineer or his/her designee during the preliminary study meeting.

P. Photographs may be used to document existing conditions of the site.

II. Projected Traffic

A. The calculation of the project traffic shall be shown in sufficient detail so that all calculations can be checked by the City Engineer or his/her designee. In addition, descriptions of the following items shall be included in the report.

B. Site Traffic (Daily, a.m. and p.m. peak)

1. Trip Generation - List of trip generation rates and sources of rates used for the study. The latest edition of the Trip Generation Manual from ITE shall be used. Calculation of trip ends assuming 100% occupancy and development.

2. Trip Distribution and Assignment - The gravity model or other locally acceptable trip distribution model can be used to estimate site trip distribution. Trip Distribution and Assignment can be accomplished either manually or with applicable computer models. A figure showing the trip distribution is required. (See Figure 3)

C. Background Traffic (Daily, a.m. and p.m. peak) - This shall account for all approved developments in the study area as well as area growth beyond study area. Typically this is determined through analysis of historical trends in the region. This should be discussed at the preliminary study meeting. If necessary, this peak-hour data shall also be shown in a figure similar to that for the existing traffic.

D. Reassignment rates for pass-by and diverted trips - A procedure for calculating pass-by trips is described in Chapter 5 of the ITE Trip Generation Handbook based on different land use classifications. Table 3 shows values to be used for the most typical land use types. Table 4 lists the additional available land use types with pass-by trip reduction data in the ITE Trip Generation Handbook. Reduction for any other land use types must be thoroughly documented and approved by the City Engineer or his/her designee. Any reduction for pass-by trips must be approved by the City Engineer or his/her designee prior to the submittal of a report.

E. Internal capture can be accounted for using the forms provided in Figure 5a and 5b and the procedures described in Chapter 7 of the ITE Traffic Engineering Handbook.

F. Total Traffic shall be shown combining project and background traffic and shown in figure form for each intersection as in Figure 4 (Also see Appendix)

G. Future Traffic (if required) shall also be calculated and shown in similar figure format.

Table 3 - Pass-By Trip Reduction For Typical Land Uses

Land Use	Acceptable Trip reduction
Retail > 400,000 GLA	20 %
Retail 100,000-400,000 GLA	25 %
Retail <100,000 GLA	35 %
Quality / Sit-down Restaurants	15 %
Fast-food Restaurants	35 %
Convenience/Gas Stations	40 %
Banks	15 %
Supermarket	20 %
Discount Club/Warehouse Store	20 %

Table 4 – Additional Pass-by trip data (See ITE Trip Generation Handbook)

ITE Land Use Codes	Description
815	Free Standing Discount Store
820	Shopping Center
831	Quality Restaurant
832	High Turnover (Sit Down) Restaurant
834	Fast Food Restaurant with Drive-through window
843	Automobile Parts Sales
844	Gasoline/Service Station
845	Gasoline/Service Station with Convenience Market
848	Tire Store
850	Supermarket
851	Convenience Market (Open 24-hours)
853	Convenience Market with gasoline pumps
854	Discount Supermarket
862	Home Improvement Superstore
863	Electronics Superstore
880	Pharmacy/Drugstore without Drive-through window
881	Pharmacy/Drugstore with Drive-through window
890	Furniture Store
912	Drive-in Bank

III. Traffic Analysis

The following information should be included in the report describing the detailed analysis performed for this study.

A. Projected Capacity and Level of Service (Background traffic and total traffic) for the study horizon years described in Table 1.

1. Signalized intersection analysis.
2. A capacity analysis using projected traffic volumes must be conducted using the latest edition of the Highway Capacity Manual (HCM).

3. Traffic analysis software may be used. The latest edition of Highway Capacity Software shall be used or prior approval of alternate software may be requested from the City Engineer during the study kickoff meeting.

    - Unsignalized intersections and traffic signal warrant analysis if applicable. A capacity analysis using projected traffic volumes must be conducted using the latest edition of the Highway Capacity Manual (HCM). If signalization is warranted by the traffic signal warrants outlined in the Manual on Uniform Traffic Control Devices (MUTCD), conduct a complete warrant analysis and analyze the intersection(s) as signalized intersection(s).

4. Roadway network - Impacts to LOS on key mainline roadway links should be determined.

5. Turning vehicle storage space needed or the adequacy of storage space for turning vehicles at study intersections should also be analyzed. This analysis should consider signal phasing and overall signal cycle length, as well as vehicle volumes. Analysis of queuing may be required.

B. A table for each of the following information will be provided. The AM and PM peak-hour data will both be shown unless determined otherwise by the City Engineer or his/her designee.

    - Existing LOS and delay.
    - Background LOS and delay without development.
    - Future LOS and delay with development.

C. Site circulation and parking requirements - Driveways should be designed considering the amount and type of traffic that will be using both the driveway and the adjacent street. Adequate access for service vehicles should be reviewed by determining the size and operating characteristics of service vehicles, particularly the turning radii. In addition, driveway throat lengths should also be considered.

