

460 Alexandra Road #28-00 PSA Building Singapore 119963
Tel: (65) 3757100 Fax: (65) 3757200

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Our ref LTA/PD/000000003962

Your ref

DID 6375 7311 Fax 6375 7213

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Dear Sirs

TRAFFIC IMPACT ASSESSMENT (TIA) GUIDELINES

I refer to LTA's letter of 12th August 2002 enclosing with it a copy of the guidelines on the preparation of traffic impact assessment (TIA).

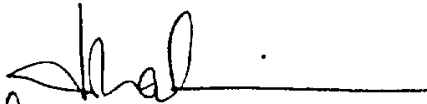
I am pleased to inform you that LTA has expanded these guidelines to further assist agencies and developers in the submission of TIA as part of Development Control (DC) submission requirements.

The expanded guidelines include information on technical requirements and assumptions to be used by the consultant undertaking the TIA study. This has been provided to improve the clarity and consistency of reports and to help expedite the preparation of TIAs since much of the technical information will be available to the consultant at the outset of the study. It will also facilitate the scoping exercise between the consultant and the Authority prior to the commencement of the TIA.

Enclosed is a copy of the guidelines for your information and dissemination to your members. The information sent in August 2002 remains unchanged and is included in this copy of the guidelines as Annex A and B.

Please contact me should you need any further information.

Yours faithfully


PETER BOW
MANAGER (PLANNING)

Enc.

Distribution List

President
Singapore Institute of Architects
79/79A/79B Neil Road
Singapore 088904

President
Association of Consulting Engineers
70 Palmer Road
#04-06 Palmer House
Singapore 079427

President
Singapore Contractors Association Ltd
Bukit Merah Lane 2
Singapore 159760

President
Institution of Engineers, Singapore
70 Bukit Tinggi Road
Singapore 289758

President
Singapore Real Estate Developers Association
190 Clemenceau Avenue #07-01
Singapore Shopping Centre

cc Mr Mohinder Singh (Senior Manager, Planning)
Mr Goh Kok Hwa (Manager, Development & Building Control)
Mr Chandrasekar S/O Palanisamy (Manager, Traffic Management)

Guidelines for Preparation of Traffic Impact Assessment Reports

Purpose

The purpose of this document is to provide general guide to developers (and transport professionals who are so engaged) required to submit a Traffic Impact Assessment (TIA) report in accordance with LTA's stipulated requirements shown in Annex A. It outlines the standard technical information and common assumptions applicable to most TIAs. Since the guide cannot feasibly cover all situations, LTA shall stipulate at its sole discretion the extent and contents that should be covered in each study.

It shall be the responsibility of the developer to (a) ensure validity of information used in the study (b) discuss the project scope with LTA in advance of preparing the study (c) evaluate the transportation impacts through a TIA report prepared by a professional transportation firm or other suitably qualified person appointed by the developer.

Requirements of TIA Reports

The following section outlines the information and assumption that may be used to assist with the preparation of TIA reports. The information should be used in conjunction with Annex B, which illustrates the structure and contents of a standard TIA report.

1. Executive Summary

- 1.1 The report should include a technical summary that concisely sums up the study purpose, major findings, conclusions and recommendations.

2. Study Purpose and Objectives

- 2.1 The objectives of the study, methodology, study timing and outputs shall be clearly stated. With large developments, LTA may require the submission of an inception report. The consultant shall obtain LTA's endorsement of the inception report prior to commencing the study.

3. A Description of Site and Study Area

- 3.1 The extent of the study area shall be determined in consultation with LTA. As a guide, it may be based on the extent of the impact of the development's traffic using preliminary estimation of traffic generation and assignment of development's traffic onto the road network up to the major road/expressway or beyond a point where development's traffic contribution becomes negligible. It is advisable that the extent of the study area be agreed upon with the LTA prior to commencing the study.

- 3.2 Analysis of contextual site issues e.g. size, current use, access points etc.
- 3.3 Description of the road and junction geometry, pedestrian routes, bus stops.
- 3.4 Appreciation of surrounding landuse and environs.

