Travis County

Guidelines for

Transportation Impact Analysis

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1. Background

The purpose of the Transportation Impact Analysis (TIA) Guidelines is to provide development and transportation consultants with the framework and guidance to prepare TIAs for review by Travis County. These guidelines also outline the basic information that must be contained in a TIA. The TIA will be valid for a period of up to five years, from the date sealed by the preparing engineer.

A TIA is required to assess the transportation aspects of a proposed development that has the potential of generating new vehicular trips. TIAs are also required when new developments and re-developments change the travel patterns in and adjacent to the development site.

A TIA will:

- Be signed and sealed by a Texas licensed professional engineer with demonstrated experience in traffic engineering.
- Provide information on the projected traffic generated by a proposed development.
- Assess the effects of the proposed development on the surrounding transportation system and recommend measures and/or improvements to mitigate adverse effects on traffic operations caused by said development.
- Identify operational, geometric, and safety impacts, then recommend actions to address these concerns.
- Include, but not be limited to, capacity analysis, safety and geometric analysis, and conceptual plans or designs to support recommended mitigations.

2. Authority and Determination

According to Chapter 482, Section 482.301 of the Travis County Development Code:

> "A traffic impact analysis will be required for developments that generate traffic volumes in excess of 1,000 vehicles per day. A traffic impact analysis may be required for developments which generate less than 1,000 vpd depending on the type of access proposed, single versus multiple, or if the County believes that existing boundary streets which are affected by the subdivision access will require improvements to maintain an acceptable level of service at the intersections of the subdivision access roads."

The expected number of vehicular trips generated by a project will be determined by the latest ITE's Trip Generation Manual as approved by Travis County. If there is not an applicable land use code in the ITE Trip Generation Manual to determine the number of trips, an alternative method to determine the anticipated number of trips must be approved by Travis County.

An applicant or applicant's consultant shall submit a TIA determination worksheet to the Travis County TNR for review in the very early stages of the development submission process. The TIA determination worksheet shall contain trip generation information and details of the entire proposed development including future phases. Individual development phases, or portions of parcels, will not be considered as separate developments. The TIA determination worksheet shall include, but not be limited to:

1) Project location

2) Land use
3) Access points
4) Density
5) Phases of site construction
6) Timeline for occupancy.

Travis County Development Services Division (DSD) staff will review the TIA determination with the Road and Bridge Engineering Division and, if required, direct the applicant to submit a Draft TIA Scope to the Travis County Road and Bridge Engineering Division for review.

3. Projects Warranting a TIA - General TIA Scope

3-A. Purpose

A TIA scope is required to determine the extent of traffic analysis. The General TIA Scope guidelines will identify objective criteria to determine the study area and the analysis required.

If review of the TIA Determination Worksheet determines that a TIA is required for a proposed development, the TIA scope shall be submitted to the Road and Bridge Engineering Division and documented in MyPermitNow. The Road and Bridge Engineering Division will review the scope, then issue an approval to proceed if the guidelines have been followed.

These are general guidelines for preparing and submitting the scope of a TIA. However, there may be exceptions based on the development's land use and location. Engineering judgement will be applied where appropriate.

3-B. Submitting a TIA Scope

If a TIA is required, a Draft TIA scope shall be submitted to the Road and Bridge Engineering Division for review. In addition to the Draft TIA scope, the following background information on the development shall be provided if applicable for the development:

1) Project Location Map.
2) Proposed Site Plan.
3) Land uses, size, and intensity of the proposed development.
4) Phases of development and timeline/opening year along with the operating conditions for study (e.g. existing, forecasted, build, etc.).
5) Estimated trip rates, peak hour trips, and daily trips generated by the proposed development.
6) Proposed internal capture rates where applicable with appropriate supporting documentation/calculations and/or estimates considering size, location, and type of proposed development.

7) Proposed pass-by trip reduction rates where applicable with appropriate supporting documentation/calculations and/or estimates considering size, location, and type of proposed development.
8) Proposed transit trip reductions with appropriate supporting documentation/calculations and/or estimates considering location and type of proposed development as well as existing and proposed transit service adjacent to the proposed development.
9) Proposed background growth with appropriate supporting documentation/calculations considering location and type of proposed development.
10) List of affected Municipal and TXDOT roadways.

Once this information has been received, a Final TIA Scope, signed by the appropriate review agencies will be provided.

3-C. Intersection Capacity Analysis Scoping Guidance

Each proposed development will uniquely impact the transportation system due to their varying sizes, mixes of land uses, orientation to adjacent streets, etc. Intersections that are anticipated to be impacted by the development should be selected for analysis.

3-D. Road-Sizing Scoping Guidance

The following roadways should be identified for road sizing:

1) Roadways adjacent to the site for non-urban areas
2) Roadways for which significant intersection improvements (e.g. the addition of more than one turn lane) are needed on the approaches.
3) Internal or on-site roadways that connect to existing or planned external roadways.
4) Roadways for which future widening or construction is planned.

3-E. Access-Management and Queuing Analysis Scoping Guidance

Access-management and queuing analysis shall be performed and shall include the following:

1) In general, the number of driveways to/from proposed developments should be minimized. This is because numerous driveways create additional conflict points and speed differential thereby creating potential safety issues. New driveways' interaction with existing roads to be analyzed will be identified in the Final Scope. Access-management analysis shall be performed. This analysis shall include a determination of the need for turn lanes and/or deceleration lanes into the development based on roadway speed and safety considerations.
2) Determination of the need for deceleration lanes into the development based on roadway speed and safety considerations.

3-F. Scope Submittal Guidance and Scoping Meeting Requests

Following the general guidance described herein, a comprehensive draft TIA scope shall be submitted for review and approval by the Road and Bridge Engineering Division. Upon review and approval, the Road and Bridge Engineering Division shall send a signed copy of the approved TIA scope to the applicant's consultant.

Upon receipt of the approved TIA scope, if the applicant's consultant has any questions regarding the scope, they should communicate with the Road and Bridge Engineering Division or request a meeting. TIAs received without an approved scope will not be accepted or reviewed by the Road and Bridge Engineering Division.

3-G. Joint Scopes with other Jurisdictions

Projects that impact or take access from another Jurisdiction's roadway network will be reviewed/discussed with other regulatory agencies (TXDOT, Municipality, etc.). If, as part of this review/discussion, these agencies determine that a TIA is required, the process for scoping and preparing the TIA will follow these guidelines. If it will be reviewed by the County and other regulatory agencies then a Joint Scope, signed by each jurisdiction, will be prepared.

4. TIA Report Submittals, Contents, and Structure

All TIAs submitted must, at a minimum, contain the following sections. The sections must be in the order identified here. Please note, TIAs submitted that do not follow this format or that are submitted without an approved scope that is signed by all review agencies will not be accepted or reviewed.

4-A. TIA Submittal Requirements

To be considered a complete submittal, the items identified in the approved scope must be provided. Reports will not be reviewed until a complete submittal is received. The applicant is tasked to provide all necessary and required information at the time of the submittal.

If a report does not include an item required by the approved scope, the author shall identify this omission in the transmittal letter/memo with an explanation of why an item was omitted. Failure to include this identification will cause the report to be considered incomplete.

