Appendix ‘E’

Maintenance and Operating Requirements

1. The Operations and Maintenance Approach

The operations and maintenance approach is explained in Appendix Y, along with various aspects in Appendix X.

Various maintenance levels of service issues are covered in Appendix B.

2. Future Maintenance Costs

The estimated future cost of maintaining the network is shown in Tables E1 and E2.

Table E.1 Estimated Maintenance & Operating Costs ($'000) – 2009/19

Excluding – Depreciation
– Loan Interest
– Footpaths

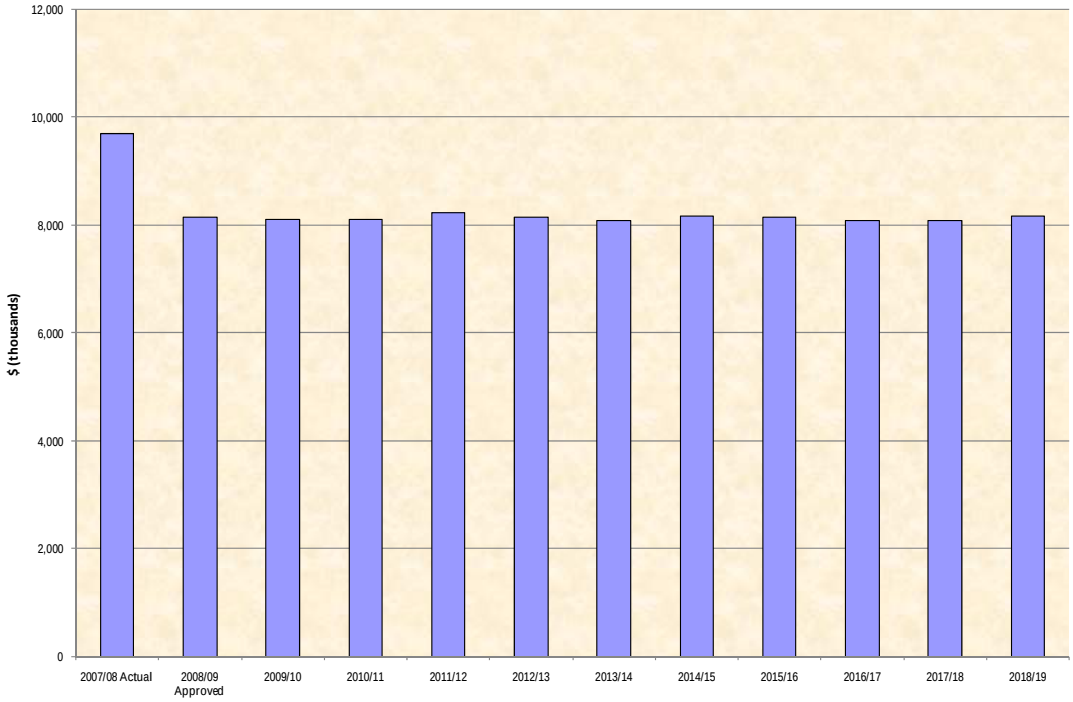
2007/08 Actual	2008/09 Approved	Work Category No	Maintenance and Operating Cost	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
0	0	2	Studies & Strategies	120	120	150	75	0	100	75	0	0	100
2,964	3,180	111	Sealed pavement maintenance	3,172	3,172	3,172	3,172	3,172	3,172	3,172	3,172	3,172	3,172
1,736	1,158	112	Unsealed pavement maintenance	1,763	1,763	1,763	1,763	1,763	1,763	1,763	1,763	1,763	1,763
861	575	113	Routine drainage maintenance	588	588	588	588	588	588	588	588	588	588
379	545	114	Structures maintenance	539	539	539	539	539	539	539	539	539	539
1,522	510	121	Environmental maintenance	525	525	525	525	525	525	525	525	525	525
1,111	1,078	122	Traffic services maintenance	245	245	245	245	245	245	245	245	245	245
0	0	124	Cycle Path Maintenance	0	0	15	15	15	15	15	15	15	15
16	25	131	Level crossing warning devices	25	25	25	25	25	25	25	25	25	25
0	0	141	Emergency reinstatement	0	0	0	0	0	0	0	0	0	0
1,100	1,078	151	Network and asset management	1,132	1,132	1,132	1,132	1,132	1,132	1,132	1,132	1,132	1,132
0	0	511	Bus Services	0	0	15	15	15	15	15	15	15	15
0	0	514	PT Operations & Maintenance	0	0	50	50	50	50	50	50	50	50
0	5	517	Total Mobility	5	5	5	5	5	5	5	5	5	5
9,689	8,154		TOTALS	8,114	8,114	8,224	8,149	8,074	8,174	8,149	8,074	8,074	8,174
			Inflation Allowances	0	235	484	687	882	1,092	1,301	1,514	1,744	1,984
			Total Maintenance (incl inflation)	8,114	8,349	8,708	8,836	8,956	9,266	9,450	9,588	9,818	10,158