D. Determine impacts to nearby neighborhoods and evaluate the potential need for any traffic calming.

E. Accident analysis may be required at intersections that currently have a high number of accidents.

F. Additional facilities

    - Sidewalks
    - Transit stop(s)
    - School bus stops

IV. Conclusions and Recommendations

The final section of the report should summarize the overall impact of the development and include the following information.

A. Site access/circulation plan

B. Intersection improvements addressing, at a minimum, the following:

1. Traffic control device(s) - modify existing or need for new
2. Additional lanes needed (left, right or thru)
3. Acceleration and/or deceleration lanes
4. Length of storage bays
5. A detailed drawing of any intersection improvements shall be included in the report.
6. Implementation schedule

C. Off site improvements

1. Modification to existing traffic control device(s)
2. Additional traffic control device(s), additional lane at major intersections, and additional roads
3. Other improvements if applicable

NOTE: The goal of the traffic impact analysis is that the level of service (LOS) resulting from the new development be no worse than the existing LOS. Any degradation in LOS shall be mitigated. Additionally, the LOS resulting from the new development shall be no worse than LOS D without the requirement of mitigation measures.

V. Appendix

The following appendices should be included in a bound report submitted to the public works department.

A. Raw traffic count data

B. Printouts of analysis results

C. Photographs of site

D. Additional tables or figures not included in report

E. Professional staff qualifications and experience

Traffic Impact Study Checklist
City of Bowling Green, Kentucky

Preliminary Meeting

- ❑ Met with the City Prior to beginning the study
- ❑ Analysis needed for AM and PM Weekday
- ❑ Analysis needed for Weekend
- ❑ Analysis needed for Mid-day Weekday or school period

Existing Conditions

- ❑ Existing zoning (source cited)
- ❑ Geometric parameters of existing roads from governing body
- ❑ Existing traffic counts
- ❑ Six-hour intersection counts by engineer (eight hours if a traffic signal warrant will be conducted)
- ❑ 24-hour volume counts by direction of engineer (Tuesday to Thursday, or possibly weekend)

Site Traffic

- ❑ Clear and concise description for trip generation purpose (source cited)
- ❑ Vicinity map
- ❑ Site plan
- ❑ Trip generation using the latest edition of ITE Trip Generation Manual
- ❑ Trip distribution (Each step of this procedure should be clearly shown in enough detail so that all calculations can be checked)
- ❑ Account for pass-by trip and internal capture reductions.

Background Traffic

- ❑ Clear and concise description for trip generation purpose (source cited)
- ❑ Vicinity maps of background sources
- ❑ Trip generation using the latest edition of ITE Trip Generation
- ❑ Trip distribution (Each step of this procedure should be clearly shown in enough detail so that all calculations can be checked)

Traffic Analysis (performed by engineer)

- ❑ Existing level of service (LOS) analysis using latest version of HCS software or other software agreed upon by the city.

- Background LOS analysis using latest version of HCS software or other software agreed upon by the city.
    - Capacity analysis for unsignalized intersection using latest version of HCS software or other software agreed upon by the city.
    - Signal warrants analysis using Manual on Uniform Traffic Control Devices
    - Capacity analysis for signalized intersection using latest version of HCS software or other software agreed upon by the city (if existing or warranted)
    - Turning vehicle storage space (queuing) analysis
- Projected LOS analysis using latest version of HCS software or other software agreed upon by the city.
    - Capacity analysis for unsignalized intersection using latest version of HCS software or other software agreed upon by the city.
    - Signal warrants analysis using Manual on Uniform Traffic Control Devices (MUCTD)
    - Capacity analysis for signalized intersection using latest version of HCS software or other software agreed upon by the city. (if existing or warranted)
    - Turning vehicle storage space (queuing) analysis
- Site circulation/parking analysis
- Safety / site distance analysis
- Discussion of additional facilities (sidewalks, bus stops, etc.)

Conclusions and Recommendations

- Recommended site modifications (include drawings)
- Recommended intersection improvements (include drawings, timing methods, etc.)
- Recommended off-site improvements (include drawings)

