

## AMA Corridor Roadside Safety Strategy –2017 Review

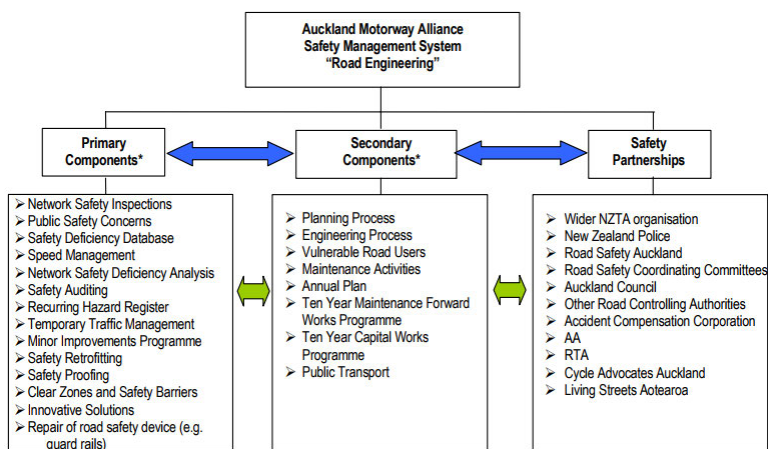
### Purpose

This review summarises the findings of a review of the AMA network' roadside safety. The investigation considers the roadsides by corridor segment, recording the current condition, the traffic demands, and the resulting gaps requiring investment. This study also considers median barrier systems on divided carriageways.

### Background

This study builds on preliminary work done in preparation for a visit from the National NSM 20 Sept 2017 – a brief update of where we are now and what we are moving towards.

### AMA Safety Strategy



\* more detail provided in the following sections

Figure 2: Road Safety Components

- Continuous network improvement aimed at leaving a positive legacy
- Increasing congestion requires a reduction in vulnerability to reduce clearance times and secondary crashes. Thus barriers need to be located to maintain space for incidents to be moved clear of lanes, allow enforcement and maintenance activities.
- Increasing impact energies and vehicle mass (100 to 110km/h, 80 to 100km/h, volume of HV's & HPMV's) leading to demand for higher containment levels
- Recognise the benefits of more resilient barrier systems – faster incident clearance, less disruption to travel and reduced secondary collisions
- Many inherited systems are not performing well, requiring replacement/renewal
- Wider carriageways can give rise to higher approach angles, plus vehicles are often yawing in ROR incidents
- Total median barrier protection of all dual carriageways – instigated following initial AMA review
- Progressive median barrier installation on rural single carriageways (SH20B, SH22, SH2) via larger scale capital projects
- Progressive protection of roadside hazards not being remedied by programmed capital projects, with priority for sites with high consequences (National Grid power pylons, schools, playgrounds), higher rates of ROR crashes,
- Improvement through new works (SWIPP) and renewals

### Achieving improvements

## 1. SWIPP

- a. Wrong Way prevention
  - b. Police enforcement pads
  - c. Extending barrier coverage on corridors unlikely to be addressed by capital projects
    - i. SH1 Newmarket to Manukau
    - ii. SH20 Puhinui to Walmsley including SH20A.
  - d. Install continuous motorcycle barrier protection SH2 to SH1 Nbd link, 01N-0478-R3 / 430 to 01N-0478-R3 / 630 (200m)
- Cost of installing barrier affected by shoulder width less than required setback, kerbs, lighting columns, formation, maintenance access and patrols

## 2. Renewals

### Picking up failings

- systems nearing the end of their life, failing
- substandard items with high crash consequence/risk
- difficulty in building a case using existing statistics
- lucky network – low DSI's related to barrier failures
- unlucky network – increasing severity of flow breakdowns & no. of barrier strikes
- increasing number of truck impacts with barrier systems – problem for older systems