Incomplete submittals will not be reviewed and may be retrieved if desired by the Applicant. Subsequent submittals addressing comments are considered stand-alone submittals and must include all information including but not limited to complete report with all appendices, Excel Spreadsheets, Synchro files etc. Partial submittals are not accepted.

4-B. Executive Summary

This section will contain a brief overview of the purpose of the study, location of the site, site description, site access, trip generation, trip distribution, and land use. The key results of the study should be presented, including principle findings, conclusions, identified improvements for construction, and financial contribution.

4-C. Table of Contents

A table of contents must be provided that identifies sections of the TIA along with a list of tables, figures, and appendices.

4-D. Introduction and Background

This section will contain a brief overview of the purpose of the study, owner’s name and contact information (e-mail and phone number), location of the site, land use, trip generation, and the type of project supported by the study. Other related studies/applications associated with the proposed development site are also useful information. The study methodology should also be summarized.

The following maps must be included in this section (not in an appendix):

1) Site Location map.

2) A map that identifies the surrounding areas' land uses including the project site.
3) Site plan and site land use, including site access (updated with each submission).
4) A map showing all bicycle routes, bus transit, and bus stops within ½ mile of the site.
5) A map using aerial imagery showing all roadways, intersections, and driveways analyzed (with labels and dimensions as appropriate) this map will form the basis of the improvement's maps (See Recommendations, Mitigations and Conclusions).

4-E. Existing Operating Conditions

This section must contain a detailed overview of the available transportation infrastructure surrounding the proposed development site, as well as identify existing issues and concerns. This section shall include the following components when applicable.

1) Detailed description of the transportation system with figures outlining traffic controls, intersection lane configuration with dimensions, bicycles routes, speed limits, parking restrictions, bus stops, directional signs, pedestrian signage, surrounding land uses, driveways, distance of driveways to adjacent intersections, railway crossings and any other information that may affect the intersection performance during the selected analyses periods. Data collected through site visits should be presented and described. It is advisable to include photos outlining particular issues (e.g., closely spaced driveways, non-standard intersections, etc.). Functional classification of existing and future roadways should be presented in this section. See classification map at the end of these guidelines.

2) Traffic volumes are to be presented both graphically in the form of maps and in Excel spreadsheet form. Daily traffic volumes are to be presented in this section when relevant. Daily traffic volumes can be obtained from actual counts or estimated using proper expansion factors if appropriate and accepted. Traffic volume maps must be provided in this section (not in an appendix).

3) Short-term changes in the surrounding area, unrelated to the site are to be documented in this section and reflected in the analyses. The consultant is expected to do due diligence in their review of system changes. If the scheduled date of the change falls within the timeframe of the study of the application, changes must be reflected in the study.

4-F. No-Build (Forecasted) Operating Conditions

This section is to provide a detailed overview of the expected transportation infrastructure in the area surrounding the proposed development site in the build year or years. This section shall include the following components when applicable:

1) Future background operating conditions and changes to the intersection configuration, unrelated to site improvements, shall be provided in both descriptive and, if significant, graphic forms. Traffic may be re-routed if it is projected future roadway patterns would alter traffic patterns.
2) When establishing background traffic volumes for the build year, the applicant's consultant should calculate annual growth rate and consider approved/accepted projects that will impact the study area. The growth rate can be determined from comparing counts from previous years. Calculations performed to obtain the background growth shall be included in the report and shown in the spreadsheets (with calculation formulas). Background traffic volumes must include traffic volumes from other accepted (but not-yet built) developments. Documentation for background developments shall be included in the Appendix.
3) Traffic volumes for all background projects shall be provided separately and the estimated trips for each background project shall be presented both graphicly in the form of maps and in Excel spreadsheet form in this section (not in an appendix).Daily traffic volumes are to be presented in this section when relevant. Daily traffic volumes can be obtained from actual counts or estimated using proper expansion factors if appropriate and accepted.

4-G. Trip Generation and Distribution

This section contains a detailed discussion of methodology used in determining trip generation and distribution throughout the roadway network and between individual site driveways. All site access must be identified.

Site traffic reductions must be estimated based on reductions as approved in the TIA scope. All calculations and assumptions used for internal capture and pass-by trips must be provided. Site traffic distribution and assignment must be completed based on the approved TIA scope. Trip distribution figures must be included in this section (not in an appendix) that show both percentage and volume distributions.

4-H. Build (Site + Forecasted) Operating Conditions

This section is meant to provide a detailed description of the proposed development itself including land uses, densities, access points, and any other details that may have an impact on the transportation system. Build Conditions traffic volumes are obtained from adding the site-generated traffic volumes to the No-Build traffic volumes.

Traffic volumes are to be presented in both graphic and tabular form. Daily traffic volumes are to be presented in this section when relevant. Daily traffic volumes can be obtained from actual counts or estimated using proper expansion factors if appropriate. Traffic volume maps must be provided in this section (not in an appendix).

4-I. Mitigated (Build w/ Mitigations) Operating Conditions

This section is to provide detailed description of operating conditions with identified improvements. Improvements should be identified for each phase of the development, if applicable.

1. All roadway improvements used in the analysis should be identified in this section.
2. Improvements should be identified for each phase of the development, if applicable.

Mitigations identified should not negatively affect safety and identified improvements should not significantly degrade another movement.

4-J. Intersection Capacity Analysis

The capacity analysis for each intersection/site access and period as outlined in the approved TIA scope must be included in this section.

1) Study Scenarios for Intersection Capacity Analysis:

   Capacity analysis must be completed for the following scenarios. Additional peak hours, such as a midday or special event or weekend peak hour, may be required if the proposed development would generate trips during non-standard periods and will be identified in the approved TIA scope.

   a) Existing Conditions – AM and PM Peak Hours.
   b) No-Build (Forecasted) Conditions – AM and PM Peak Hours.
   c) Build (Site+Forecasted) Conditions without Mitigation – AM and PM Peak Hours.
   d) Mitigated (Build with Mitigations) Conditions – AM and PM Peak Hours.

   Additional operating conditions should be analyzed for long term projects that will be constructed in phases over a period of five years or more. Improvements should be identified in the phase for which they are needed. If not enough is known about the proposed project schedule and land use to estimate proposed phases of construction, TIA updates will be required with site plans in addition to estimating the proposed phasing of development.

   A description of the methodology and software (Synchro) used to complete the assessment must be included. Signal timing plans must be obtained from appropriate agency that maintains the signal and must be used for the analyses. Timing sheets shall be included in the Appendix of the TIA. In the event of a proposed or planned traffic signal, a reasonable signal timing plan should be provided. All intersections must be modeled in one Synchro file (including unsignalized intersections). SIDRA software should be used for any capacity analysis at a roundabout. Synchro files must be in real world coordinates.

2) Peak Hour Factors:

Peak Hour Factors used shall be by movement and shall be based on the Traffic counts conducted. The use of the default of 0.92 shall not be allowed except for the following:

- When a new intersection is created or proposed.
- When a new approach is created or proposed.
- When a new movement is created or proposed.
- When the volume on an approach or movement is increased by more than 100% by the proposed site traffic.