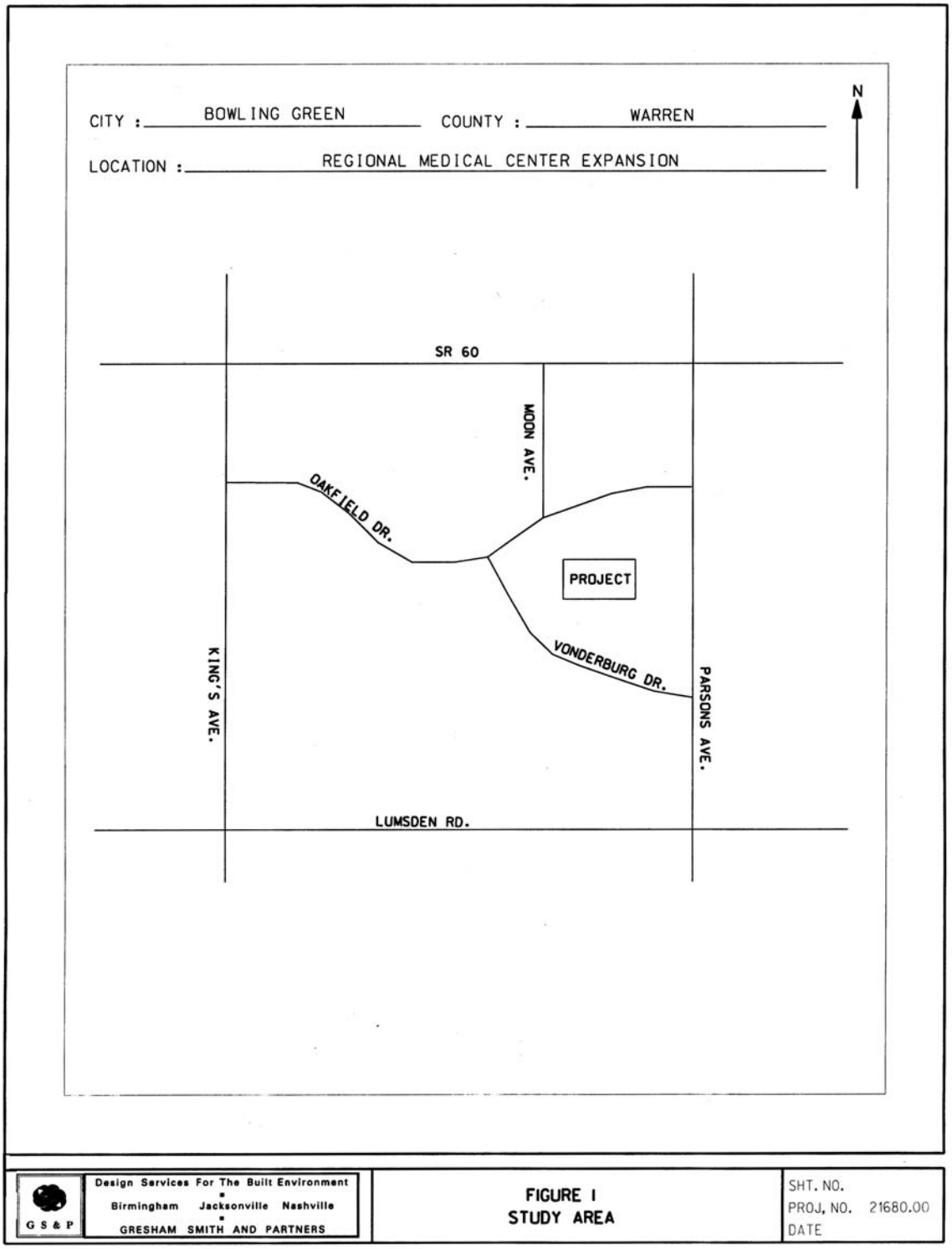
Documentation

- Raw traffic count data
- ITE Trip Generation summary
- Capacity analysis printouts and data file
- MUTCD Traffic Signal Warrant worksheets

Report

- ❑ Signed and stamped by registered Professional Engineer in the State of Kentucky

NOTE: This checklist is provided for convenience only and represents only a partial list of the requirements for any given study. For the full requirements see the Bowling Green Traffic Impact Study Guidelines.

