



MATRIX ANALYSIS

A Stepwise Procedure Designed for Engineers and Planning Practitioners to use when Assessing Community Effects and Responses to Planned Transport Changes

Prepared by:

Dr K.T. Ludvigson

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TERNZ Ltd
17-19 Gladding Place, Manukau City
PO Box 97846
South Auckland Mail Centre
info@ternz.co.nz

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Introduction

Matrix Analysis is a stepwise procedure designed for engineers and planning practitioners to use when assessing community effects and responses to planned transport changes. The present report describes how to conduct a Matrix Analysis of project effects, and is based on research into community responses to transport system changes.¹ The research was one component in a larger research programme aimed to determine the impact of light and heavy vehicle traffic on local communities, and the expectations of those communities of the road transport system, in order to guide the sustainable development of the road transport system. The particular focus of the research was community effects from traffic-related developments, as described in resource consent applications and other public consultation documents produced in the context of meeting the statutory requirements for resource consent under the New Zealand Resources Management Act 1991. The research sought significant commonalities and differences in communities' responses to changes in transport systems, with a view to building a predictive model. The documentary research and model building was complemented by interviews and action research with transport planners and traffic engineers, including piloting the model in the context of ongoing real-world transport planning and development. The research aimed ultimately to provide a resource for transport planners and engineers in the form of research-based information to guide assessments.

The "Matrix Analysis" presented here is a series of eight linked tasks that allow for a differentiated analysis of community data to be carried out. Each task in the series generates its own valuable /useful output; which also makes up part of the input required to carry out the next task in the series:

- Task 1: Preparing the Matrix
- Task 2: Mapping direct /physical effects
- Task 3: Mapping community activities
- Task 4: Identifying potential effects on activities
- Task 5: Identifying potentially affected stakeholders
- Task 6: Identifying stakeholders' response objectives
- Task 7: Identifying mitigation options
- Task 8: Displaying the results of the Matrix Analysis

Situations where Matrix Analysis can add value are best characterized by their relationship to a community consultation (of whatever magnitude) built into a larger project cycle:

- Before a community consultation: Matrix Analysis can here be used to systematically predict likely community responses to a planned [transport /infrastructure] project, in order to scope appropriate mitigation and the associated dollar cost;
- During a community consultation: Matrix Analysis can here serve as an organising framework for study information, which allows easy checks for data completeness and coverage in relation to a defined impact corridor; plus it can be used to develop lists of appropriate stakeholders for direct consultation; and
- After a community consultation: Matrix Analysis can here furnish a systematic framework for presenting /reporting consultation findings; and it can also provide a framework for collating public responses /submissions on the consultation report.

¹ The research was carried out by Transport Engineering Research New Zealand Ltd. and funded by the New Zealand Foundation for Research, Science and Technology.

Task 1: Preparing the Matrix

What you need / inputs

- A software spreadsheet programme (like, for example, MS Excel), or
- A large sheet of paper

Action

Create a spreadsheet or table with *ten columns* with the following headings (ordered left to right): **Locations**, **Activities**, **Effects** (two columns), **Changes**, **Stakeholders** (two columns), **Responses**, and **Mitigation** (two columns).

Result / outputs

You now have a table or spreadsheet ('the Matrix') with ten labelled columns to use as a framework for entering data pertinent to analysing community effects (see Table 1). You can now use the Matrix to develop a systematic 'Matrix analysis' of community effects and responses, and to display the results of your analysis.

Table 1. Preparing the matrix.

Locations	Activities	Effects 1	Effects 2	Changes	Stakeholders 1	Stakeholders 2	Responses	Mitigation 1	Mitigation 2

Task 2: Mapping direct /physical effects

What you need / inputs

- A description of the planned changes – infrastructure construction, policy or programme
- A detailed map or recent aerial photograph of the geographical area concerned

Action

On the map or aerial photograph,

1. mark the precise location (in relation to features of the existing environment shown) of the planned changes;
2. draw a line around a wider area surrounding the planned changes, to define a preliminary *impact area or corridor*;
3. divide the area / corridor into *ordered* segments as you see appropriate; and
4. label each segment with an distinctive name.

In the table or spreadsheet,

5. Enter into the column labelled **Location** the names in order of each segment of the preliminary impact area /corridor

Result / outputs

You now have a map or aerial photograph marked to show the location and extent of the planned *direct /physical changes*, and a surrounding hypothetical *impact area / corridor*, divided into named segments. This marked map allows you to systematically examine the impact corridor for community activities that may potentially be affected by the changes being analysed.

You also have a series of ‘headings’ in the leftmost **Locations** column of your developing Matrix spreadsheet, showing in consecutive order the names of the segments of the preliminary impact area or corridor, from one end to the other (see Table 2).