4. Existing Conditions in the Area of Development

- 4.1 Assessment of all junctions likely to be significantly affected by traffic generated by the development during am and pm commuter peak hour.
- 4.2 In addition, assessment of all above signalised junctions at development's peak hour. This assessment is required if the development peak occurs outside of the commuter peak.

5. Anticipated Nearby Developments

- 5.1 The effects of other developments/ redevelopments in the study area are generally accounted for in the assumed background traffic growth discussed in Paragraph 7. For approved developments closer to the development under study or on lower category roads, the magnitude of traffic from the future developments should be estimated and assigned *in addition* to the background traffic onto the affected road network.

6. Assessment Years

Table 1 Assessment Years for New Developments

| Size of Development | Assessment Year |
|---|---|
| Small and moderate size developments | <ul style="list-style-type: none"> · Anticipated opening year assuming fully occupied · Five years after the full opening date |
| Large single phase development | <ul style="list-style-type: none"> · Anticipated opening year assuming fully occupied · Five years after the opening date · Y2015 if the development is larger or different than that assumed in the prevailing masterplan. |
| Moderate/large multiple-phase development | <ul style="list-style-type: none"> · Anticipated opening years of each major phase assuming full occupancy of each phase · Anticipated year of complete occupancy · Five years after full opening date · Y2015 if the development is larger or different than that assumed in the prevailing masterplan |

Note: LTA staff will be able to advise on which scenarios to adopt

7. Traffic Forecasts

- 7.1 For forecasts up to and including year 2005, the background traffic volume is to be estimated using the growth factor method. Growth factors of 2% for the CBD and 3% per annum for non-CBD may be assumed. The location and proximity of the development to other major new developments or new roads will largely influence the extent of background traffic and other growth rates in some circumstances may

need to be adopted.

- 7.2 For other future years traffic forecast, area-wide growth rates would be provided by the Planning Department using the strategic transport model.

8. Trip Generation

- 8.1 Trip generation rates shall be based on survey of similar development(s) agreeable to LTA.
- 8.2 For developments where a comparable site may not exist, trip generation may be estimated from first principles based on a methodology agreeable to LTA.

9. Trip Distribution

- 9.1 A statement of methodology used to distribute traffic shall be provided.
- 9.2 Diagrams shall be provided showing the directional and turning distribution of the proposed development trips onto the road network.
- 9.3 For mixed developments, different trip distribution for different components of the development may need to be adopted.

10. Modal Split

- 10.1 Developments proposed away from major public transport nodes are likely to have higher vehicular generation. Trip generation rates should therefore account for lower level of public transport accessibility. Modal split of a similar development in a similarly located site with similar public transport service level may be used as a guide.
- 10.2 The TIA should address alternative mode of travel and the provisions to cater for pedestrians (Item 14) and cyclists needs.

11. Traffic Assignment Resulting From the Development

- 11.1 Assignment shall be based using shortest travel time/cost in peak periods (LTA may request the inclusion of weekend peak) and shortest travel distance/cost in off-peak periods.
- 11.2 LTA may require the consultant to substantiate the routes chosen for the assignment using field travel time and/or origin-destination surveys.

12. Assessment of the Change in Roadway Operating Conditions Resulting from the Development Traffic

- 12.1 The performance of the affected junctions should be assessed using the latest aaSIDRA modelling programme.
- 12.2 Where queues from signalised junctions are likely to interact on downstream junctions, the performance of the junctions should be assessed as a system. LTA uses Transyt-7F (version 9.6 and above) modelling program for this purpose.
- 12.3 LTA may request submission of softcopies of all data files in aaSIDRA or Transyt-7F formats for verifications of results.
- 12.4 The performance standard of traffic flow shall be based on level of service (LOS) criteria using average delay (sec/veh) and the degree of saturation shown in tables 2 and 3 below.