### Renewal Priorities:

#### a. CMJ weaknesses high consequence risks but high cost solutions:

- AHB northbound approach Thriebeam installation prior to AMA
- AHB southbound approach Thriebeam recently completed by AMA
- AHB Gantry 2 (northbound departure) protection is in detailed design stage
  - TL5+ (1.8m high) for motorway security and headlight glare prevention
  - popular walking route, potentially major access to Skypath
- AHB southbound departure to Shelly Beach Rd
  - Thriebeam installed, but abutment joint issue
  - Solution is being developed
- Structures section edge containment risk assessment priorities:
  - Grafton No. 1 bridge (nbd SH1 over port link) rhs feasibility assessment next year
  - Grafton No. 3A and 3B bridges (sbd SH1 and Symonds St on ramp over SH16) feasibility assessment next year
  - Shelly Beach Rd off ramp bridge over SH1 detailed design this year
- ~~SH1 nbd rhs (median) Grafton No. 1 to Upper Queen St UP~~
  - ~~Installed MASH TL 4 system (Ezyguard HC)~~

#### b. Failing rigid systems with Thriebeam patches:

- Mt Wellington Bridges
- Sylvia Park Bridges
- Tamaki River Bridges
- SH1

- c. High capacity routes with substandard systems  
in no particular order as priority assessment to be reviewed:
  - Northern motorway median WRB Brifen TL3 (Constellation to Esmonde)
  - Southern motorway median WRB Brifen TL-3 (Papakura to Drury)
  - Southern motorway median WRB WashDoT TL-2 low tension (Quarry to St Stephens)
3. Existing corridors to be treated by Capital Projects or 110km/h and/or Road Safety Alliance
  - a. SH1 Northern Motorway 110km/h and NCI
  - b. SH1 Southern Motorway Rd Safety Alliance, SCI, 6 laning to St Stephens with southern growth areas
  - c. SH18 Upper Harbour Motorway 110km/h and NCI
  - d. SH16 Lincoln to Westgate and future SH16/SH18 remaining links to SH16 north
  - e. SH2 from SH1 to SH25

Projects do not always address problems:

- SH16 median timber toe to NJB
- Tric Block
- Other deficient systems
- Local road bridge approaches (mwy UP's)

4. Remaining corridors with significant legacy issues:

a. SH1 Northern Motorway JHT to UHH

AADT = 19,000 (JHT) to over 125,000 (Tristram to Esmonde)

Concern	Risk	Strategy
Kerb in front of barrier - JHT	19,000vpd	Monitor via CRS
T-Lok barriers at JHT southern portals	19,000vpd	Renewal – high priority in view of condition
Non-traversable roadsides, cuttings	19,000vpd	Monitor via CRS
Transitions at bridges Orewa River Bridges Awanohi Bridges	26,000vpd 60,000vpd	Include with bridge barrier renewals
Suspect capacity of bolted on concrete bridge barriers Orewa River Bridges Awanohi Bridges	26,000vpd 60,000vpd	Renewals – low priority pending structural assessment
BCT's, including median around gantry legs & bridge piers Wainui Rd UP Hibiscus Coast Hwy Silverdale UP Silverdale Nbd exit gantry Silverdale Nbd advance gantry Wilks Rd UP Bawden Rd UP Lonely Track Rd	26,000vpd 27,000vpd 60,000vpd 60,000vpd 60,000vpd 60,000vpd 60,000vpd	Renewals – low priority unless demonstrable risk increase
Segmental NJB north of Oteha Valley IC (further south replaced by NCI)	60,000vpd	Renewals – medium priority
Timber post W-section TL-3 in 110km/h	60,000vpd	Renewals – low priority unless demonstrable risk increase
Edge containment and anti-throw screens Lonely Track Rd UP McClymonts Rd UP	60,000vpd	Renewals and SWIPP (anti-throw screens), UHH Project

b. SH18 Upper Harbour Motorway

Concern	Risk	Strategy
Failing HD sockets embedded in bridge decks Albany Hwy UP Greenhithe Rd UP Tauhinu Rd UP	AHW over 46,000vpd GHR over 46,000vpd TR over 46,000vpd	Renewals – medium priority low priority medium priority
Anti-throw screens Albany Hwy UP Greenhithe Rd UP Tauhinu Rd UP Squadron Drive Trig Rd	46,000vpd 46,000vpd 46,000vpd 46,000vpd 46,000vpd	SWIPP – assess priority using established procedure
Median cross-over bodes	46,000vpd	Mtce

c. SH1 Northern Motorway from SH1 Upper Harbour Mwy to CMJ (Esmonde)