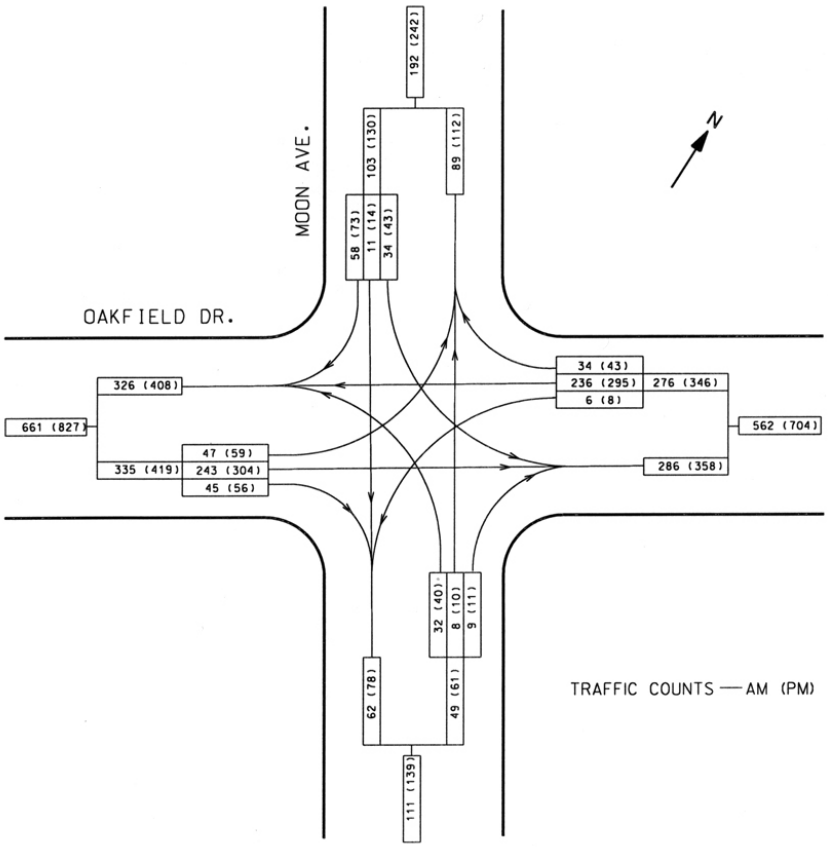

CITY : BOWLING GREEN
COUNTY : WARREN
LOCATION : REGIONAL MEDICAL CENTER EXPANSION
N
SR 60
MOON AVE.
OAKFIELD DR.
PROJECT
VONDERBURG DR.
KING'S AVE.
PARSONS AVE.
LUMSDEN RD.
G S & P
Design Services For The Built Environment
Birmingham Jacksonville Nashville
GRESHAM SMITH AND PARTNERS
FIGURE 1
STUDY AREA
SHT. NO.
PROJ. NO. 21680.00
DATE

TURNING MOVEMENT COUNT SUMMARY SHEET

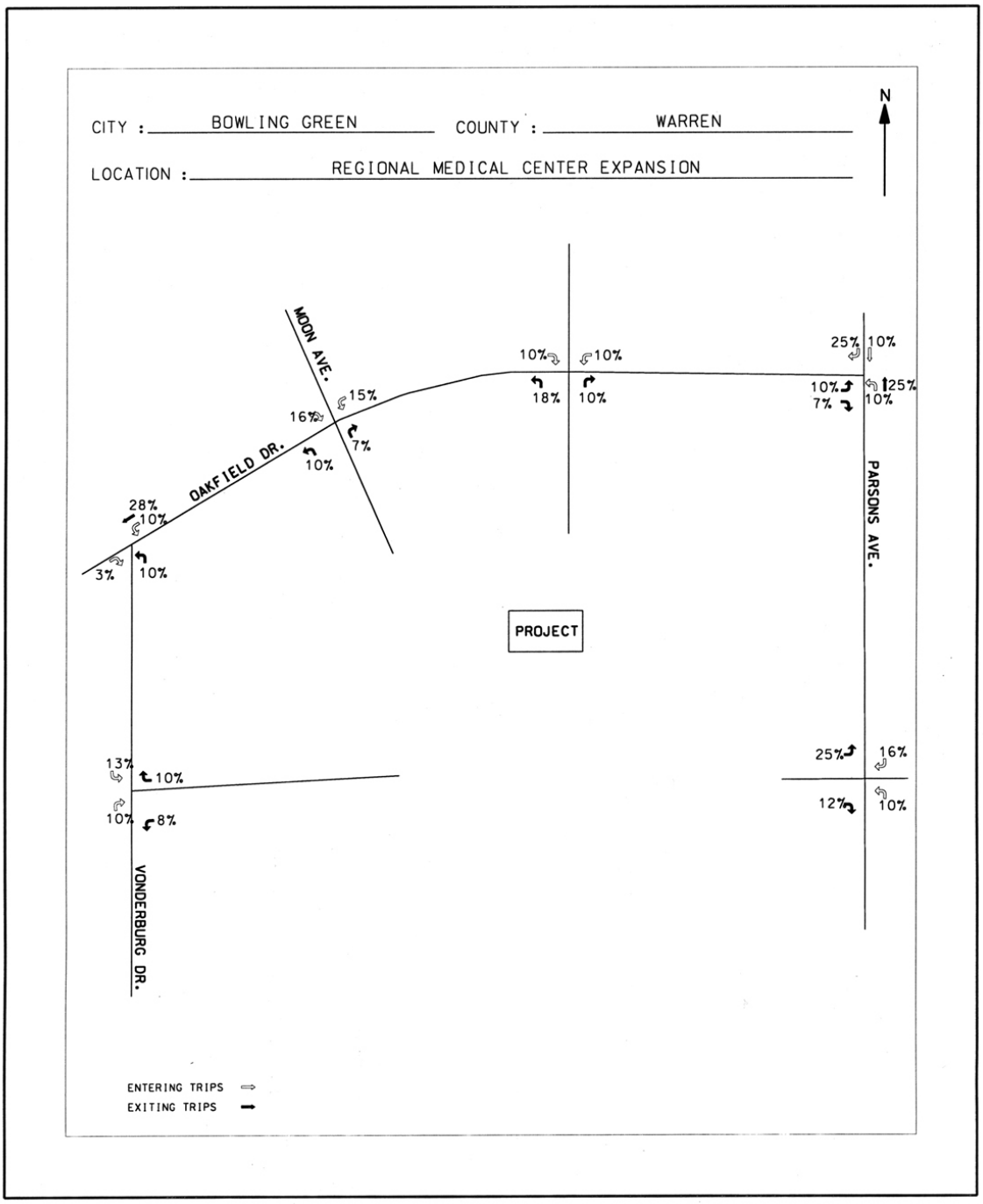
CITY : BOWLING GREEN, KY COUNTY : WARREN

LOCATION : OAKFIELD DR. & MOON AVE.