The consecutive segment names in the **Location** column of your table or spreadsheet can now serve as a linear spatial metaphor for the full extent of the impact area or corridor. This will allow you to systematically enter and display data in your developing Matrix in such a manner that the vertical layout of the data in the Matrix reflects the spatial organisation ‘on the ground’ of the changes being examined for their community effects.

Table 2. Mapping direct/physical effects.

Locations	Activities	Effects 1	Effects 2	Changes	Stakeholders 1	Stakeholders 2	Responses	Mitigation 1	Mitigation 2
West Bay									
Seaview Drive									
South Harbour									
Lake Road									
Forest Gully									

Task 3: Mapping community activities

What you need / inputs

- Community information – especially information on activities that *regularly* take place within the impact area. Note the cyclical repetition of such ‘regular’ community activities – diurnal, weekly, seasonal. Relevant community information can be sourced in documents, site visits and targeted key informant interview(s) as required.
- CHECKLIST #1 - ACTIVITIES (See Appendix 1)

Action

Starting at one end of the preliminary impact area or corridor, examine one consecutive segment of the area /corridor at a time for activities, until all named segments of the area /corridor have been so analysed. Use ‘CHECKLIST #1 - ACTIVITIES’ to ‘interrogate’ your sources of community information about each segment of the impact corridor for the presence or not of the listed activities. For each activity identified as taking place within the segment under analysis, make the following Matrix entries:

1. *create a new row* immediately below the row that has the segment name in its **Locations** column;
2. in the (empty) **Locations** column cell of this new row, *specify the location of the activity*;
3. into the **Activities** column of the same row, *enter a brief characterisation of the activity*; and

Repeat these three steps for *all activities* identified as taking place within the segment under analysis. Include also any impact area activities that do not appear on the checklist, if you deem them relevant to the analysis of community effects.

Result / outputs

You now have a vertical list (the **Activities** column in your developing Matrix) of community activities that regularly take place within the impact area. This list, organised under corridor segment name headings (the **Location** column in your Matrix), displays the activity information in such a manner that the vertical layout of the data reflects the spatial organisation ‘on the ground’ of the activities identified as regularly re-occurring within the impact area (see Table 3).

This list of community activities will make possible a systematic detailed analysis of potential effects on community activities of the planned changes under examination.

Table 3. Mapping community activities.

Locations	Activities	Effects 1	Effects 2	Changes	Stakeholders 1	Stakeholders 2	Responses	Mitigation 1	Mitigation 2
West Bay									
at Heritage Baths	swimming at pool								
around the bay	residence in homes								
Seaview Drive									
(etc.)	(etc.)								
South Harbour									
Lake Road									
Forest Gully									
(etc.)									

Task 4: Identifying potential effects on activities

What you need / inputs

- List of activities that re-occur along the impact corridor / area.
- Your annotated map or aerial photograph (produced as part of Task 2), showing the location and extent of the planned *direct /physical changes*, and the surrounding hypothetical *impact area / corridor*, divided into named segments.

Action

Use the annotated map of the planned direct /physical changes to systematically consider and *evaluate each impact corridor activity* identified in the analysis (and displayed in the **Activities** column in your Matrix) for any *potential effects* arising from the changes – effects *on the activities of the planned changes*. Starting at one end of the preliminary impact corridor, examine each consecutive segment of the corridor for any such potential effects on identified recurring activities, until all named segments of the corridor have been so analysed.

For each activity that you have identified as potentially affected by the planned changes (and displayed as a separate item in the vertical list in the **Activities** column), make entries *in the same Matrix row as that inhabited by that listed activity*, as set out below:

1. into the **Effects** column 1 of that row, *enter a label for the(type of) effect*;
2. into the **Effects** column 2 of that row, *enter a brief description of effect detail*; and
3. into the **Changes** column of that same row, *enter a brief description of the specific change detail that mediates the effect*.

Repeat these three steps for all impact corridor activities that you have identified as potentially affected by the planned changes.

Result / outputs

You now have a vertical list of labels for broad types of (potential) effects on activities that regularly occur within each corridor segment (the **Effects** column 1 in your developing Matrix); along with a brief description of each (potential) effect in the list (the **Effects** column 2 in your Matrix). The list is organised under corridor segment name headings (the **Locations** column in your Matrix), and displays the information on (potential) effects in such a manner that the vertical layout of the data reflects the spatial organisation ‘on the ground’ of the (potential) effects on identified activities (see Table 4).

This list of potential effects on activities that occur regularly within each corridor segment will enable you to systematically identify categories of stakeholders whose activities may potentially be affected by the planned changes under scrutiny.

Table 4. Identifying potential effects on activities.