Concern	Risk	Strategy
Lighting slip bases too high	125,000vpd	Renewals – medium priority
Northcote – Esmonde TL-3 WRB foundations exposed	125,000vpd	Renewals – high priority
Wairau – Esmonde roadside hazards: high slip bases, nbd drainage headwall, access control	125,000vpd	SWIPP medium priority
Anti-throw screens Sunset Rd UP Sunnynook Rd Northcote Rd UP (possible AT project)		SWIPP – assess priority using established procedure

d. SH1 and SH16 CMJ

Concern	Risk	Strategy
Segmental NJB AHB – Esmonde	>150,000vpd	Renewals – medium priority
Segmental NJB AHB – Esmonde	>150,000vpd	Renewals – medium priority
TL3 median W-section Esmonde	>150,000vpd	Renewals – medium priority
Some old style concrete bridge barriers & transitions SH16 over southern to port links	>150,000vpd	Renewals – medium priority
Old style channel barriers (Grafton 1, 3A & 3B)	>75,000vpd	Renewals – medium priority
Segmental concrete barriers (Thriebeam patches)	>75,000vpd	Renewals – medium priority
Deep drainage channels in front of barrier – VPT	61,000vpd	Renewals – medium priority
Anti-throw screens SH1 Exemouth Rd FB SH1 Shelly Beach Rd UP SH1 Wellington St UP SH1 Hopetoun St UP SH1 & 16 Upper Queen St UP SH1 & 16 Symonds St UP SH1 Grafton Rd UP SH1 Mountain Rd UP SH16 Grafton Rd UP SH16 Newton Rd UP SH16 Waima-Haslett FB SH16 Bond St UP	>150,000vpd >150,000vpd >120,000vpd >120,000vpd >150,000vpd >150,000vpd >150,000vpd 200,000vpd >60,000vpd >120,000vpd >120,000vpd >120,000vpd	SWIPP – assess priority using established procedure
Exposed rock / hazards at Port link / Symonds St off	19,150vpd (01N48429)	SWIPP
SH16 / Gladstone Rd int	48,050vpd (01600001)	SWIPP



e. SH16 CMJ to Lincoln

Concern	Risk	Strategy
Non-complying rigid median barrier with timber toe extension and excess vertical reveal at eastern transitions 016-0000-I-7600 to 016-0000-I-8190	66,000vpd	Renewals – medium priority
Old style channel bridge barriers GNR OB Rosebank Wbd off ramp Br Rosebank Ebd on ramp UP Patiki Ebd off ramp	36,000 over GNR 5,000 over water 6,000 over 101,000 8,000 over 101,000	Renewals – medium priority low priority medium priority medium priority
GNR Ebd on ramp (McLaren's cnr)	Ongoing LOC ROR	SWIPP
Poor transitions between W-section and concrete, project issues		Renewals – low priority
Anti-throw screens St Lukes Rd UP Te Atatu Rd UP Lincoln Rd UP Royal Rd UP Hobsonville Rd UP	92,000vpd 77,000vpd 49,000vpd 58,000vpd 19,000vpd	SWIPP – assess priority using established procedure

f. SH1 CMJ to Manukau

Concern	Risk	Strategy
Weak barrier systems EPH to Newmarket adjacent rail	75,000vpd	Renewals – high priority
Tric Block 01N-0431-I / 15219 to 01N-0431-I / 16744 (1,525m)	98,000vpd	Renewals – high priority
Segmental concrete barriers, ASR	98,000vpd	Renewals – medium priority
Weak segmental bridge barriers: Mt Wgtn Hwy and Sylvia Park Bridges Tamaki River Bridges	44,000vpd, failing 66,000vpd	Renewals – high priority high priority
Roadside hazards Penrose substation rocks, trees Wiri substation trees, park EPH NB rock outcrop Park 259-261 Bairds Rd Park at 21 Whitley Cres Green Lane East Nbd exit		SWIPP
Weak bridge pier protection Market Rd Penrose Rd Panama Rd Princes St Bairds Rd Reagan Rd		Princes St replaced by capital project, rest SWIPP or renewals