3) Results for Intersection Capacity Analysis:

The results from the capacity analysis for all the scenarios will include, but not be limited to, the following:

a) Intersection Level of Service (LOS) by individual movements at an intersection.
b) Volume/Capacity (v/c) ratio by individual movements at an intersection.
c) Delay (veh/sec) by individual movements at an intersection.
d) Queueing analysis with 95% queue length by movements, vs existing storage bay and/or distance from adjacent intersection(s); and
e) Overall intersection LOS.

The Highway Capacity Manual (HCM) capacity analysis results must be presented in a single tabular format (on 11”x17” sheets) for all the scenarios noted. Previous versions of the HCM should be used if the latest version of the HCM is unable to analyze intersection operations and documented in the report where this is the case. The HCM methodology used for a given intersection must be consistent for that intersection for all analysis periods. Synchro Lane/Volume/Timing reports should be presented for capacity purposes only if Synchro is unable to analyze intersection operations using HCM methodology. Document in the report where this is the case.

When results obtained from analyses completed in Synchro show poor performance, the consultant shall validate the results with observations in the field for existing conditions or SimTraffic simulation for post development/build conditions. When this occurs, discussion and documentation must be included in the report.

Poor performance is defined by LOS E or F, and/or Volume/Capacity ratio over 0.95 for individual movements or overall intersection. Poor performance may also include extensive queues for movements that extend beyond available storage/deceleration length or blocks other travel lanes or site driveways, or extensive queues on through movements that extend past and blocks adjacent

intersections. If No-Build Conditions are LOS D or better and Volume/Capacity ratio less than 0.95, Mitigated (Build w/ Improvements) Conditions must maintain the No-Build LOS, Delay and Volume/Capacity ratio for individual movements and overall intersection during the peak hours evaluated. Any extensive queues blocking travel lanes, adjacent intersections and/or driveways expected in the Build Conditions must be mitigated to address the potential safety concern.

Definition of poor performance noted above is provided as a general guidance for TIA preparation. It is understood that development projects vary in nature, scale, location, and impacts on transportation infrastructure. The purpose is to provide a general guidance on the acceptable traffic parameters in the TIA. But it should be noted that each development project will be assessed on a case by case basis considering nature, scale, location, and impacts of the proposed development on transportation infrastructure.

4) Special Considerations for phased developments:

   a) For projects with more than one phase of development, signal retiming should be assumed in the No-Build Condition This does not apply to the first phase.
   b) Improvements should not be carried over in the No-Build or Build Conditions of future phases unless there is documentation provided that they will be constructed by the time of the future phase. Improvements should only be included in the Mitigated (Build w/ Improvements) Condition.
   c) Improvements must be identified in the phase for which they are needed.
   d) Improvements by other developments or by governmental agencies can only be included if there is certainty that the improvements are funded and will be constructed/completed for the specified analysis period.
   e) Example of Phasing Approach:

Phase	Scenario	Trips	Mitigation Pro-Rata	Roadway netowrk
Phase 1	NB	existing+BG		NB
	Build	E + BG + Ph1		NB + DWY
	Mit	E + BG + Ph1	Ph1/Build	NB + DWY + PH1 Mit
Phase 2	NB	E + BG + Ph1		NB + PH 1 DWY
	Build	E + BG + PH1 + Ph2		NB + PH 1 DWY + PH 2 DWY
	Mit	E + BG + PH1 + Ph2	Ph2/Build	NB + PH 1 & 2 DWY + Ph 2 Mit*
*Ph 2 Mitgation may include similar or the same measures utilized in the Ph 1 analysis.				

5) Presentation:

Results of Intersection Capacity Analysis must be presented in tabular format, displaying the following for each movement at an intersection for each analysis condition.

- Delay
- Level of Service

- v/c ratio
- 95 percentile queue
- Bay length (storage plus deceleration)

The cells in the table must be highlighted for the following conditions:

- At an unacceptable level of service (LOS E or F).
- When the delay in the Mitigation Condition is greater than the delay in the No-Build Conditions.
- When the V/C ratio is greater than 0.95.
- When the queue length is unacceptable**.**

Below is the format that is required. Colors used shall be at the discretion of the submitting engineer.

Intersection / Movement	Existing					No-Build				Build				Mitigated (w/ Imps)				
	LOS	Delay	V/C	95th % Queue (ft)	Bay Length (ft)	LOS	Delay	V/C	95th % Queue (ft)	LOS	Delay	V/C	95th % Queue (ft)	LOS	Delay	V/C	95th % Queue (ft)	Bay Length (ft)
Example Street and Frist Street	C	22.3	0.74	-	-	C	34.8	1.19	-	F	153.0	2.14	-	F	95.6	2.14	-	-
EBL	C	22.0	0.20	61	100	C	22.3	0.38	107	E	74.5	1.00	462	E	73.0	1.00	461	100
EBT/R	C	20.5	0.53	567	-	A	9.1	0.79	166	A	8.4	0.83	296	A	7.9	0.83	252	-
WBL	E	61.2	0.57	96	100	F	160.5	1.19	327	F	190.0	1.28	373	F	190.9	1.28	377	100
WBT/R	A	6.1	0.46	60	-	B	16.4	0.78	550	C	20.1	0.86	702	C	20.6	0.86	742	-
NBL	D	46.0	0.44	110	150	E	76.4	0.81	202	F	120.0	1.00	227	F	120.0	1.00	277	300
NBT	E	62.0	0.44	153	-	E	62.9	0.53	230	F	146.5	1.14	561	F	146.5	1.14	561	-
NBR	A	6.4	0.32	24	50	B	15.6	0.42	76	B	19.8	0.47	95	B	19.8	0.47	95	50
SBL	D	43.4	0.35	97	100	E	56.1	0.62	160	F	281.4	1.48	303	F	281.4	1.48	280	300
SBT	E	76.3	0.74	209	-	F	84.9	0.87	301	F	550.8	2.14	998	F	550.8	2.14	998	-
SBR	B	11.3	0.60	15	50	F	102.4	1.11	349	F	500.7	2.05	1099	E	65.6	1.00	338	50

4-K. Road Sizing Analysis

The road sizing analysis for each roadway as outlined in the approved TIA scope must be included in this section. If it is determined that a non-scoped roadway is under capacity due to site traffic, additional analysis will be required.

1) Daily traffic volumes must be estimated for post-development condition on adjacent roads (boundary streets and internal roads), roadways identified for road-sizing in the scope, and roadways for which it has been determined are under-sized as a result of analysis.

   In addition to controlling the adequacy of the roadway for the projected traffic volume, the TIA must compare the existing roadway cross-section with standard roadway cross-sections regarding the pavement width, sidewalk, curb and gutter, etc. If the results indicate that the roadway is substandard, the report must propose improvements and pro-rata shares to bring it to the standard level.

   Based on this analysis, cross-section of roads shall be recommended for boundary streets and internal roads. Roadway sizing must be done using the cross-sections

in the appropriate jurisdiction's Transportation Criteria Manual and as indicated in section 5-E. Road-Sizing Analysis.

Results must be presented in tabular format in the report and discussed in the report. Additional documentation/calculations must be provided in the appendix as needed. The proposed cross-section and an aerial exhibit showing the extents of widening and required and available ROW must be included in the report.