Locations	Activities	Effects 1	Effects 2	Changes	Stakeholders 1	Stakeholders 2	Responses	Mitigation 1	Mitigation 2
West Bay									
at Heritage Baths	swimming at pool	social	loss of pool facility	road alignment through Baths area					
around the bay	residence in homes	nuisance	more traffic noise	road along bay side					
Seaview Drive									
(etc.)	(etc.)	(etc.)	(etc.)	(etc.)					
South Harbour									
Lake Road									
Forest Gully									
(etc.)									

Task 5: Identifying potentially affected stakeholders

What you need / inputs

- Community information – especially information on who takes part in the activities identified as regularly occurring within the preliminary impact area. Relevant community information can be sourced in documents, site visits and targeted key informant interview(s) as required.
- CHECKLIST #2 - STAKEHOLDERS (See Appendix 2)
- The Matrix Analysis DATABASE (See Appendix 3)

Action

Starting at one end of the preliminary impact corridor, analyse each consecutive segment of the corridor for potentially affected stakeholders as described below, until all named segments of the corridor have been so analysed. For each identified potential effect on a corridor activity (as displayed as a vertical list of separate entries in the **Effects** column), identify the (category of) *stakeholders* who perform the recurring activity that may potentially be affected by the changes. Then make entries *in the same Matrix row as that inhabited by each specific listed effect*, as follows:

1. into the **Stakeholders** column 1 of that row, *enter a descriptive label for each category of stakeholder* that you have identified as performing the activity potentially affected by the listed effect;
2. into the **Stakeholders** column 2 of that same row, *enter an estimate of the number of potentially affected stakeholders of that category*; and

Repeat these two steps for all potential effects that appear in the **Effects** columns in your Matrix.

Next, use ‘CHECKLIST #2 - STAKEHOLDERS’ to again interrogate each segment of the preliminary impact corridor for the presence of any further *categories of stakeholders* that appear in the checklist. For any *new* category of stakeholder so identified,

1. *create a new row* in the appropriate place in the Matrix;
2. repeat the two steps described just above to enter into the **Stakeholders** columns 1 and 2 respectively *of the new row*, appropriate descriptive and quantitative information about each new category of stakeholder identified; and
3. drawing on your community information, enter pertinent data into the remaining five cells to the left in each new row, specifying locations, activities, effects, and changes as appropriate.

In the absence of pertinent community information you can use the Matrix Analysis DATABASE as a source of hypotheses, as required. To derive hypotheses from the Matrix Analysis DATABASE, first

- identify an item listed in the DATABASE that is **known** to occur within the preliminary impact corridor; then
- read along *the same row* to discover suggestions for hypotheses about items as yet **not known**.

Result / outputs

Your first seven Matrix columns should now be relatively full of the data that you have entered into the Matrix as part of carrying out Tasks 1-5 of the Matrix Analysis. You now have a list of stakeholders (displayed as entries in the **Stakeholders** column in your Matrix) whose recurring activities within each impact area segment may potentially be affected by the changes being analysed (see Table 5).

This result can be used in a number of ways:

- The list of potentially affected stakeholders can be used as a guide suggesting whom to seek out for interviews when conducting a community consultation on the changes being analysed.
- The quantitative estimates of stakeholder numbers can be used when evaluating / comparing the severity of effects of specific options at a later stage in the analysis.
- The analysis so far can also be used as a springboard to form hypotheses about potential stakeholder responses and potential mitigation of negative community effects.
- The part of the Matrix so far unutilised can be used to enter and display further data on potential responses and mitigation options.

Table 5. Identifying potentially affected stakeholders.

Locations	Activities	Effects 1	Effects 2	Changes	Stakeholders 1	Stakeholders 2	Responses	Mitigation 1	Mitigation 2
West Bay									
at Heritage Baths	swimming at pool	social	loss of pool facility	road alignment through Baths area	Heritage Baths users	large user base, ## of users per year			
around the bay	residence in homes	nuisance	more traffic noise	road along bay side	area residents	## of properties			
Seaview Drive									
(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)			
South Harbour									
Lake Road									
Forest Gully									
(etc.)									

Task 6: Identifying stakeholders' response objectives

What you need / inputs

- List of potentially affected stakeholders and the likely effects on their activities
- Community information – especially information on stakeholders' responses to the prospect of some of their regularly occurring impact area activities being affected by planned changes.
- The Matrix Analysis DATABASE (See Appendix 3)

Action

Identify responses to each potential effect on stakeholder activities, as listed in your developing Matrix analysis. Start at one end of the impact corridor and identify responses to all effects within each consecutive segment of the area, until responses have been identified to all effects listed within each named segment of the impact area. Relevant community information is best obtained through direct stakeholder consultation, but may be otherwise sourced at early stages in the project cycle.