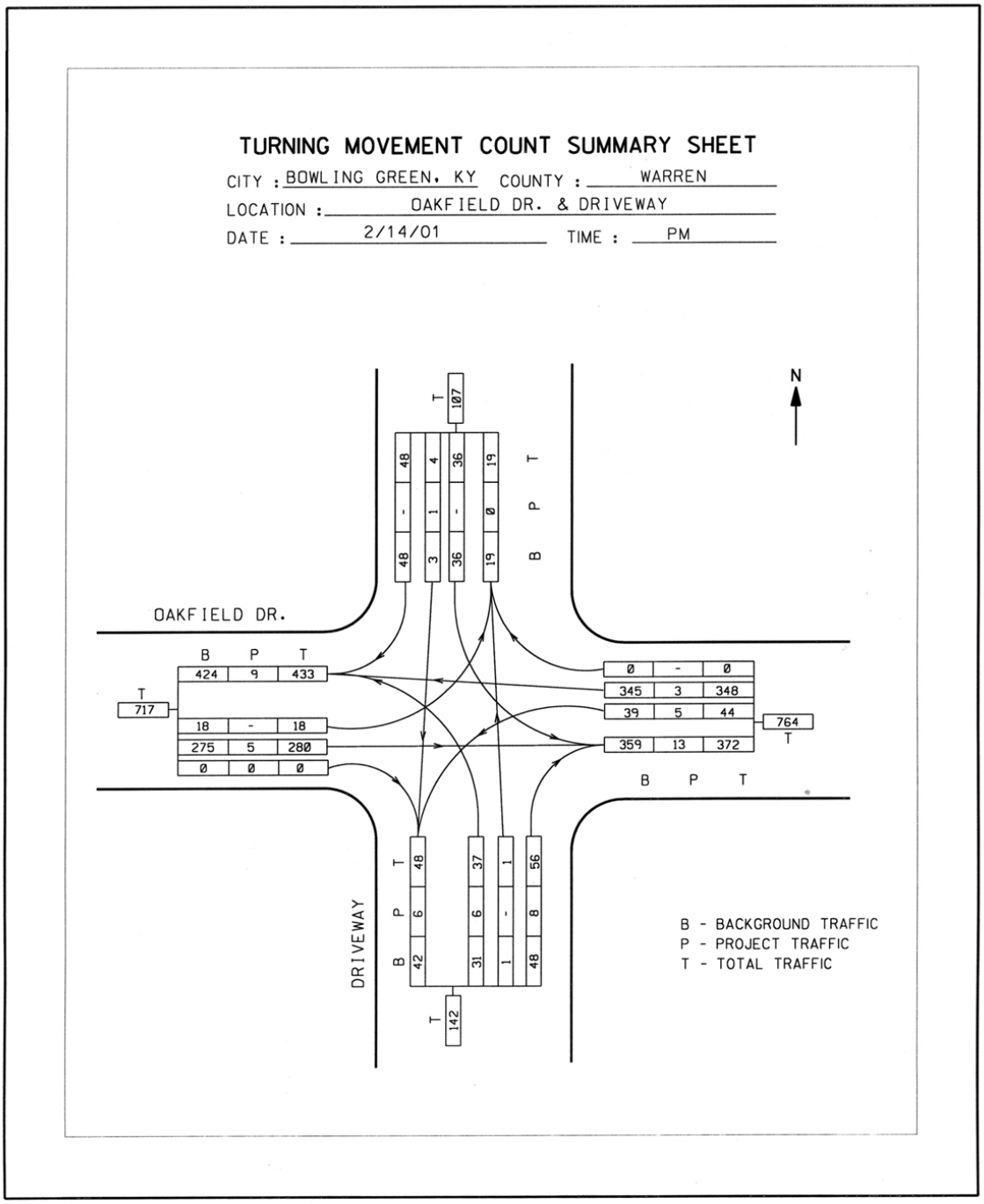
DATE : 2/14/01 TIME : AM (PM)



GS&P — Design Services For The Built Environment • Birmingham Jacksonville Nashville • GRESHAM SMITH AND PARTNERS	FIGURE 2 EXISTING TRAFFIC COUNTS	SHT. NO. PROJ. NO. 21680.00 DATE



G S & P	Design Services For The Built Environment Birmingham Jacksonville Nashville GRESHAM SMITH AND PARTNERS	FIGURE 3 EXISTING TRIP DISTRIBUTION	SHT. NO. PROJ. NO. 21680.00 DATE