Note:

- Most of the maintenance activities are flat lined as the network is not growing sufficiently, through the addition of vested assets, to produce a significant increase in maintenance costs. It is also assumed that increasing renewals expenditure will be sufficient (pavement rehabilitations, gravel roading metalling, reseals) to keep up with the extra degradation on the network so that maintenance expenditure can stay reasonably constant.
- Special Purpose Roads (SPR) are excluded from all tables as these are funded separately at 100% subsidy by NZTA. The only SPR in the District is now the Lower Hollyford Road (16kms of gravel road). This is maintained under a separate maintenance contract (part of the Milford Road State Highway contract) and a separate Professional Services agreement. Costs are therefore passed directly on to NZTA.
- The total expenditure on maintenance on SPR is of the order of $75,000pa. Given the relatively small amount spent and the special nature of this road with its 100% subsidy, this expenditure has not been included in the figures in Table E.1 above.
- Only the subsidised portion of street cleaning is included under Environmental Maintenance in the above table. The rest of the cost is covered in individual Community Board budgets.

- Figures are assessed in 1 July 2009 dollars. Inflation is added to the combined totals using the rates described in Table R.G.2.
- Figures for sealed pavement maintenance assume sufficient funding for pavement rehabilitations is maintained to avoid a significant increase in heavy duty maintenance funding.
- Most of Traffic Services are in Traffic Services Renewals.
- The table excludes management and administration costs. These are separately shown on Table M.1. An allowance of 2.25% from these is subsidised by NZTA.
- The above allows to carry out strategic reviews and studies to see how best Active and Passenger Transport can be encouraged and supported within Southland District. An allowance is made to progress these issues through work categories 124, 151, 511, 514, and 517.

Table E.2 Estimated Maintenance and Operating Costs – 2009/19



Note:

- The 2007/08 year is actual costs and the reason for the spike is the amount of ice/frost work carried out during that year. This table excludes inflation.

3. Issues

- Telecommunications, power and gas utility organisations have infrastructure sited in many locations within the road corridor that the Council manages. Legislation gives these organisations legal right to the road corridor but the location of the facilities is subject to conditions imposed by the Council. These conditions must not be unreasonable. In short, utility companies have a right to use the road corridor and the Council has a right to impose reasonable conditions on the company as to location within the road.
- Continue to monitor the benefits of the Alliance Contract to determine if it should also be applied to other areas.

4. Future Action and Improvements

Schedule
Future Improvement Priorities

Ref. No.	Item	Appendix Relative Urgency						Comments
		1	2	3	4	5	6	
E1	Continue to monitor and manage utilities activities on network					✓		This is now a business as usual activity.
E2	Adopt NZUAG recommended Code of Practice to manage utilities in the road corridor		✓					Awaiting the Government regulations to be established.

Key:

1 = Extremely urgent (needs to be addressed now)
2 = Very urgent
3 = Urgent
4 = Reasonably or fairly urgent
5 = Not urgent
6 = A good idea for some time in the future

Attachment 'A'

Maintenance and Operation Works Description

1. Maintenance and Operations Work

Maintenance work is aimed at providing the desired level of service in the most cost effective manner for all customers over a significant period of time or viewed another way it is the right action, at the right time when considering whole of life cost. Overall maintenance includes renewals (discussed in Appendix F) and operations work.