In the absence of data from direct stakeholder consultation, to identify *potential* stakeholder responses; for each identified potential negative effect on a stakeholder activity (displayed row by row as a vertical list of entries in the **Effects** columns of your Matrix), first

- express the effect as a *negative state*; then
- re-vision this negative state as a *positive state*, to constitute ***an objective in response***, aimed to prevent the potential negative effect from occurring and instead protect and preserve (or restore) the stakeholder activity identified as potentially under threat from effects of the planned changes being analysed; and
- into the **Responses** column of that Matrix row, *enter a brief description of each (potential) response objective* so identified.

Use the Matrix Analysis DATABASE to source further hypotheses for candidate response objectives, as required.

Result / outputs

You now have a differentiated list of specific *objectives for remedies* (treatments / mitigation), each aimed to ameliorate specific potential negative effects on specific stakeholder activities, as identified in the Matrix analysis so far (see Table 6).

This list of objectives (displayed as entries in the **Responses** column of your Matrix) will allow you systematically to define, for each objective in turn, a set of options for potential solutions to the issue that the objective aims to address.

Table 6. Identifying stakeholders' response objectives.

Locations	Activities	Effects 1	Effects 2	Changes	Stakeholders 1	Stakeholders 2	Responses	Mitigation 1	Mitigation 2
West Bay									
at Heritage Baths	swimming at pool	social	loss of pool facility	road alignment through Baths area	Heritage Baths users	large user base, ## of users per year	Heritage Baths to remain a viable facility		
around the bay	residence in homes	nuisance	more traffic noise	road along bay side	area residents	## of properties	no added traffic noise		
Seaview Drive									
(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)		
South Harbour									
Lake Road									
Forest Gully									
(etc.)									

Task 7: Identifying mitigation options

What you need / inputs

- List of 'remedial objectives'
- The Matrix DATABASE

Action

For each remedial objective (listed row by row in the **Responses** column), use the Matrix DATABASE along with any available traffic engineering expertise² to identify a set of corresponding appropriate *options for treatments / mitigation*, designed to avoid or ameliorate each relevant potential community effect (as listed and described in the same row in the **Effects** columns of the Matrix). Enter data into the Matrix as follows:

1. into the **Mitigation** column 1 of that row, *enter a description of mitigation options identified as potential remedies for identified effects; and*
2. into the **Mitigation** column 2 of that same row, *enter a description of any potential enhancements to the mitigation options identified.*

It is important to keep in mind that with any mitigation there are usually other, sometimes quite significant, effects that need to be spelt out. Often these effects are felt downstream of the "site" being considered. After completion of the column on "aim of mitigation measures" or responses, it is appropriate for the RCAs to get involved to provide the range of options to meet these aims. The RCAs need to spell out the benefits and disbenefits, including costs etc.; then take these to the public for further consultation. (Extra columns could be added to the Matrix to allow for listing of Benefits and Disbenefits).

Result / outputs

You now have a list of *specific construction, policy or programme options* to mitigate the (potential) effects identified in the Matrix Analysis (see Table 7).

This list of specific (potential) mitigation options allows you to:

- estimate with some accuracy the specific ("extra") dollar cost of mitigating community effects of planned changes;
- build such cost estimates into B/C calculations already at the early stages of project planning / appraisal; and .
- move rapidly to select and implement appropriate treatments / mitigation options and enhancements to minimise negative community effects.

² Note that the mitigation measures listed in the Matrix DATABASE were empirically derived from analyses of specific cases, and are not intended to be a definitive list of solutions that are applicable to every new case. Some mitigation measures in the list may be unachievable in each specific case and could give rise to false expectations if applied indiscriminately.

Table 7. Identifying mitigation options.

Locations	Activities	Effects 1	Effects 2	Changes	Stakeholders 1	Stakeholders 2	Responses	Mitigation 1	Mitigation 2
West Bay									
at Heritage Baths	swimming at pool	social	loss of pool facility	road alignment through Baths area	Heritage Baths users	large user base, ## of users per year	Heritage Baths to remain a viable facility	use different road alignment	(no suggestion)
around the bay	residence in homes	nuisance	more traffic noise	road along bay side	area residents	## of properties	no added traffic noise	noise barriers along road	tree planting
Seaview Drive									
(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)	(etc.)
South Harbour									
Lake Road									
Forest Gully									
(etc.)									

Task 8: Displaying the results of the Matrix Analysis

What you need / inputs

Your completed Matrix, featuring data in most cells within the spreadsheet (or table).

Action

Enter a descriptive name for completed Matrix, and add any explanatory text that you deem appropriate. Print your completed Matrix. If you have carried out the analysis on paper, now is the time to produce a clean copy.

Result / outputs

You now have a succinct and well organised graphic overview of all the community information you have identified during the course of the analysis as relevant to assessing community effects and responses to the planned changes under examination. This can be used, for example, in a report to indicate the extent of potential community effects / responses / mitigation when seeking public submissions on a planned project as part of statutory process (for an example of this of use the Matrix, see Table 8).