GS&P — Design Services For The Built Environment · Birmingham Jacksonville Nashville · GRESHAM SMITH AND PARTNERS	FIGURE 4 PEAK HOUR TRAFFIC WITH PROJECT	SHT. NO. PROJ. NO. 21680.00 DATE

Figure 5a – Internal Capture Form #1

Figure 5a

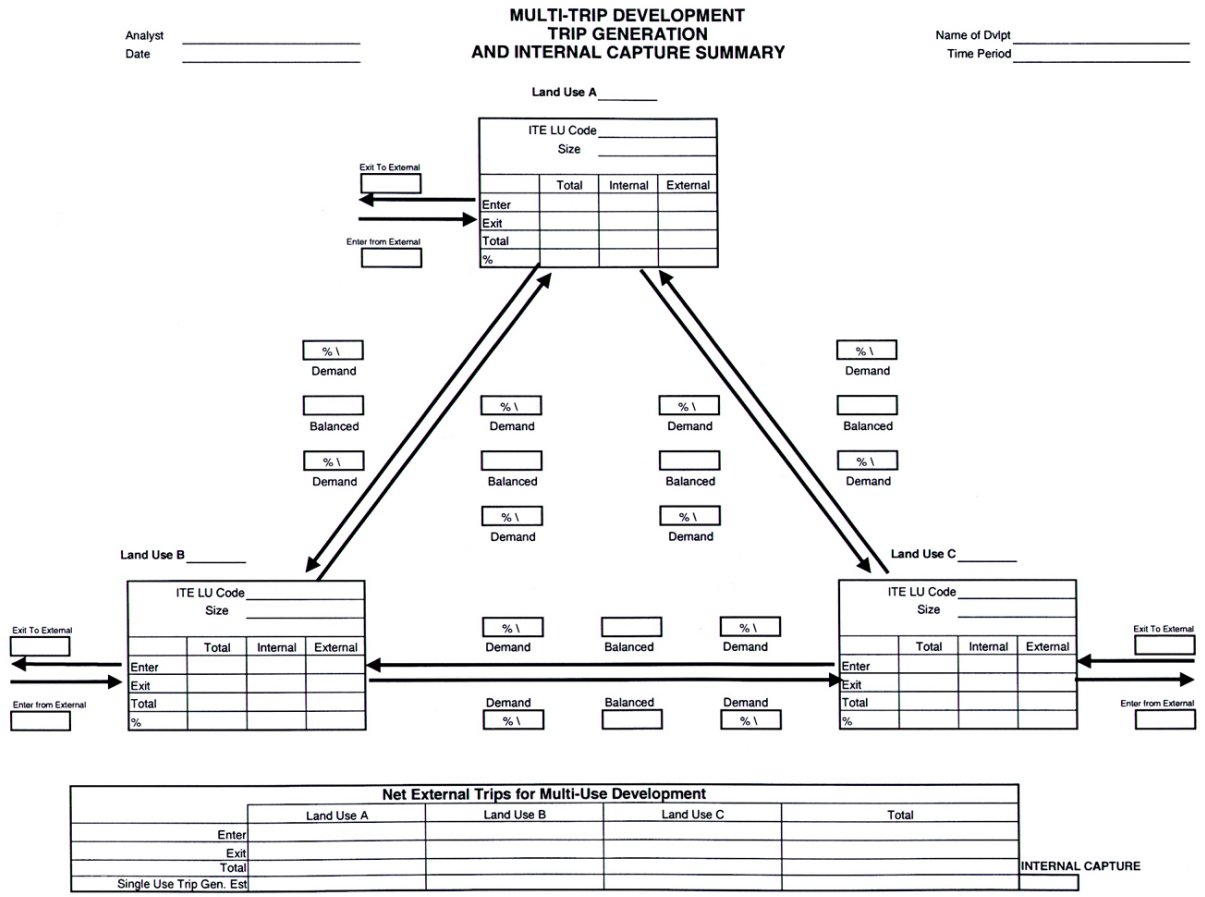
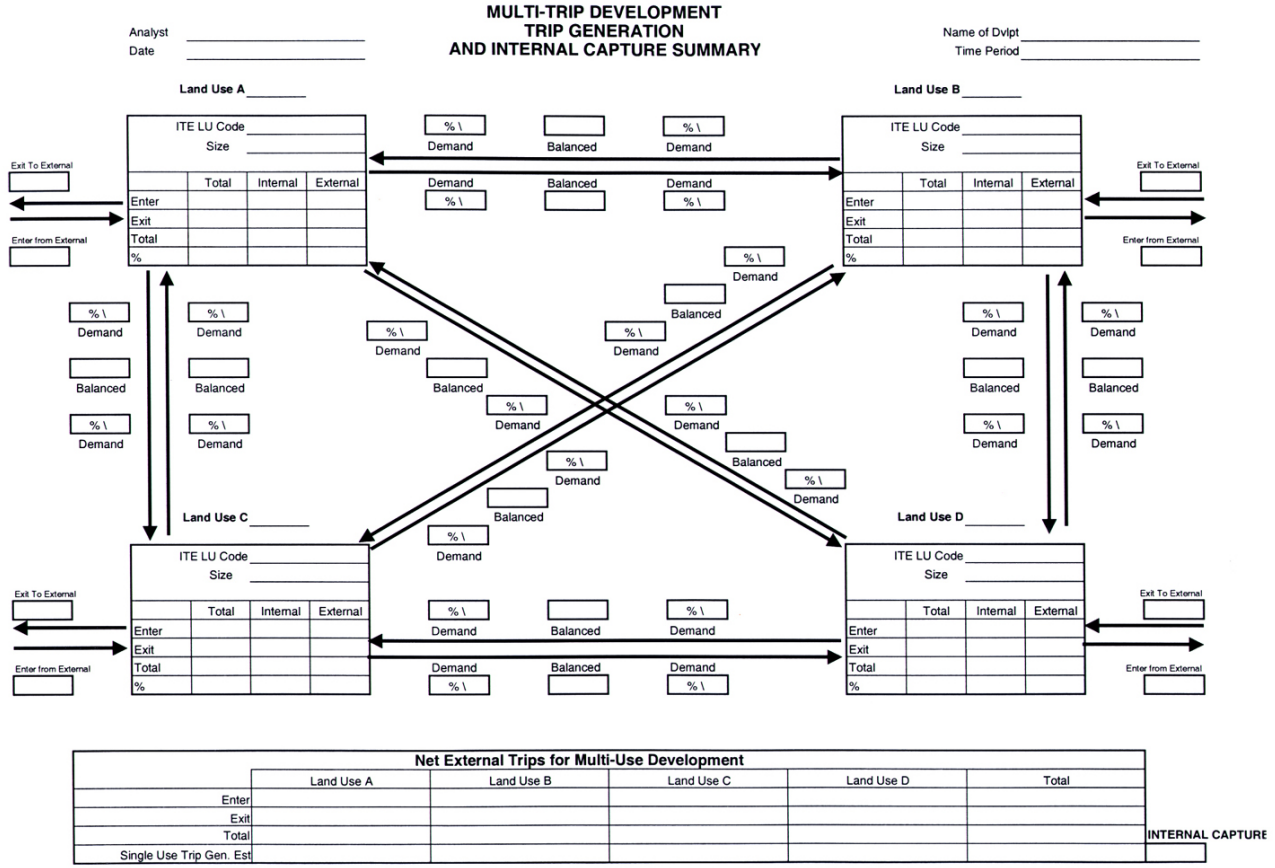