Operations work covers the daily minor issues and failures that arise from initial deterioration of surfacing and pavement failures and ensuring traffic service features (signs, marker posts, pavement markings, etc) are at the required level of service.

Within the transportation industry there are many references available, the most common documents are local authority standards and NZ Transport Agency documents.

These notes for maintenance and operations works cover how the failures are identified and indicate how repairs are to be carried out.

A note regarding structures; extra consideration needs to be taken and the method of repair may vary as damage to the structure or the potential extra loading may affect the performance of the structure.

1.1 Sealed Roads

Pavement maintenance involves a range of work including structural, surfacing and drainage repairs. Surfacing and drainage repairs ensure there is a water proofing cap over the pavement and the drainage ensures any moisture can escape through a controlled medium.

Operation maintenance also encompasses the greater road environment with signage, markings, vegetation, delineation and other safety related tasks. It also covers the asset management staff involvement in looking after a network.

The main forms of maintenance works are:

1.1.1 Structural Pavement

Structural pavement repairs cover isolated areas of sealed pavement which fail as they deform and crack which leads to further failure as the deformation and cracking allows more water into the pavement. Depending on the level of deformation the failed area can either be repaired by scarifying the surface (rip and remake) and mixing in lime and / or cement to strengthen the top layer of material or the failed materials can be removed (digout) to a depth which is strong enough to support the expected loads with the addition of good quality subbase and basecourse materials.

Some digouts may require subsoil drainage and in some cases the base of the digout is also covered in filter fabric to provide a separation between the marginal subgrade material and the new subbase and basecourse materials.
In both cases the rip and remake or digout repair is finished with a two coat seal aimed at providing similar texture to the remaining sealed area.

1.1.2 Seal Repairs

Various problems can occur with the sealed surface and addressing these failures is covered by the daily maintenance contractors operations.

The most common failures are discussed below.

Flushing – A smooth surface with no texture caused by binder rise or caused by chip embedment.

Bleeding – The extrusion of the binder onto the road surface, generally in hot weather. Bleeding will typically adhere to vehicle tyres and then be tracked along the road and apply a thin coat to the chip surface. This has the potential to reduce skid resistance.

Ravelling – Ravelling is associated with asphaltic concrete pavements or slurry surfaces and is typically when the binder has oxidised and has lost adhesion to the aggregates.

Scabbing – Defined as chip loss or stripping as a result of four common causes:

- insufficient binder
- lack of adhesion between the binder and the chip
- oxidised binder becoming brittle
- insufficient adhesion within the first 48 hours following a new seal.

Cracking – There are many forms of cracking and there are various causes for these cracks appearing in the surface such as:

- Brittle binder (indicating end-of-life condition)
- Loading failures (shear, rutting, tension, etc)
- Reflective cracking from lower layers following overlays
- Initial pavement failure
- Surfacing shrinkage
- Differential pavement layer strength

Pothole repairs – Pothole repairs are required when isolated areas of the seal coat have failed and have been lost, exposing the basecourse below. Provided these are picked up in time they can be repaired by removing the loose / damp material and filling them with an appropriate material, i.e. asphalt or emulsion mix.

Wheel Rutting – Overtime the concentration of heavy loads in defined wheel tracks can lead to wheel rutting. The wheel ruts are not necessarily a failure of the pavement but more a settlement / consolidation of the material below. If the seal has not cracked these can be repaired by filling the ruts with an appropriate material, i.e. asphalt or emulsion mix. If the seal in the ruts has cracked normal practice is to carry out a rip and remake repair.

Shoving – This is also known as a shallow shear failure as the pavement surface or surfacing layers have been deformed.

Delamination – When the surfacing is separated from the base course, the lower surfacing segments of the top surface may delaminate and break off completely. This is quite a common failure on bridges as the surfacing may not have fully adhered to the bridge structure.