Table 8. Matrix analysis results.

Location	Change	Effect		Activity	Stakeholder	Response	Mitigation	
		Perceived /projected	Effect detail				Activity affected	Stakeholder(s) affected
Auckland roads	increasing urban congestion	access	difficult access, especially around peak times	urban driving	short haul / deliveries drivers; residential services	relieve traffic congestion	improve road network	
existing streets and intersections	traffic flow through existing streets and intersections will be affected by corridor	different intensity of traffic	more / less traffic / trucks on residential roads	dwelling / driving locally	residents	no through traffic on residential roads	improve capacity of collector / arterial roads	traffic calming measures & street closing
along transport corridor	increased concentration of vehicles along corridor	health	increased concentration of exhaust emissions	inhaling increased amounts of pollutants	CBD residents and workers	less air pollution from vehicle emissions	stricter (EU?) standards for vehicle fuel constituents	emissions testing for vehicle Warrant of Fitness
Auckland CBD	increase of vehicles in CBD	nuisance	insufficient parking	CBD parking	CBD residents / workers	provide enough parking	build more parking facilities	discourage CBD vehicle use
CBD /Tamaki Drive	traffic exiting at City end	nuisance	traffic congestion	CBD driving	CBD residents and workers	less cars in CBD	congestion toll pricing	improve public transport
Tamaki Drive	increase in heavy truck traffic	hazard, nuisance	noise, vibration, traffic congestion	dwelling / driving locally	Tamaki Drive residents / users; local drivers	keep trucks away from Tamaki Drive	provide alternative truck access to container port	prohibit trucks; use rail for containers from wharf
Judges Bay	Parnell Pool alignment options	social	loss of recreational facility	swimming in pool /using pool facility	Parnell Pool users; local /CBD residents	Parnell Pool to remain a viable facility	use different alignment	
Hobson Bay	EC alignment by Outboard Boating Club facility	social	restricts facility with expanding needs	boat use / storage	Outboard Boating Club members	no constraints on expansion of facility	preserve boat storage capacity	provide more boat storage capacity
Hobson Bay	alignment across bay	access	limited recreational access to bay waters	recreational use of parts of bay waters	rowing clubs, potential recreational users	facilitate free public access to bay waters	avoid encroachment on bay; tunnel under bay	remove /relocate Watercare sewage pipeline
Kepa Road	increase in heavy truck traffic	hazard /nuisance	noise, vibration, traffic congestion	dwelling / driving locally	Kepa Road area residents, local drivers	keep trucks away from Kepa Road	provide alternative truck access to container port	prohibit trucks; use rail to move cargo from wharf
Orakei Basin	alignment across bay	access	access to waters	water skiing	water skiers, boat owners	preserve access	tunnel under basin	enhance water quality?

Purewa gully	corridor by land undergoing reforestation	environment / social	loss of trees /wildlife	reforestation project	Selwyn College staff and pupils	avoid affecting project and reforested land	use south bank alignment	walkway for improved public access to /across gully
Purewa Cemetery	continuous traffic through now mostly peaceful place	nuisance	noise, vibration	contemplation, grave visits, dwelling	relatives of people buried there	preserve peace	tree planting, noise barriers	
Tipene Road, Meadowbank	continuous traffic through now mostly peaceful place	social	noise, vibration, loss of property value /amenities	at home	owners /residents on abutting properties	equity	property purchase?	tree planting, noise barriers
St Johns	corridor through horse paddocks	social	loss of recreational facility /opportunity	horse grazing, recreational riding	Pony Club members and families, young riders	retain local riding facility /opportunity	provide replacement facility in close vicinity (where?)	
ASB Stadium, St Johns	traffic chaotic at peak times	access	visitors by car, clash with Port truck / through traffic	visiting / using ASB Stadium facilities	ASB Stadium users - 160,000 visitors /year	redirect Port / through traffic elsewhere	construct alternative road facility / bypass	
Auckland University Tamaki Campus	campus more isolated from Glen Innes shops /rail	access	difficult /unsafe access made worse	walking /cycling from campus to shops /train	University staff, students, visitors, G.I. Residents	improved access to Glen Innes shops and rail	provide safe, well lit walkway /overbridge	public transport /rail station closer to campus
Tamaki Campus	corridor separates sports fields from public users	access	access made difficult for current users	sports /recreation	current users in G.I. /Pt. England /Tamaki	retain access	provide pedestrian access /overbridge	
Mt Wellington	corridor through Go Cart racing facility	social	loss of recreational facility /opportunities	Go Cart racing	Mt Wellington Go Cart Club members / users	retain local facility / recreational opportunity	relocate facility to alternative local site	
Maungarei /Mount Wellington	corridor through woodlands and archaeological sites	environment /cultural	destruction of sites and Winifred Huggins woodlands	heritage protection	tangata whenua, recreational users	avoid corridor encroachment on sites	use different corridor alignment option	
Pilkington Road, Panmure	plans for Eastern Corridor	social	uncertainty re alignment and timing of construction	construction of housing held up	Panmure businesses, potential investors	no more uncertainty regarding corridor detail	rapid final resolution to corridor issues	announce timetable for decisions /process
Panmure town centre	Panmure bus / light rail transfer station	social /safety	loitering around station; social problems	walking past	Panmure residents	no transfer station at Panmure	locate bus / rail transfer station elsewhere	
Panmure	traffic exiting at Panmure end	nuisance	traffic congestion	driving locally	Panmure residents	less traffic not more	locate corridor end elsewhere	
St Patrick's School, Panmure	intense vehicle traffic use Tripoli Road as bypass	hazard	risk of injury from traffic	crossing road on way to /from school	St Patrick's' School staff, pupils and parents	decrease traffic intensity; stop Tripoli Rd rat-running	channel traffic away from vicinity of school	provide alternative through route