Figure 5b – Internal Capture Form #2

Figure 5b



APPENDIX A
TO
TRAFFIC IMPACT STUDIES:

TECHNICAL NOTES

TECHNICAL NOTES

A. **Trip Generation:** Average trip generation rates or regression equations for the peak hour of the adjacent street will be obtained form the current edition of the Institute of Transportation Engineer's Trip Generation Manual. Other local data may be acceptable provided it was collected using recommended methodology and can be properly document.

B. **Peak Hour Percent:** A peak hour percentage of 10 percent of the daily trips will be assumed for existing traffic unless hourly counts are available.

C. **Peak Hour:** Generally, the petitioner shall use the peak one hour period which occurs during either 7-9 A.M. or 4-6 P.M. periods or both, as agreed to by the staff and petitioner. In some cases, however, the City Engineer or his/her designee may require additional hours, for example, Friday nights or Saturday afternoon, to also be analyzed dependent upon the land use type being proposed.

D. **Directional Split:** The directional split of the entering and exiting traffic associated with the development will be derived from the ITE Trip Generation manual unless other acceptable locally generated data is available.

E. **Pass-by Trips:** The percent of pass-by trips shall be applied to the trips generated by the proposed development and assigned to the adjacent street network. This rate does not affect the proposed project's driveway volumes but rather reassigns existing trips to movements entering and existing the proposed development. The pass-by trip rates will be agreed upon during the preliminary meeting. The following pass-by trip rates have been determined for some land uses:

Land Use	Acceptable Trip Reduction
Retail > 400,000 GLA	20 %
Retail 100,000-400,000 GLA	25 %
Retail <100,000 GLA	35 %
Quality / Sit-down Restaurants	15 %
Fast-food Restaurants	35 %
Convenience/Gas Stations	40 %
Banks	15 %
Supermarket	20 %
Discount Club/Warehouse Store	20 %

F. Diverted Linked Trips: A reassignment for diverted trips will generally occur outside the impacted study area; therefore, for the purpose of these traffic impact studies, diverted trips would be considered “new trips” within the study area and can be ignored in most cases. This factor, if applicable, will be decided during the preliminary meeting.