4-L. Turn Lane Analysis

The turn lane analysis for site driveway/roadways as outlined in the approved TIA scope must be included in this section.

1) Turn Lane Analysis for Travis County roadways will be based on NCHRP Report 457 spreadsheets for the appropriate analysis period. This section must include a discussion of the analysis and the results in addition to a discussion of the length of the turn lane when a turn lane is required. The length of the turn lane must be based on the 95% queue length shown in the intersection analysis plus the deceleration length recommended by AASHTO. Copies of the NCHRP spreadsheets must be included in the Appendix.

2) Turn Lane analysis for non-Travis County roadways shall follow the requirements of the maintaining jurisdiction. In instances where the maintaining jurisdiction does not have a standard, the NCHRP Report 457 spreadsheets shall be followed.

4-M. Additional Analysis

Additional analysis, listed below, must be included in its own separate section if required by the scope or if it is determined as part of the analysis that there is a need or safety concern. Each section must include all relevant information necessary for review.

1) Queuing Analysis showing adequate storage/deceleration length
2) Sight Distance
3) Signal Warrant Studies
4) Safety/Geometric Review
5) Access Management

4-N. Recommendations, Mitigations and Conclusions

Improvements must be identified and recommended that mitigate the site's impact on the transportation network. Identified improvements must be described and include an explanation discussing why the improvement was recommended. The identified improvement, cost estimate and a pro-rata contribution (see appropriate section of these guidelines for more information) must be provided in tabular format. An example is provided below.

Location	Improvement	Total Cost	Pro-Rata Share (%)	Justification for Pro-Rata	Pro-Rata Cost
Example Street and 1st Street	WBLT Turn lane (200')	$250,000	48%	WBLT Volume and Queue Length	$120,000
	SBRT Turn lane (100')	$150,000	25%	SBRT Volume and Queue Length	$37500
	Signal Timing Mod	$5,000	100%		$5000

The calculations used to determine the pro-rata share must also be included and shown in the appendix and provided in the Excel spreadsheets. Exhibits of the proposed improvements must be presented here. Either planning-level or itemized cost estimates for each improvement must be provided with supporting documentation.

Exhibits must contain:

1) Required, available, and to-be-dedicated ROW (approximations shall be provided if survey is not available).
2) Lane configurations.
3) Lane widths (measured from the lip of gutter).
4) Sidewalks and Ramps.
5) Signal Poles.
6) Utility Locations (above and below ground).
7) Signage and Striping.
8) Driveway Spacing (dimensioned).
9) Relevant items (i.e. ROW width, lane widths, turn bay lengths, etc.) must be dimensioned for roadways and driveways.

In addition to separate exhibits for each intersection/roadway with improvements, a single-sheet exhibit must be included to show all the study intersections with the proposed mitigations to provide a clear picture of their possible interrelationships.

Identified improvements must be prioritized based on safety considerations, the development's needs and impacts, feasibility of construction, as well as the review agencies priorities. Based on the pro-rata share, improvements should be identified for construction. When construction of the improvement is not desired by the review agency, fiscal may be posted to be used for the improvements identified in the TIA.

4-O. Cost Estimates

Cost estimates for improvements identified in the TIA, for which the applicant is to construct, may be a high level, lump-sum estimate to determine the pro-rata share of needed improvements. When the applicant has been required to construct an improvement and the ultimate construction cost differs or exceeds the estimated cost of the improvement(s), the obligation will remain with the Applicant.

Cost estimates for improvements identified in the TIA for which fiscal will be posted shall be itemized and include all costs reasonably expected to design, permit, and construct said improvements. These include, but are not limited to, the following:

1) Engineering costs
2) Contingency
3) Mobilization costs
4) Right-of-Way preparation
5) Traffic control
6) Concrete and asphalt excavation and/or construction
7) Traffic signal equipment removal, relocation, and/or installation
8) Traffic signal re-timing
9) Traffic signs and markings
10) Sidewalks and curb ramps
11) Pavement resurfacing
12) Drainage/utility modifications
13) Right-of-way acquisition
14) Erosion/Sedimentation Control
15) Restoration

Additionally, the cost estimates for the improvements shall be for the year in which they are intended to be built. The cost increase to the future year must be based on the Engineering News Record (ENR) construction cost index for the past 10 years and documented.

4-P. Appendices

Supporting documentation, data, and calculations are to be included in the report appendix. Each section of the hard copies must be tabbed. Calculations associated with each section should be included in the appropriate section. The sections will include:

1) TIA determination worksheet
2) TIA scoping document
3) Traffic Counts
4) Signal Timing Sheets
5) Trip Generation Calculations
6) Traffic Volume Calculations
7) Synchro Outputs
8) Turn Lane Analysis
9) Queuing Analysis showing adequate storage/deceleration length
10) Sight Distance
11) Signal Warrant Studies
12) Safety/Geometric Review (when required by the scope)
13) Access Management (when required by the scope)
14) Cost Estimates
15) Other Appendices required in the scope or relevant to the study. These shall be separate appendices and shall be named so that they are discernable.

5. Technical Guidelines and Requirements for TIA Reports

5-A. Trip Generation Rates

In assessing the trip generation potential of a site:

1) The latest edition of the Institute of Transportation Engineers' (ITE) Trip Generation Manual is used as a guide. While determining whether to use average trip rates or trip rates from derived equations included in the Trip Generation Manual, the guidance provided by ITE shall be used.
2) Trip generation rates from local trip generation studies at proxy sites (sites with similar land use, intensity, surrounding network characteristics, AM/PM peak flow direction, etc.) may be proposed to the Road and Bridge Engineering Division for review, discussion and agreement to use in a TIA. The trip generation study must be completed during the times of day and days of the week in which the analyses will be completed and must follow ITE guidelines.
3) When using non-standard trip generation rates, the applicant's consultant shall submit the appropriate documentation that supports the proposed trip rates (e.g., data obtained from trip generation surveys of proxy sites, rationale of first principles, comparison of trip rates, etc.).

5-B. Trip Reductions: Internal Capture, Pass-by, Transit, Biking

1) Different factors should be considered in determining internal capture, pass-by trips, transit trips, and Bike trips. Factors include, but are not limited to, the following: location of the proposed development, land use mix of development, size and intensity of development, local context, adjacent roadway system, transit connectivity and access to proposed development, pedestrian and/or bicycle trip generators, and the availability of facilities to justify reductions.
2) The latest edition of the ITE Trip Generation Handbook may be consulted to determine internal capture or pass-by trips. However, internal capture and/or pass-by trips estimation from this publication may not be readily applicable considering the local context, proposed land use mix, location of proposed development, type and size of development, adjacent roadway system.
3) Proper engineering judgment should be applied, and documentation provided for all proposed trip reductions.

5-C. Site Trip Distribution and Assignment

When distributing site generated trips, the applicant's consultant should consider existing traffic patterns in the area, availability of connecting roads, and proximity to other attracting land uses, location of major roadways and highways, and trip-to-work data from

Capital Area Metropolitan Planning Organizing (CAMPO). When assigning site generated trips, an applicant's consultant should consider access to the proposed development in relation to the major roadway connections, orientation of development on the site, ease of access, reliability of trip time, shortest duration of travel, shortest path, and connectivity. Considerations should also be made for the differences in traffic patterns in both the AM and PM peak hours as the trip distribution may not be the same across both conditions. The trip distribution, along with a brief description of expected travel patterns, should be submitted with the proposed TIA for review.