Concern	Risk	Strategy
Anti-throw screens Market Rd UP Omahu Rd UP Green Lane East FB Penrose Rd UP Panama Rd UP Princes St UP Highbrook UP Bairds Rd UP East Tamaki Rd UP Reagan Rd UP Te Irirangi Rd UP Redoubt Rd UP		SWIPP – assess priority using established procedure

g. SH1 Manukau to St Stephens

Concern	Risk	Strategy
Anti-throw screens Orams Rd UP Hill Rd UP Walter Strevens Dr UP Beach Rd UP Park Estate Rd UP Bremner Rd UP		SWIPP – assess priority using established procedure
Roadside Hazards		Ensure addressed in capital projects (SCI, 110km/h, SRA)
Median Brifen N2 Beach Rd to Drury	50,600vpd AMA SDD: Medium IIMM: Poor	Ensure addressed in capital project (6-laning), SRA, or renewals.
Median shoulder and barrier containment level Redoubt Rd to Orams Rd	123,000vpd AMA SDD: Medium IIMM: Poor	Possible large SWIPP project?
Weak containment Slippery Creek Bridges (bolted to side of deck)	34,200vpd AMA SDD: Medium IIMM: Poor	Ensure addressed in capital project (6-laning), SRA, or renewals.
Median WashDoT WRB south of Drury to St Stephens	Medium – high	Ensure addressed in capital project (6-laning) or renewals.

h. SH1 St Stephens to Pokeno

Concern	Risk	Strategy
Motorcycle barrier rail SH2 to SH1 Nbd link 01N-0478-R3 / 430 to 01N-0478-R3 / 630 (200m)		SWIPP
Tric Block 01N-0461-I / 11011 to 13597 (2,586m) 01N-0461-I / 14252 to 16257 (2,005m)		Renewals – medium priority unless SRA?
Median cross-over bodes		Maintenance
Roadside hazards	Low – medium	Ensure addressed in SRA
Weak bridge edge containment St Stephens Overbridge		

i. SH20 Puhinui to SH20A and SH20A to SH16

Concern	Risk	Strategy
Segmental bridge barriers and weak systems (Thriebeam patches) at Puhinui OBs	>50,000vpd	Renewals – medium priority
Inadequate containment on mwy over mwy bridges SH20 / SH20A OB	35,000vpd	Renewal or upgrade under structures risk project
Roadside hazards – trees		SWIPP
Anti-throw screens Portage Rd UP Massey Rd UP Bader Dr UP South Grade Line FB Hall Ave FB Walmsley Rd UP Hastie Ave FB Beachcroft Ave FB Queenstown Rd UP Hillsborough Rd UP Hayr Rd UP Keith Hay FB Dominion Rd UP May Rd UP Ernie Pinches FP Maoro St UP		SWIPP – assess priority using established procedure

Segmental bridge barriers and weak systems (Thriebeam patches)

Inadequate containment on mwy over mwy bridges



j. SH20A Montgomerie to Verrissimo/The Landing

Concern	Risk	Strategy
Roadside hazards		
Anti-throw screens Interchange FB Bader Dr UP Killington Cres FB Kirkbride Rd UP		SWIPP – assess priority using established procedure

Median WRB to roundabout, crossing bdy with AIAL

k. SH20B Puhinui Rd Start to Orrs Rd/AIAL boundary

Concern	Risk	Strategy
Roadside hazards		

l. SH22 Start at Hingaia Stream Bridge to End at Adams Dr / Lough Bourne Dr

Concern	Risk	Strategy
Roadside hazards		

m. SH2 Start at SH1 to End at RS35 SH25 Junction

AADT = 16,200vpd (2016 Telemetry site)

Concern	Risk	Strategy
Roadside hazards – culvert ends		
Roadside hazards – bridge approaches	AMA / IIMM	
Grahams Bridge 0/2.53	Medium / Poor	
McAnultys Stream Br 0/2.94	Medium / Poor	
Grattens Br 0/4.11	Medium / Poor	
Mangatawhiri Strm Br 0/7.11	Medium / Poor	
Culvert 0/8.41	High / Very Poor	
Culvert 0/9.97	High / Very Poor	
Culvert 0/11.13	High / Very Poor	
Mangatangi Strm Br 18/0	Medium / Poor	
Culvert 18/2.39	Medium / Poor	
Culvert (Br 287) 18/10.72	Medium / Poor	
Culvert/ Br 306 18/12.61	Medium / Poor	
Culvert/ Br 311 18/13.16	Medium / Poor	
Culvert/ Br 313 18/13.29	Medium / Poor	