G. Internal Circulation Trips: Reductions for internal circulation trips are applicable for projects such as shopping centers with out-lots and represents a reduction in projected driveway trips. The internal circulation trip rate will be agreed upon during the preliminary meeting and shall not exceed 10 percent.

H. Trip Distribution: The directional distribution of the generated trips entering and exiting the proposed development via all access points must be justified by the relative locations of other traffic generators (e.g., employment centers, transportation terminals, etc.) and/or trip table information. These factors, or other factors agreed upon by the staff, shall be applied to the traffic generated by the proposed development as well as the traffic generated by nearby approved projects.

I. Trip Assignment: The distribution factors shall be applied to the trips generated by the proposed development and nearby approved projects and assigned to the existing traffic on the road network providing access to the proposed development.

J. Capacity Analysis: At the identified critical intersection(s), the existing and generated traffic is to be related to the adequacy of the intersection by using the techniques described in the latest edition of the Highway Capacity Manual. The BGPW staff has the necessary computer program to review and verify this analysis. The analysis should be carried out for the A.M. and/or P.M. peaks, as agreed to by the staff and petitioner. This analysis should use traffic data for non-holiday weekdays, unless specifically requested by BGPW staff to analyze other periods. It is also recommended that the operational methodology be used in the analysis of signalized intersections. If so desired, alternative capacity and level of service analysis techniques may be used, provided data is presented in such a form that the results may be duplicated using the latest version of the Highway Capacity Software and Signal Software sponsored by FHWA and McTrans, respectively.

K. Traffic Data:

1. Traffic volume data IS NOT available from BGPW at this time. Average Daily Traffic volumes, turning movement counts and traffic control signals data on roadways maintained by the Commonwealth

of Kentucky MAY BE available from the Transportation Cabinet. The above sources may be contacted concerning the availability of traffic data. If, however, acceptable data is not available, the petitioner is responsible for obtaining such data.

2. Traffic count data should be no older than one year or the city will require new counts be collected. If, in the opinion of the BGPW staff, traffic volumes have significantly increased due to some change(s) in the traffic pattern, such as the completion of a development project after the count was made new counts may also be required.
3. If turning movement data is outdated or if there are locations for which data is non-existent, data must be acquired at the applicant's expense.
4. Intersection traffic counts conducted by the petitioner should be comprised of manual turning movement counts covering the period of 7-9 A.M. and 4-6 P.M. (or agreed upon A.M. and P.M. peak times) in order to allow for the selection of the peak hour within the next fifteen minutes (e.g., 4:00-5:00, 4:15-5:15, etc.) The inclusion of all 7-9 A.M. and 4-6 P.M. turning movement data is requested as part of the petitioner traffic impact analysis. Summaries of each fifteen-minute period should be submitted, under separate cover, to BGPW
5. Ideally the traffic analysis should be performed for the design hour which represents the 30th highest hourly traffic volume on an annual basis. However, most peak hour traffic volume counts in urban areas closely approximate the 30th highest hour. Historical counts and staff knowledge of the area will be used to judge the adequacy of counts used by the applicant.
6. If the proposed development includes plans for the installation of a new traffic control signal, the petitioner must conduct a Traffic Signal Warrant Analysis. This analysis would produce documentation that indicates the conditions at the proposed location warrant a traffic signal by meeting the recommended minimum warrants presented in the Manual for Uniform Traffic Control Devices, (MUTCD). Documentation of this analysis should be included in the appendix of the final report and should include, but not be limited to, the methodology used, daily traffic count data used in the analysis, and the resulting capacity analysis results at this location.

L. Adequate Accommodation of Traffic: The ability of a highway system to carry traffic is expressed in terms of volume-to-capacity (V/C) ratios and

level of service at the critical locations, usually intersections. The V/C ratios clearly define the degree of saturation at an intersection. A V/C ratio of 1.0 indicates that the intersection is operating at its theoretical capacity, that is, the traffic volume demand equals the estimated number of vehicles that may pass through the intersection in a given period of time. A value of over 1.0 depicts a situation where the demand exceeds the intersection's capacity and operational problems exist, either in geometrics or signalization. As the V/C ratio approaches 0.9, breakdowns in the operational efficiency of the intersection tend to develop. When the V/C increases above 0.9, operational breakdowns also increase in frequency and may result in a high level of delay to motorists.

In considering mitigation measures, the change in V/C ratio and level of service must be taken into account as well as the actual V/C values of individual approaches and the overall intersection. If no mitigation exists or if the improvements required are beyond what could reasonably be expected from the petitioner, then negotiations between the petitioner and BGPW staff members will be conducted to determine the level of petitioner responsibility for improvements at the intersection.

Level-of-service for signalized intersections is defined by the Transportation Research Board's Highway Capacity Manual, in terms of delay. Generally, delay is considered a measure of driver discomfort, frustration, lost time and fuel consumption. Delay at signalized intersections is a result of a number of factors, including the signal's cycle length, phasing, progression in relation to other signals, traffic volumes and the intersection's lane configuration and geometrics.