Lagoon Leisure and Fitness Centre ("Swimarama")	Lagoon Drive alignment options through recreational precinct	social	severance; recreational precinct compromised	access to / use of recreational facilities	Panmure residents; 1,700 LLFC members; 500,000 users per year	no corridor along north edge of Panmure Basin	use different alignment for corridor	tunnel under (part of) basin?
Riverina School, Pakuranga	increased traffic in Lagoon Drive	hazard, access	risk of injury from traffic; chaos at pickup after school	travel to and from school	school staff, pupils and parents	restore /improve safe access	use different alignment for corridor	provide alternative route for through traffic
Riverina School	increased traffic on Pakuranga Highway	health, nuisance	increased concentration of emissions; noise	classroom activities, playground activities	school staff, pupils and parents	diminish health hazard to staff and pupils from fumes	provide air conditioning in school	more tree planting to screen school from roads
Ti Rakau Drive	encroachment on residential properties abutting corridor	social	loss of property /value / amenities	at home	residents on abutting property	equity	land /property purchase /compensation	minimise uncertainty; fast resolution; relocation grants
Edgewater College	increased traffic in Ti Rakau Drive	hazard, access	risk of injury from traffic; chaos at pickup after school	travel to and from school	school staff, pupils and parents	restore /improve safe access	pedestrian overbridge /underpass	provide for easy vehicle access to school

Appendix 1: Checklist of Activities

CHECKLIST #1 - ACTIVITIES

Community Activities Potentially Affected by Traffic Changes

- Road-oriented activities**
- Driving to /from work Yes Where? _____
 - Driving to /from local home Yes Where? _____
 - Driving to /from school Yes Where? _____
 - Driving and stopping Yes Where? _____
 - Turning right into side road /driveway Yes Where? _____
 - Turning left into side road /driveway Yes Where? _____
 - Turning out of side road /driveway Yes Where? _____
 - Reversing out of side road /driveway Yes Where? _____
 - Pulling out from kerbside parking Yes Where? _____
 - Kerbside parking by home Yes Where? _____
 - Walking along road Yes Where? _____
 - Crossing road Yes Where? _____
 - Riding along road Yes Where? _____
 - Cycling along road Yes Where? _____

- Off-road activities**
- Staying in home Yes Where? _____
 - Sleeping at night Yes Where? _____
 - Running a shop /business Yes Where? _____
 - Selling a home Yes Where? _____

Other (please write in)

- _____ Where? _____
- _____ Where? _____
- _____ Where? _____
- _____ Where? _____
- _____ Where? _____
- _____ Where? _____
- _____ Where? _____

Appendix 2: Checklist of Stakeholders

CHECKLIST #2 - STAKEHOLDERS

Community Stakeholders Potentially Affected by Traffic Changes

Residents

on abutting properties	Yes <input type="checkbox"/> Where? _____
with driveways	Yes <input type="checkbox"/> Where? _____
land /dwellings /access /amenities affected	Yes <input type="checkbox"/> Where? _____
with environment concerns	Yes <input type="checkbox"/> Where? _____
other area residents	Yes <input type="checkbox"/> Where? _____

business owners	Yes <input type="checkbox"/> Where? _____
loss of customer /staff access /parking	Yes <input type="checkbox"/> Where? _____

Drivers

Commuters / through traffic	Yes <input type="checkbox"/> Where? _____
Residential services' tradesmen	Yes <input type="checkbox"/> Where? _____
Bus driver	Yes <input type="checkbox"/> Where? _____
Local residents	Yes <input type="checkbox"/> Where? _____
Local residents commuting	Yes <input type="checkbox"/> Where? _____
Residents on abutting property	Yes <input type="checkbox"/> Where? _____
Parents of school children	Yes <input type="checkbox"/> Where? _____