Concern	Risk	Strategy

## 5. GLOBAL ISSUES

Retrofitting NuGuard posts (criteria, guidance, NZTA expectations)

Motorcycle retrofits, e.g. SH2 to SH1 Nbd

Anti-throw screens

Local road approaches to bridges over the motorway (e.g. Hill Rd)

Pest plant removal exposing residential properties or sensitive land use

Effects of MASH – replacement of strong post W-section

Segmental barriers prone to overturning

Weak barriers / handrails

Low barriers

### Asset assessment for renewal

Forward planning needs to consider means of predicting the remaining asset life. This is determined by asset environment, age and condition, and by NZTA policy. The International Infrastructure Management Manual (IIMM) applies the following rating system:

Rating	Remaining Useful Life	Condition	Implications
1	100%	New	New asset of sound physical condition and 100% functional.
2	75%	Good	Sound physical condition like new, 100% functional
3	50%	Average	Acceptable physical condition, mid through life still 100% functional.
4	25%	Poor	Deterioration evident; reaching asset life, may be illustrating defects, issues, and minor safety risks. Monitoring and planning renewal needed. 90% functional.
5	0%	Very Poor	Functionally failed; asset not fulfilling its intended service. Asset may be posing a high safety risk. Asset has reached its life and requires immediate replacement.

From a safety perspective, a barrier system must continue to function, so replacement should be programmed as the asset reaches an IIMM rating of 4.

In terms of steel components, this is typically assessed at 25 years in service, although longer service lives are often achieved. The effective life is dependent environmental factors (impacts, marine conditions, maintenance activities such as weedspraying or mowing, adjacent surfacing overlays). After 20 years in service closer maintenance attention and assessment may be required.

Concrete component life is dependent on concrete quality and degradation, such as from Alkali-Silica Reaction (ASR), reinforcement corrosion, abrasion / impact damage, and support issues. In an ideal situation, concrete can be expected to last well beyond 100 years. However, if there are problems with the concrete materials, such as aggregates containing certain forms of silica, then moisture will cause the material to swell, resulting in extensive random pattern cracking, and loss of strength. Such concrete may have a significantly reduced life, although the effect can be minimised by ensuring concrete is manufactured using appropriate aggregates (low ASR sensitivity) and/or mineral admixtures, and moisture control. Some median barriers between East Tamaki Road and

### Concrete barrier systems

Relating this to the typical barriers on the AMA network, the following strategy is derived:

System	Strategy	Derivation / Source
Flexible WRB not NZTA approved	Renew according to priority based on risk.	NZTA M23 App.A
Flexible WRB NZTA approved system	Maintain, provided that meets required containment level. Most medians should be considering rigid systems to MASH TL-4 or higher.	NZTA M23 App.A, discussion with Julian Chisnall



<b>System</b>	<b>Strategy</b>	<b>Derivation / Source</b>
Semi-rigid not NZTA approved. Steel rail & timber post, other rail/post/support	Repair minor damage, replace extensive damage or at end of life with an NZTA M23 approved system. End of life determined by condition of timber (splitting, loss of section) and steel (loss of galv, rust) Priority determined by risk assessment.	NZTA M23 App. A, discussion with Julian Chisnall
Steel rail, steel post, NZTA approved system	Repair damage, replace at end of life with an NZTA M23 approved system. End of life determined by condition of steel (loss of galv., rust)	NZTA M23 App. A
Rigid segmental	Replace under renewals prioritised by risk profile based on condition and impact risk	NZTA M23 App. A
Rigid continuous non-compliant	Replace under renewals prioritised by risk profile based on condition and impact risk	NZTA M23 App. A
Rigid continuous compliant	Maintain existing	NZTA M23 App. A
Rigid cover plates	Maintain until NZTA final design published, then replace as renewals prioritised by risk profile based on condition and impact risk	NZTA M23 App. B
Transitions non-compliant	Replace under renewals prioritised by risk profile based on condition and impact risk	NZTA M23 App. A
Transitions compliant	Maintain existing	NZTA M23 and RSB-5, TM series