Treatments For Localised Pavement And Surfacing Failures

Flushing and Bleeding Repairs

- Water Blasting uses a high pressure jet of water to strip away the softer bitumen material while the chip remains. Use of this process is generally suitable for resolving bleeding situations since it is reasonably localised but would not be considered a long term solution for flushing. As it removes binder material chip loss may result and it is not suitable for first coat seals.
- Gritting is not a suitable practice for addressing flushing or bleeding as it has been shown the grit pushes into the bitumen raising the bitumen higher increasing the severity of the problem.
- Hot chip treatments is suitable for flushed areas when the existing bitumen is still soft and flexible. The hot chip assists in penetrating the excess bitumen.
- Diluent and chip is when a solvent is applied to the flushed surface to assist in softening the bitumen in order to assist the additional chip material to penetrate and adhere to the surface.

Chip Loss (Scabbing, Stripping, Ravelling)

Wet lock seals can be used to address chip loss. This type of seal applies a thin coat of bitumen to the existing surface followed by the application of a smaller chip material.

Cracking Repair Options

- If the cracks are a result of pavement layer failure a digout may be required.
- If the surface is at the end-of-life state an overlay or reseal operation would be required
- If they are longitudinal or transverse cracks as a result of surfacing failure a crack bandage can be used to seal the crack eliminating the potential of moisture penetration into the pavement.
- Crack filling is typically used on wider cracks. Depending on the location and the width the applied methodology will vary as filler material will generally be required.
- Reflective cracking may be bandaged but the cracks may re-occur potentially less extensively. Failing this it may be more cost effective to reseal the section.
- Extensive cracking, where the localised options are not economic and there is a sound pavement, the solution may be to reseal the area and this may even include geotextile fabrics to provide greater strength in the surfacing.

Shoving

- If the shoved area is quite shallow then it can be removed and repaired similar to pot holes.
- If the failure is well into the pavement layers than a digout would be required to correctly reinstate the failed layers.
- If it is just the surface layer that has deformed from horizontal loading then the shoved surface can be removed and reinstated with cold mix asphalt. Depending on the location of the shove the chip seal texture may be required to be reinstated.

Delamination

- Delamination repairs may need to be given extra consideration if it is on a bridge.
- In some situations it may require the failed area to be milled out and the area resurfaced
- The failure may be minor and a general bitumen and stone mix could be applied.

1.1.3 Other Maintenance

Sweeping – Detritus is the accumulation of debris typically gravel or sand. Sweeping ensures the detritus is cleared away from intersections, corners and out of drainage paths. The finer detritus particles could penetrate the bitumen increasing the potential for bleeding or clog up the voids utilised for surface drainage in some asphalt surfaces.

Shoulders – Shoulder operations have to consider the shape of the unsealed shoulder and the seal condition at the edge of the carriageway. Shoulders can provide suitable manoeuvring to an out of control vehicle to regain control, they provide a safer area to pull off the carriageway and they can provide additional width to heavy vehicles to manoeuvre on tight bends or narrow roads. They also provide support for the road pavement.

- Shoulder shape has to ensure there is not significant build up of granular material or detritus
- Shoulders should not have potholes or rippling effects
- Edge break is when 100mm of road edge has broken away potentially leaving a significant drop to the shoulder

Drainage – Drainage is installed for several reasons the most common are to reduce the moisture content in the pavement layer and to control surface water.