Cyclists

School children on bicycles	Yes <input type="checkbox"/> Where? _____
Commuters on bicycles	Yes <input type="checkbox"/> Where? _____
Other cyclists	Yes <input type="checkbox"/> Where? _____

Pedestrians

School children	Yes <input type="checkbox"/> Where? _____
Mothers with kids	Yes <input type="checkbox"/> Where? _____
Retired people	Yes <input type="checkbox"/> Where? _____

Users of other modes

horse riders	Yes <input type="checkbox"/> Where? _____
tricycle riders	Yes <input type="checkbox"/> Where? _____
walker users	Yes <input type="checkbox"/> Where? _____
wheelchair users	Yes <input type="checkbox"/> Where? _____
skateboard riders	Yes <input type="checkbox"/> Where? _____
rollerblade users	Yes <input type="checkbox"/> Where? _____

Other (please write in)

_____ Where? _____

_____ Where? _____

Appendix 3: The MATRIX ANALYSIS DATABASE

Changes	Effects		Activities	Stakeholders	Responses	Mitigation	
Traffic change /increase	Perceived /projected	Effect detail	Potentially affected activities	Stakeholders potentially affected	Objectives for remedy	Potential treatments	Potential enhancements
			<u>ROAD USE</u>	<u>ROAD USERS</u>			
cars driving fast	hazard	risk of injury from traffic	walking along road	pedestrians	slower traffic	lower speed limit	speed camera, police
proximity to traffic	hazard	risk of injury from traffic	walking along road	pedestrians	separation from traffic	footpath, fences, railings	separator
traffic not stopping	hazard	risk of injury from traffic	crossing road	pedestrians	stop traffic	pedestrian crossing	traffic lights
traffic not stopping	hazard	risk of injury from traffic	crossing road	pedestrians	avoid traffic	pedestrian overbridge	
traffic not stopping	hazard	risk of injury from traffic	crossing road	pedestrians	avoid traffic	pedestrian underpass	well lit /patrolled
fast through traffic spooking horses	hazard	risk of injury from traffic	riding along road	horse riders	keep riders and through traffic separate	divert through traffic from horse riding areas	provide riding paths away from traffic
cars driving fast	hazard	risk of injury from traffic	cycling along road	cyclists	slower traffic	lower speed limit; traffic calming	speed camera, police; regular patrolling
proximity to traffic	hazard	risk of injury from traffic	cycling along road	cyclists	separation from traffic	cycle lanes	provide separator
hill crest, dip, corner that obscures view of road	hazard	risk of crash due to poor visibility	driving	drivers	improved visibility	straighten bend /road; dig out hill; remove obstacles	
streams of vehicles cross each other's paths	hazard	risk of crash at busy intersection	driving	drivers	reduce direct crossing of moving vehicle paths	give way signs /road markings; traffic lights; roundabouts	

narrow /single lane road	hazard	risk of crash from other cars stopping /turning /parking /pulling out	driving	drivers	reduce stopping in moving vehicle paths	provide lanes for turning /stopping /passing; median strip for right turn	reduce road /property entrances; prohibit parking
traffic congestion	nuisance	delays; wasted time	driving through	outside commuters	improve traffic flow	widen road; multiple lanes	raise speed limit
local cars starting /stopping /parking /turning in traffic	hazard	car crash risk	driving through	outside commuters	minimise crash risk	median strip; parking lanes; slow lanes; turning bays; traffic lights /roundabouts	
traffic congestion; extended peak	hazard	hard access arriving /departing; delays	driving to /from work	local residents commuting	minimise crash risk	median strip; parking lanes; slow lanes; turning bays; traffic lights /roundabouts	
traffic congestion; extended peak	nuisance	hard access; delays; wasted time	driving to /from local residence	residential services' tradesmen	improve traffic flow	widen road; multiple lanes	raise speed limit
increased concern re safety of kids	nuisance	response to hazard; takes time	driving to /from school	parents of school children	safer school trip	walkway, cycleway, sidewalk, railing, school bus	traffic patrols at crossings
risk of car hitting people getting on /off /running for bus	hazard	injury to passengers from traffic	driving and stopping	bus driver, passengers	safety for bus and passengers	bus stop bays, bus lanes	pedestrian crossing; traffic lights by bus stop
steady traffic flow from behind; traffic not stopping	hazard	risk of injury from traffic	turning right into side road /driveway	local residents; residents on abutting property /visitors	avoid main traffic stream	median strip	close access, use alternative access
steady traffic flow from behind; traffic not stopping	hazard	risk of injury from traffic	turning left into side road /driveway	local residents; residents on abutting property /visitors	avoid main traffic stream	slow lanes; turning lanes	close access, use alternative access
steady traffic flow from behind; traffic not stopping	hazard	risk of injury from traffic	turning out of side road /driveway	local residents; residents on abutting property /visitors	avoid main traffic stream	slow lanes; passing lanes	
steady traffic flow from behind; traffic not stopping	hazard	risk of injury from traffic	reversing out of driveway	local residents; residents on abutting property /visitors	avoid reversing into traffic	slow lane + reverse into driveway	driveways sized to turn car around; double driveways