Site trip distribution and entrance/exit splits between site driveways must be explained and discussed, with supporting calculations, showing how the trips were assigned to each driveway.

5-D. Traffic Count Data and Data Collection

Traffic counts (vehicular, pedestrians, and bicycle) are the foundation for most of the analyses and proper assessment. Consider the following when obtaining/using traffic counts:

1) All sources of information are to be provided (i.e., who completed the counts, date of completion, periods counted).
2) Traffic turning movement counts shall be obtained for an average weekday (Tuesday, Wednesday, or Thursday). Traffic turning movement counts shall not be taken during a week with a Travis County Texas, Local City or State of Texas Holiday. Traffic turning movement counts taken during the morning peak shall be taken from 6:00 AM to 9:00 AM and during the evening peak shall be taken from 4:00 PM to 7:00 PM. However, if traffic turning movement counts are required for signal warrant analysis, turning movement counts shall be taken for a minimum of 10 hours and shall include the peak periods.
3) Data validity varies depending on the area that is being studied. The County may accept data that is up to two-years-old. However, the County will not accept data beyond one-year-old if the County determines that relevant non-target development has occurred since the data was collected which will affect the validity of the data.
4) Applicant's consultants are strongly encouraged to collect traffic count data when schools are in session (approximately September to April, actual dates will be reviewed based on development proximity to schools or school districts). If traffic count data is collected when the schools are not in session, appropriate adjustment factors shall be calculated and agreed upon by the Road and Bridge Engineering Division prior to Scoping the TIA.

5) Whenever data is adjusted or modified from what was observed in the field (e.g., balanced traffic volumes, deletion of illegal movements, etc.), rationale for the modification is to be provided with documentation. Modified traffic volumes shall be clearly identified in the exhibits and in the report.

6) In cases where additional data is collected, the methodology used must be documented and included in the TIA.

5-E. Road-Sizing Analysis

Road-sizing analysis should be completed for future Build conditions by calculating the segmental vehicles per hour (vph) for the average of the PM peak hour volume at the boundary intersections. The ADT shall be determined by dividing the segmental vph by 9% (0.09) to estimate the average daily trips:

(vph / 0.09 = ADT)

Alternatively, ADT may be calculated using other methods, such as collecting 24-hr traffic counts for Existing Conditions volumes and the volumes recommended from the ITE's Trip Generation Manual for the site and background projects. In this case, the methodology and calculations must be documented in the report.

Road-sizing shall be based on the figures included in Appendix A plus additional considerations for turn lanes at intersections.

Additional considerations should be made based on any Transportation Plans and the latest edition of the *Appropriate Jurisdictions Transportation Criteria Manual*. It is the intent that bike lanes and sidewalks be included as part of the road sizing evaluation.

5-F. Safety and Sight Distance

1) Safety/Geometric Review: If any potential safety or geometric issues are identified based on the analysis presented in the TIA, proper mitigation measures shall be recommended to address capacity, safety, and/or geometric issues. If the proposed development is located in an area of existing safety concerns, analysis must be completed to identify whether or not the proposed development would worsen the existing safety issues. Appropriate mitigation measures shall be recommended to address any safety issues identified.

2) Sight Distance: Sight distance calculations shall be provided in the TIA at proposed site driveways, newly created intersections of public streets proposed by the development and at all proposed signal locations. The TIA shall include vertical and horizontal sightline profiles (to scale and labeled) for both Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD). The profiles shall document the required and actual sight distance in relation to field conditions.

SSD provides a view of the road that is sufficient to allow drivers to stop to avoid a collision with an obstruction on the road. SSD shall also be evaluated for vehicles approaching a proposed signalized location to ensure there is sufficient distance to allow drivers to stop to avoid a collision with a queued or stopped vehicle at the intersection.

ISD allows for the safe maneuver of a vehicle from the stopped position at an intersection. Sight triangles at an intersection shall be clear of obstructions that might block a driver's view of potential conflicts.

SSD and ISD calculations shall be based on the more restrictive of the City of *Austin Transportation Criteria Manual* (Case III) or most recent edition of the American Association of State Highway and Transportation Officials (AASHTO) manual with the approval of the TIA reviewer. If minimum sight distances cannot be accommodated, the TIA shall recognize this and propose mitigation to provide safety improvements at driveways and intersections.

5-G. Signal Warrants

Signal Warrants must be provided for all locations where a traffic signal is recommended or where identified in the approved scope following the procedure in the TMUTCD for all warrant conditions for all warrants. Existing, No-Build, and Build Condition volumes should be used when a signal is recommended as a result of the analysis.

5-H. Turn Lane Analysis

Turn lane analysis for Travis County roadways shall utilize NCHRP 457 spreadsheets to determine the need for turn lanes. The analysis spreadsheets shall be included in the appendix of the report as well as included in the electronic submittal. Turn Lane analysis for non-Travis County roadways shall follow the requirements of the maintaining jurisdiction. In instances where the maintaining jurisdiction does not have a standard, the NCHRP Report 457 spreadsheets shall be followed. Design criteria used to determine the turn lane length requirements shall be documented in this section.

5-I. Access Management and Queuing Analysis

As required in the TIA scope, an access management analysis shall be performed and include the following:

1. The number of driveways to/from proposed developments. The number of access points should be minimized since additional driveways create additional conflict points and speed differential, creating additional potential safety issues. New driveways' interaction with major roads should be analyzed.
2. Determination of the need for deceleration and/or acceleration lanes at the development's access points based on roadway speed and safety considerations.

3. Queuing analysis showing adequate storage on-site for any anticipated queues (e.g. for drive-thru or school pickup).
4. School related items identified in the TIA scope.

6. Projects Warranting a TIA - Alternative TIA Application

6-A. Purpose

An Alternative TIA is effectively a TIA which is limited in scope. The Alternative TIA is intended to identify improvements and provide justification when it may be impractical or unnecessary to conduct additional study, allowing the analysis/report and review to be completed in a shortened timeframe. This may include reference to a study completed as part of a nearby development. Upon acceptance, the Alternative TIA fulfils the requirement of a TIA.

6-B. Guidance

An Alternative TIA may be considered if all the following conditions are met, as determined by the Travis County Road and Bridge Engineering Division:

1) There has already been a significant study in the last 5 years of the transportation system around the proposed development;
2) Needed improvements can be identified without further study;
3) It can be shown that the development's site trips will benefit from the proposed improvements identified;
4) An alternate TIA will not be applicable if the proposed site trips are greater than 4,000 daily trips or more than 50% of the daily trips of the study from which the mitigations are being identified.

6-C. Application for an Alternative TIA

To be considered for the Alternate TIA process, the applicant should electronically submit a formal request to DSD for review. The request should include:

1) TIA determination worksheet.
2) Site location map.
3) Site Plan.
4) Trip generation.
5) Expected site trip distribution (Diagram).
6) Identify traffic studies completed around the proposed development. Include the daily trips included in each identified study.
7) Improvements identified by other studies in the study area.
8) Improvements proposed to be constructed by the development

Based on review of the application with the Road and Bridge Engineering Division, DSD will determine if the Alternative TIA is applicable. If it is determined to be not applicable, then the applicant must complete a formal TIA. If the application is accepted, the applicant should coordinate with the Road and Bridge Engineering Division to finalize the Alternative TIA Scope.