Table 2 Level of Service Definition Based on Control Delay

| Level of Service | Delay per Vehicle in Secs (signalised & roundabouts) | Delay per Vehicle in Secs (Give Way/ Stop Signs) | Definition |
|------------------|--|--|--|
| A | $d \leq 10$ | $D \leq 10$ | Good operation |
| B | 11 to 20 | 11 to 15 | Acceptable delays & spare capacity |
| C | 21 to 35 | 16 to 25 | Satisfactory, but accident study required for unsignalised junctions |
| D | 36 to 55 | 26 to 35 | Operating near capacity |
| E | 56 to 80 | 36 to 50 | At capacity requires other type of traffic control |
| F | $d > 80$ | $d > 50$ | Poor |

Table 3 Signalised Intersection Performance Evaluation Based on Degree of Saturation

| X-Value for Critical Lane Group | Performance |
|---------------------------------|----------------|
| $X \leq 0.85$ | Under capacity |
| $0.85 < X \leq 0.95$ | Near capacity |
| $0.95 < X \leq 1.00$ | At capacity |
| $X > 1.00$ | Over capacity |

13. Evaluation of Junction Performances

- 13.1 The values shown below are provided for the evaluation of isolated signalised junction performances. Consultant should seek LTA's concurrence prior to using other values.
- Cycle time: 120 seconds in peak periods,
 - Peak flow factor: 0.9, lower for developments with significant demand peaking e.g. cinemas, concerts, sporting events,
 - Intergreen time: minimum of 5 seconds,
 - Basic lane saturation flow: Maximum 1,900 pcu/hr/lane, lower values shall be used for environment with high roadside friction i.e. CBD.

- (e) Practical degree of saturation: 0.9,
- (f) Percentage of heavy vehicles: From traffic surveys,
- (g) Queue length: 6m light vehicle, 12m heavy vehicle,
- (h) Delay definition: Control delay i.e. overall delay with geometric delay,
- (i) Queue definition: 95% back of queue,
- (j) Level of service definition: As per Table 2 and 3.

For unsignalised junctions:

Level of service definition as per Table 2.

14. Pedestrians

14.1 To cater for the needs of pedestrians, TIA should contain an evaluation of:

- (a) Major pedestrian desire lines
- (b) Assessment of pedestrian facilities including footpaths, waiting areas, stairways, crossings and their adequacy to cater for forecast demand
- (c) Pedestrian safety and security

The TIA shall identify the major pedestrian trip generators and pedestrian desire lines based on shortest and most convenient travel distance. A map of the site showing the location of major pedestrian generators, MRT stations, bus stops and the desired pedestrian walk lines should be provided in the report.

The location of crossing facilities, footbridges etc. shall match pedestrian movement needs with minimal diversion from the most convenient line. Justifications would be required on why a proposed facility cannot be provided on the desired line. The TIA shall also address pedestrian safety in terms of visibility and sight distances at intersections, entry/exit points to the development and road crossings. Where relevant, it should also contain an assessment of security issues in term of lighting provision, extent of foliage and landscaping along the pedestrian pathways proposed.

Where development is likely to generate high volume of pedestrians, the TIA should include an assessment of pedestrian numbers, capacity and performance to substantiate the adequacy of the proposed design.

15. Access Provision

15.1 The provision and arrangement of access of any development proposal shall comply with the requirements stipulated in "Guidelines to Submission of Street and Vehicle Parking Proposals in Development Control". Chapters 4, 5 and 7 stipulate in detail the requirements for access proposal. Requirements stipulated in other chapters should also be

complied with.

- 15.2 If any proposal is unable to meet the access provision and arrangement requirements or LTA considers that the development access point warrants detailed evaluation, the applicant shall demonstrate the viability of the proposed arrangement.

16. Recommendations for Site Access and Transportation Improvements

- 16.1 The proposals (access, lay-by, drop-off point, pedestrian facility etc) shall take into consideration the following requirements:

16.1.1 Safety – The location and configuration of the access, lay-by, drop-off point, pedestrian facilities, etc shall not pose danger to the motorists and pedestrians.

16.1.2 Capacity of road – This shall be considered when designing the configuration of the access. For example Left-in-Left-Out (LILO) arrangement for joining access to a road with heavy traffic volume may be appropriate.