steady traffic flow from behind; traffic not stopping	hazard	dangerous pulling into peak traffic; injury from traffic /car crash	pulling out from kerbside parking	local residents; residents on abutting property /visitors	eliminate situation of risk	parking bays; off-street parking	access lanes
steady traffic flow from behind; traffic not stopping	hazard	dangerous stopping in peak traffic; injury from traffic /car crash	kerbside parking by home	local residents; residents on abutting property /visitors	eliminate situation of risk	parking bays; off-street parking	

Changes	Effects		Activities	Stakeholders	Responses	Mitigation	
Traffic change /increase	Perceived /projected	Effect detail	Activity affected	Stakeholder(s) affected	Objective for remedy	Potential treatments	Potential enhancements

ROADSIDE USE ROADSIDE USERS

loss of land / dwelling to roading development	social	loss of property value / amenities	at home	on abutting property	equity	relocate dwelling; land / property purchase; compensation	minimise uncertainty; fast resolution; relocation grants
automotive traffic	nuisance	exhaust emissions	at home	on abutting property	less emissions	plant /preserve green belts	more efficient engines
car fumes from peak traffic	health	exhaust emissions in drinking water	at home	on abutting property, on tank water	remove health hazard	connect to /provide reticulated water supply	enforce emission standards
traffic /roading changes	social	loss of access /parking for customers > loss of business	trading, selling goods /services	roadside businesses	preserve /replace access and parking	parking bays; alternative parking / access provided	shopping centres /zoning
engines racing; esp. trucks /motor cycles; uphill; stopping /starting at traffic lights /intersections	nuisance	noise nuisance, esp. at night	at home	area residents	minimise situations that cause engine noise	lower speed limit; minimise stops; redirect trucks /through traffic	dedicated truck /through traffic routes; plant trees for screening

spill over through traffic	nuisance	traffic congestion	at home	area residents	less through traffic	improve capacity of collector / arterial roads	traffic calming on local roads, speed bumps etc.
cars, street lights	nuisance	light nuisance	at home	area residents	no light on home	plant shelter belt /hedge	
large trucks driving past	nuisance /hazard	vibration, house /land shaking	at home	area residents	less vibrations felt	redirect trucks elsewhere	dedicated truck routes
(anticipated) traffic effects, road development effects	social	decrease in property values	at home	area residents	equity	property purchase /compensation	minimise uncertainty; fast resolution; relocation grant
better access > rising land values; new roading costs	social	rates increases, people on fixed incomes rated out of their homes	at home	area residents	reduce hardship; equity	calculate rates on other criteria than property market values	
access to neighbourhood disrupted by traffic /roading changes	social	social networks bisected by traffic /roading changes	visiting neighbours	area residents	preserve /re-instate access	over /underpass; pedestrian crossing /plus traffic lights	
construction effects; runoff from road; heavy metals	environment	erosion; silting /pollution of waterways; loss of wildlife	nature walks, swimming	environment concerned	no loss of environment quality	culverts; silt traps; environmentally sensitive road alignment	
infrastructure construction / operation	environment / wai	pollution of waterways	katiakitanga	tangata whenua	no pollution of wai	prevent pollution of waterways	
infrastructure construction / operation	environment / kai	availability / state of kai moana	katiakitanga	tangata whenua	no loss / pollution of kai	prevent pollution effects	
loss of businesses that employ Maori	social	loss of employment opportunities for Maori	working at a job	tangata whenua	no loss of employment	mediate / provide alternative	
loss of housing / homes for Maori	social	loss of rental accommodation for Maori	living somewhere	tangata whenua	no loss of accommodation	mediate / provide alternative	

increased traffic intensity	hazard	journey to / from crèche /kohanga reo	crèche /kohanga reo services provision	parents, young children	safe access to crèche /kohanga reo facilities	provide for safe access	
increased traffic intensity	hazard	journey to / from school	school services provision	pupils, parents	safe access to school facilities	provide for safe access	
increased traffic intensity	hazard	journey to / from church	church services provision /use	church services providers, churchgoers	safe access to church facilities	provide for safe access	
increased traffic intensity	hazard	journey to / from sports	sports grounds use	players, spectators	safe access to sports facilities	provide for safe access	
increased traffic intensity	nuisance	cars seeking parking	parking	drivers, passengers	access to safe parking	provide for safe access	