6-D. Alternative TIA

Once the application for an Alternative TIA is accepted, the applicant should provide an Alternative TIA to the Road and Bridge Engineering Division for review. The Alternative TIA should include the following:

1) TIA determination worksheet.
2) Site location map.
3) Site Plan.
4) Trip generation.
5) Trip distribution (Diagram).
6) Traffic studies completed around the proposed development. Include the daily trips from each identified study.
7) Identify proposed improvements and proposed contribution for mitigations. An explanation of why the mitigations were selected and documentation of how the proposed contributions were determined.
8) Justification for proposed improvements as mitigation for the site's traffic impact and demonstration that the site trips will benefit from the identified improvements.
9) Cost Estimates for the selected mitigations.

As deemed acceptable by the Road and Bridge Engineering Division, the Alternative TIA will replace the typical TIA requirement.

7. Contribution for Mitigation

This section includes the method of determining the financial participation requirement for system mitigations identified within TIAs. Applicants are expected to fully construct site mitigation measures. Once all mitigations to be constructed are identified, a determination of the Applicant's Roughly Proportionate Share will be made to ensure the mitigation requested does not exceed the demand the development is placing on the system.

7-A. Cost Estimates

Cost estimates for improvements identified in the TIA may be a high level, lump sum estimate for the purpose of determining the pro-rata share of needed improvements.

Mitigation measures equivalent to the financial participation as identified in the TIA and agreed to with the County should be prioritized and the contribution identified should be pooled to fund the construction of critical improvements. The Applicant should rely on the analysis and work with the Road and Bridge Engineering Division to determine the critical improvements for construction.

If the County and the Applicant agree to a posting of fiscal for improvements identified in the TIA, cost estimates shall be itemized and include all costs reasonably expected to design, permit, and construct them. These include, but are not be limited to, the following:

1) Engineering costs
2) Contingency
3) Mobilization costs
4) Right-of-Way preparation
5) Traffic control
6) Concrete and asphalt excavation and/or construction
7) Traffic signal equipment removal, relocation, and/or installation
8) Traffic signal re-timing
9) Traffic signs and markings
10) Sidewalks and curb ramps
11) Pavement resurfacing
12) Drainage/utility modifications
13) Right-of-way acquisition
14) Erosion/Sedimentation Control
15) Restoration

Additionally, the cost estimates for the improvements shall be for the year in which they are intended to be built. The cost increase to the future year must be based on the Engineering News Record (ENR) construction cost index for the past 10 years and documented

7-B. Financial Participation

To determine the financial participation for a development, the Travis County compares the No-Build conditions with Build Condition and identified trip reductions required to determine the relative impact on the transportation system caused by the site. Mitigations should be determined to eliminate adverse conditions to the transportation system caused by the site trips. On this basis, the County utilizes a pro-rata calculation based on the site traffic and the forecasted conditions for the impacted movement, intersection, or roadway. Typically, financial participation for improvement can be based on the greater proportional share of site traffic (Pro-rata Share = Site Volume/(Build Volume)) in each condition, AM or PM, for which the improvement is needed. However, this may not cover all cases. In general, total financial participation is to be based on the applicant's cost estimates of the proposed mitigation multiplied by the Pro-rata percentage calculated and will be reviewed and approved by the Road and Bridge Engineering Division.

1) To calculate the financial participation for a roadway improvement for a specific movement, (e.g. turn lane), a pro-rata calculation should be used. The site traffic must be divided by the Build traffic (Pro-rata Share = Site Volume/(Build Volume)) for the movement or approach which has caused the need for the improvement, the 'critical movement'.

2) To calculate the financial participation for signals, the typical method is to use the pro-rata share of the movement with the highest percent of site traffic, the 'critical movement'. However, often it is difficult to determine the appropriate financial participation required for a signal. In many cases, engineering judgment must be used to determine the correct contribution if signal improvements are needed. The pro-rata share should be based on the "critical impact", the approach or movement, with the highest percent of site traffic, which is causing the need for a signal. Typically, the need for a signal is caused by volumes on the major street, volumes on the minor street, and to facilitate left turn movements. Therefore, the pro-rata share will be based on the highest ratio of the site traffic to Build traffic for the approach or movement which is driving the need for a signal.

3) To calculate the financial participation for major roadway improvements (e.g. roadway widening) the site traffic divided by the Build traffic for the roadway segment (Pro-rata Share = site/(Build)).

4) Exceptions to Pro-Rata

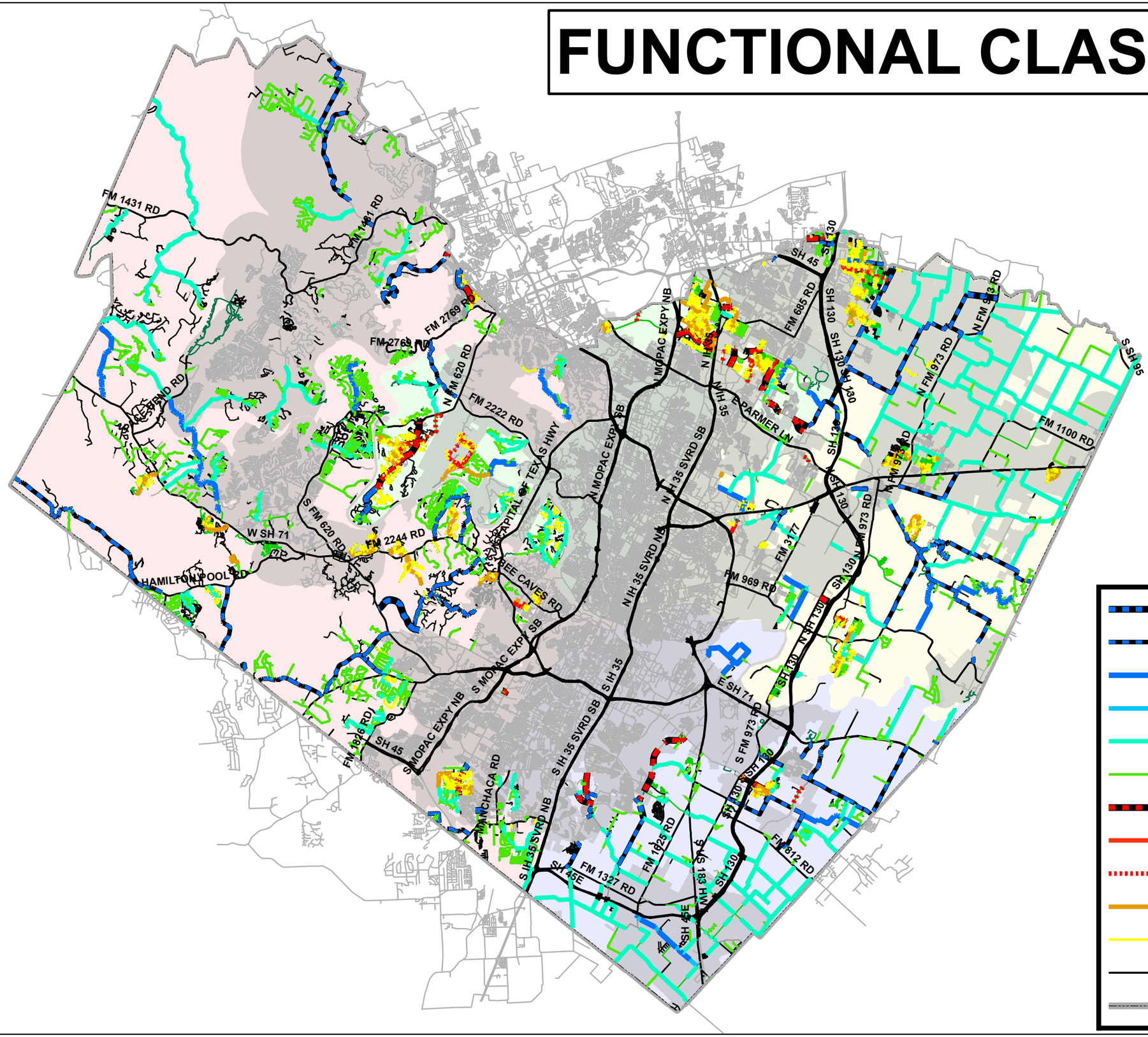
   There are also several cases where the financial participation required is greater than the pro-rata share. In cases where there is a clear safety risk to the public if improvements are not made, the impact of the site traffic in isolation is clearly causing the need for the improvement, or if the improvement is needed to provide