16.1.3 Queuing Length – Sufficient queuing length should be provided for proposed access, lay-by or drop-off point to prevent queue encroaching into the main carriageway and obstructing the traffic. The TIA shall include an assessment of entry barrier capacity and queue length to show that the distance between the access from the frontage road to the car-park barrier is sufficient to accommodate the queue.

16.1.4 Conflict of traffic – Proposal shall not create conflicts of traffic. Access points should not be located opposite each other, near bus stops or across very busy footpaths.

16.1.5 Obstruction to traffic – Manoeuvring of vehicles into the access shall not obstruct the traffic along the carriageway. All vehicles should enter and exit the site in a forward direction with no reversing allowed onto a public road.

16.2 Pedestrian/commuter facilities – Impact of the facility on the traffic flow shall be analysed if proposing a pedestrian crossing along a road. Other facilities like pedestrian overhead bridge or underpass may be considered.

16.3 Generally, proposals for signalisation of junction of development's access point on arterial class roads will not be accepted unless special circumstances exist. If new signals are proposed, the impact of the signals on major road traffic flow must be evaluated. For closely spaced signalised junctions, the analysis should include junction modelling results to demonstrate that the proposed signal will not disrupt the traffic

flow along the major road. Softcopy of all data files are to be provided using the latest aaSIDRA or Transyt-7F as appropriate.

- 16.4 Access, roadway and junction improvements shall be in accordance with appropriate LTA design standards and specifications.

General Comments

- Report should be easy to read and set out logically with clear conclusions and recommendations.
- All assumptions and sources of information should be clearly documented.
- Data should be presented in tables and graphs rather than narrative text. Results of traffic modelling should be summarised in table form and included in the main body of the report. LTA officers shall not be expected to look through appendices to find and interpret results.
- Ambiguities and validity/lack of information should be resolved with LTA as soon as possible. Inadequate reports would be returned to the consultant for completion or modification as needed.

Construction Traffic Management

For assessment of impact of traffic during construction, a separate assessment/ submission (not part of the TIA study) may be required depending on the scale and phasing of the development proposed. Reference should be made to the appropriate guidelines for this purpose.

ANNEX A**Conditions When a Local Traffic Impact Assessment (TIA) Would be Required**

A TIA is required to be prepared at the Development Control stage if one or more of the following conditions applies to the development:

1. Developments exceeding the scales specified in the following table:

| Type of Development | Scale of Development |
|--|--------------------------------|
| <u>Residential</u> | |
| a. Landed properties/Condominiums/ Executive HDB housings | a. 600 or more units |
| b. HDB housing | b. 800 or more units |
| <u>Retail</u> | |
| Shopping centres | $\geq 10,000\text{m}^2$ GFA |
| <u>Commercial</u> | |
| Office developments | $\geq 20,000\text{ m}^2$ GFA |
| <u>Industrial</u> | |
| a. General industries | a. $\geq 50,000\text{m}^2$ GFA |
| b. Warehousing/Distribution | b. $\geq 40,000\text{m}^2$ |
| c. Science park/High tech park | c. $\geq 40,000\text{m}^2$ |
| <u>Educational</u> | |
| a. Primary school | a. $\geq 2,000$ students |
| b. Secondary school | b. $\geq 2,000$ students |
| c. International school | c. $\geq 2,000$ students |
| d. Junior college | d. $\geq 2,000$ students |
| e. University, polytechnic, ITE campus | e. TIA required |
| <u>Medical</u> | |
| Hospitals | ≥ 200 parking spaces |
| <u>Hotel</u> | |
| Business & tourist | ≥ 600 rooms |
| <u>Recreational</u> | |
| Exhibition centre & major tourist attractions | ≥ 200 parking spaces |

Note:

For mixed-use residential/retail developments, a TIA will be required if the total trip generation of the development exceeds 200 veh/hr either inbound or outbound. In such instances, Traffic Management Department would be able to advise applicant whether a TIA shall be required.