connectivity to the site, the financial participation required may be greater than pro-rata.

The Developer contribution shall be 100% for the following exceptions to the calculated pro-rata:

a) Any improvements that will only serve the proposed development.
b) Any turn lane improvements where:
    i. A left turn where site traffic for the proposed movement is greater than or equal to 100 peak hour vehicles.
    ii. For a right turn where the site traffic is greater than or equal to 150 peak hour vehicles.
c) Clear safety risk results from the development's impact to the system if improvements identified in the TIA are not implemented.
d) ROW dedication, favorable for system improvements.
e) Signal timing/phasing improvements.
f) 100% contribution for a signal or Pedestrian Hybrid Beacon is required if:
    i. The signal is required to provide adequate access to the proposed development (e.g. at the development's driveway, for pedestrian access)
    ii. The signal is required due to the addition of an additional approach, needed for the development, at the intersection. (e.g. an additional leg at the intersection due to the development, site access, boundary roadways constructed to facilitate the site)
    iii. The modification to an existing signal is required due to the addition of an additional approach, needed for the development, at the intersection. (e.g. an additional leg at the intersection due to the development, site access, boundary roadways constructed to facilitate the site)
    iv. The signal is required for safety reasons (e.g. school crossing, grade crossing, high number of crashes).

FUNCTIONAL CLASS



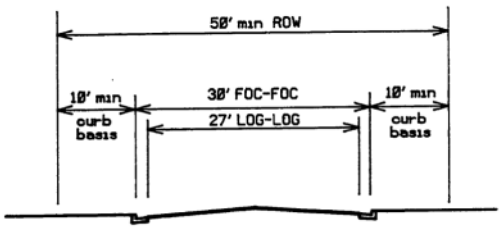
- Rural Arterial
- Rural Minor Arterial
- Rural Major Collector
- Rural Minor Collector
- Rural Collector
- Rural Local
- Urban Arterial
- Urban Principal Arterial (other)
- Urban Minor Arterial
- Urban Collector
- Urban Local
- Travis_County_Roads - Highways
- County_Line

Appendix A

Figure 1-22 Design Criteria For Local Streets (SF-1 or SF-2)

Typical ADT Range, less than 1000
Design Speed, 25, 30 mph
General Length, less than 1500'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 50'
Minimum Curb Basis, 10'
Zoning, SF-1 or SF-2 (Or comparable land use) •

TYPICAL CROSS-SECTION



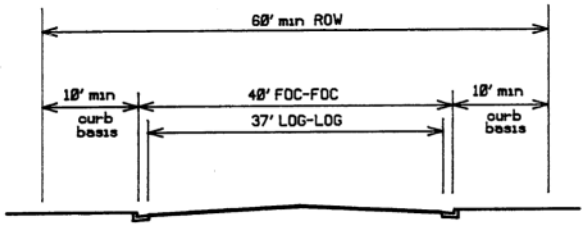
• NOTE: See Figure 1-23, for design criteria for local street where SF-3 thru SF-6 zoning is proposed.

Source: City of Austin Transportation and Public Services Department

Figure 1-27 Design Criteria for Residential Collector Streets

Typical ADT Range, 500 to 3000
Design Speed, 30, 35 mph
General Length, less than 1 mile
Typical Spacing Between Residential Collectors, 1/4 mile
Typical Spacing Between Intersections, 300'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 100'
Minimum Curb Basis, 10'
Zoning, SF-1 thru SF-6, MF-1 (Or comparable land use)

TYPICAL CROSS-SECTION

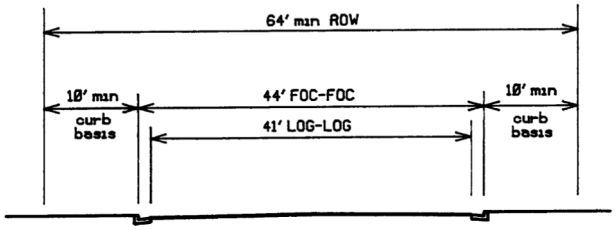


Source: City of Austin Transportation and Public Services Department

Figure 1-28 Design Criteria for Neighborhood Collector Streets

Typical ADT Range, from 2000 to 6000
Design Speed, 35 mph
General Length, 1-2 miles
Typical Spacing Between Intersections, 500'
Typical Spacing Between Neighborhood Collectors, 1/2 mile
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 100'
Minimum Curb Basis, 10'

TYPICAL CROSS-SECTION

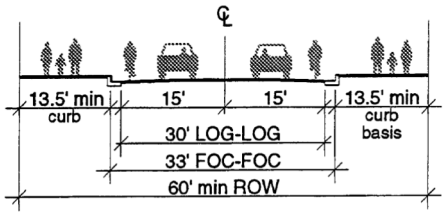


Source: City of Austin Transportation and Public Services Department

Figure 1-34A Design Crieria for MNR 2: Two Lanes, Undivided Minor Arterial Streets with Shared Wide Curb Lanes

Typical ADT Range, 1750-15250
Design speed, 45 mph
Typical Spacing Between Intersections, 1000'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 150'
Minimum Curb Basis, 13.5'

TYPICAL CROSS-SECTION

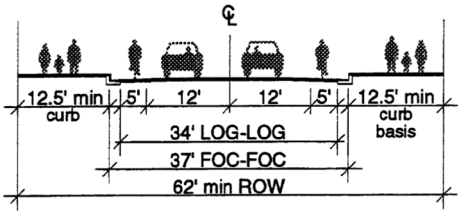


Source: City of Austin Department of Public Works and Transportation

Figure 1-34B Design Criteria for MNR 2: Two Lanes, Undivided Minor Arterial Streets with Bike Lanes

Typical ADT Range, 1750-15250
Design speed, 45 mph
Typical Spacing Between Intersections, 1000'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 150'
Minimum Curb Basis, 12.5'

TYPICAL CROSS-SECTION

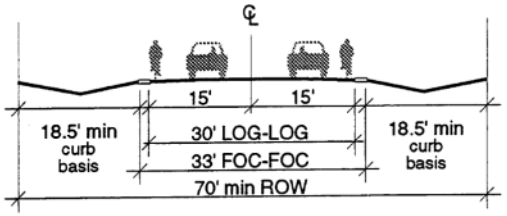


Source: City of Austin Department of Public Works and Transportation

Figure 1-34C Alternate Design Criteria for MNR 2: Two Lanes with Ribbon Curb, Undivided Minor Arterial Streets with Shared Wide Curb Lane

Typical ADT Range, 1750-15250
Design speed, 45 mph
Typical Spacing Between Intersections, 1000'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 150'
Minimum Curb Basis, 18.5'

TYPICAL CROSS-SECTION

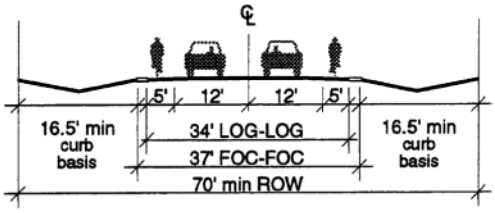


Source: City of Austin Department of Public Works and Transportation

Figure 1-34D Alternate Design Criteria for MNR 2: Two Lanes with Ribbon Curb, Undivided Minor Aterial Streets with Bike Lanes

Typical ADT Range, 1750-15250
Design speed, 45 mph
Typical Spacing Between Intersections, 1000'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 150'
Minimum Curb Basis, 16.5'

TYPICAL CROSS-SECTION

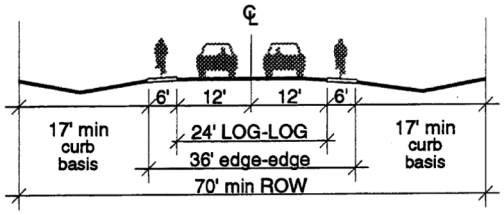


Source: City of Austin Department of Public Works and Transportation

Figure 1-34E Alternate Design Criteria for MNR 2: Two Lanes Without Curb and Gutter, Undivided Minor Arterial Streets with Shoulder

Typical ADT Range, 1750-15250
Design speed, 45 mph
Typical Spacing Between Intersections, 1000'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 150'
Minimum Curb Basis, 17'

TYPICAL CROSS-SECTION

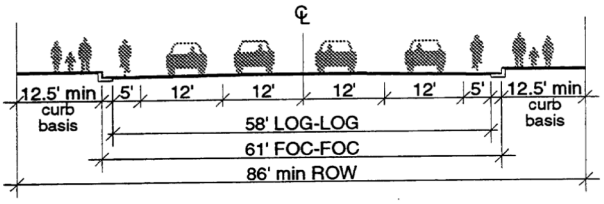


Source: City of Austin Department of Public Works and Transportation

Figure 1-35B Design Criteria for MNR 4: Four Lanes, Undivided Minor Arterial Streets with Bike Lanes

Typical ADT Range, 3500-30500
Design speed, 45 mph
Typical Spacing Between Intersections, 1000'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 150'
Minimum Curb Basis, 12.5'

TYPICAL CROSS-SECTION

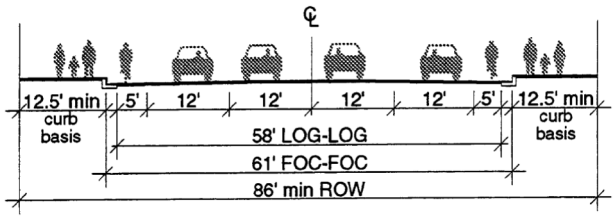


Source: City of Austin Department of Public Works and Transportation

Figure 1-36B Design Criteria for MAU 4: Four Lanes, Undivided Major Arterial Streets with Bike Lanes

Typical ADT Range, 3900-34000
Design speed, 45 mph
Typical Spacing Between Intersections, 1000'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 150'
Minimum Curb Basis, 12.5'

TYPICAL CROSS-SECTION

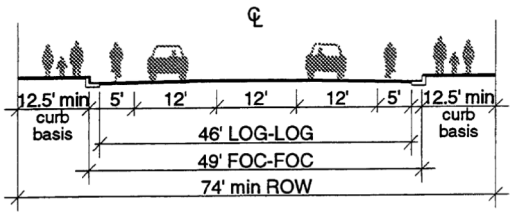


Source: City of Austin Department of Public Works and Transportation

Figure 1-37B Design Criteria for MAD 2: Two Lanes, Divided Major Arterial Streets with Bike Lanes and Two-Way Left-Turn Lane

Typical ADT Range, 2500-17750
Design speed, 45 mph
Typical Spacing Between Intersections, 1000'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 150'
Minimum Curb Basis, 12.5'

TYPICAL CROSS-SECTION

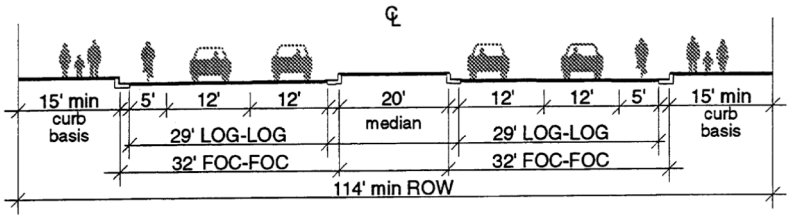


Source: City of Austin Department of Public Works and Transportation

Figure 1-37D Design Criteria for MAD 4: Four Lanes, Divided Major Arterial Streets with Bike Lanes and Raised Median

Typical ADT Range, 9000-35500
Design speed, 45 mph
Typical Spacing Between Intersections, 1000'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 150'
Minimum Curb Basis, 15'

TYPICAL CROSS-SECTION

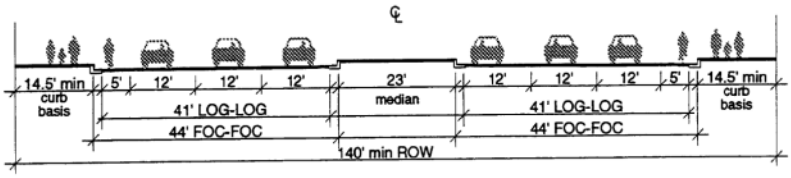


Source: City of Austin Department of Public Works and Transportation

Figure 1-38 Design Criteria for MAD 6: Six Lanes, Divided Major Arterial Streets with Bike Lanes and Raised Median

Typical ADT Range, 18000-53250
Design speed, 50 mph
Typical Spacing Between Intersections, 1300'
Minimum Centerline Radius, See Page 1-8
Minimum Tangent Length Between Horizontal Curves, 200'
Minimum Curb Basis, 14.5'

TYPICAL CROSS-SECTION



Source: City of Austin Department of Public Works and Transportation