2. For types of development not listed in table above that may significantly impact on their surroundings, LTA may require the submission of a TIA. In considering whether a TIA is required, LTA will take into consideration the type, location and circumstances of the development proposed.
3. Any development seeking direct access either via a dedicated driveway or a new service/access road onto a Category 2 (major arterial) or above type road.

ANNEX B

Key Issues to be Addressed in a Traffic Impact Assessment Report

| Major Heading | Description of What to Include |
|---|---|
| 1.0 INTRODUCTION | Description of the development proposal, study methodology, timing and output |
| 1.1 Background | |
| 1.2 Scope of Report | |
| 1.3 The key Issues and Objectives of the TIA | |
| 2.0 GENERAL DATA COLLECTION / EXISTING CONDITIONS | 2.1 Current landuse characteristic of the site & in the vicinity, site access |
| 2.1 Site Location | 2.2 Description of road network & hierarchy, no. of lanes, medians, on-street parking, location of bus stops etc. |
| 2.2 Description of Road Network | 2.3 AM and PM and off-peak (required only if development's peak hour different from commuter peak) peak hour intersection and classification counts at critical intersections, maximum queue length at intersections on critical approaches. Assessment of the performance of the intersection including average delays, degree of saturation & queue length on all approaches and for the intersection without the development traffic |
| 2.3 Existing Traffic Flow & Conditions | 2.4 Current on-street parking supply & utilisation |
| 2.4 Parking Supply & Demand | 2.5 Rail & bus stop locations & distance, pedestrian access routes to bus stops |
| 2.5 Public Transport | 2.6 Identify existing pedestrian facilities & potential conflict locations with vehicles |
| 2.6 Pedestrian Network | 2.7 Approved proposed developments/redevelopment sites adjacent to the site |
| 2.7 Proposed Developments in Vicinity | |
| 3.0 PROPOSED DEVELOPMENT | 3.1 Nature & size of the development, projected number of residential units, GFA of each component of development, hours & days of operations, staging and timing of development |
| 3.1 The Development | 3.2 Development access locations, sight distance of access points & comparison with stopping and desirable minimum sight distances, projected queuing at entrances |
| 3.2 Access | 3.3 The new road network, improvements to existing roads, circulation pattern & internal road layout |
| 3.3 Traffic Circulation & Local System | 3.4 Proposed parking provision, parking layout, location of |
| 3.4 Parking | |

| | |
|---------------------------------------|---|
| | carpark entry/exit barriers, projected peak demand based on survey(s) of similar sites |
| 3.5 Loading & Unloading Facilities | 3.5 Provision and operation of service vehicle area |
| 4.0 IMPACT OF PROPOSED DEVELOPMENT | 4.1 Estimation of future traffic volumes following the full opening of development taking into account background traffic growth and adjacent approved developments |
| 4.1 Future Background Traffic | 4.2 Estimated peak hour traffic generation based on surveys of similar sites (full survey results are to be included for reference) |
| 4.2 Traffic Generation | 4.3 Assignment of trips to the road system based on origin/destination surveys of similar or other developments in the area or another method agreeable to LTA |
| 4.3 Traffic Distribution & Assignment | 4.4 Projected traffic flows at key intersections for assessment years. Assessment of the performance of the intersection including the average delays, degree of saturation, reserve capacity, back of queue length on all approaches to key intersections (SIDRA output). Assessment of impact on residential amenity |
| 4.4 Impact of Generated Traffic | 4.5 Assessment of road safety impact e.g. whether a slip road should be considered at the entrance to the development to enhance safety |
| 4.5 Impact on Traffic Safety | 4.6 Provision for pedestrian crossings/overhead bridge to the bus stop & MRT |
| 4.6 Pedestrians & Other Users | 4.7 Provide suitable justifications to show need for improvement. Improvements may include site access and circulation, local improvements to road junction(s) and any other traffic management measures. These should be shown on plan(s) drawn to scale 1:500 or 1:1000. Approximate cost of recommended works to be provided |
| 4.7 Recommended Works | |
| 5.0 SUMMARY & CONCLUSION | A technical summary that concisely sums up the study purpose, conclusions and recommendations |