- Pavements may have sub-soil drains which collect moisture from within the pavement and provide an easy path out to the main drainage system. As the fine particles get blocked from entering the drain they can reduce its effectiveness. Additionally there may be a small blockage in the drain that could cause water build up that could potentially seep into the pavement also rendering the drain ineffective. Maintenance teams should be checking these drains are operating effectively. The solutions for repair range from unblocking the drains to removing the defective drain and replacing it.
- Culverts provide a main channel below the pavement for either small streams or waterways. The most common issue with culverts is debris build up after storm events. This material will need to be removed and the frequency and quantity in generally unknown. To assist in ensuring the capacity is available for storms regular checks are carried out and known loose material cleared frequently.
- Side drains collect the surface water run off and can also consolidate the water from subsoil drains. These drains would typically disperse the water into a main stream. Maintenance requirements include keeping vegetation to a minimum and any rubbish out of the drain, as well as reformation when required.
- Kerb and Channel systems are usually through townships providing a formed edge to seal up to and a smooth path for water to flow into a centralised storm water system. Kerb and channel systems need to be kept clean as the gradients may be minimal and small blockages can reduce their effectiveness.
- Sumps (catchpits) generally take the water from the kerb and channel system and provide a chamber for the water velocity to reduce allowing the finer gravels and stones to consolidate at the bottom of the sump. Over time sumps can become fill of detritus, rubbish and vegetation so require cleaning to ensure they are working effectively.

Vegetation control – Vegetation control needs to be factored into the maintenance as signs can be covered, drainage systems fail to operate correctly, shading can cause ice spots and visibility can be restricted.

- Maintenance contractors will typically spray weeds and water channels, grassed areas are mowed to the required level of service and vegetation obstructing signage is typically removed.
- When it comes to visibility and shading the maintenance teams need to consider the rightful owner of the offending vegetation. The owner may require the privacy the vegetation provides or enjoy the aesthetic effects.

- Spraying operations also need to take into consideration organic farms or nurseries. Contractors maintain a "no spray" list to avoid upsetting residents, in these situations.

1.1.4 Traffic Services

Traffic services typically covers road safety features such as pavement markings, signage (regulatory and warning), marker posts and delineation devices. Each of these provide the road user guidance on the alignment to assist on judging speeds, potential conflicts and vehicle separation.

Signage is required to be cleaned and legible in all conditions 24 hours a day. Typical maintenance will be regularly cleaning the signage but as the colour or reflectivity of the sign reduces it will need to be replaced. Sight distance visibility of the sign also needs to be factored in by maintenance. Generally if a sign becomes obstructed vegetation would be the reason, however it has also been known for signs to be obstructed by alternative means (traffic management signage, advertising, parked vehicles, etc) inadvertently obstructing signs. If parking is permitted then potentially very little can be done to correct the situation and repositioning the sign may be a solution if motorists safety is significantly compromised. For other obstructing situations the operations staff should be notified and the appropriate action should be determined.

Edge marker posts and raised pavement markers (plain or reflectorised) provide additional delineation during night driving and during storm events.

- Edge marker posts are typically placed in rural areas on corners to provide the driver an indication of where the road is going, for this to be most effective the driver should be able to clearly see four markers at any one time throughout the curve.
- Raised pavement markers will be along the centre lines and assist in wet conditions by raising the lines alignment above the surface water which can restrict viewing the lane markings.

Pavement marking provides an indication to motorists of the intended lane widths and provides guidance for keeping left to avoid on-coming traffic. There are several products in the market from paint through to long life and profiled markings. The pavement marking contracts are performance based which require the contractors to maintain the day and night time visibility of the markings above a minimum level.

1.2 Unsealed Roads

Unsealed roads have a different driver for maintenance than sealed roads. The top surface is gravel (metal) to provide a suitable wearing surface, the shape provides surface water run-off and the underlying material needs to be resistant to moisture penetration by appropriate material grading.

Metal replacement is based on an estimated depletion rate along with scheduled inspections and this operation is covered under renewals.

Scheduled maintenance is typically grading of the metal surface to ensure shape is maintained and rutting and corrugations are removed. Maintaining the shape of the carriageway ensures drainage to both sides of the carriageway which reduces potholing of the surfaces.

With potholes they either need to be dealt with through grading or filled. If filled the repair material needs to be capable of compaction to ensure it is dense and stable for trafficking while still performing similar to the

surrounding pavement. The repair should also match the existing crossfall and gradient with a finish that will ensure there will be no ponding of water and no discernable difference in surface level.

Loose surface build up is also required to be monitored as the deeper the loose surface the greater the risk of a driver loosing control. If it is over 25mm deep it needs to be rectified under the maintenance contract requirements.

Transition areas from sealed to unsealed carriageways also need attention under unsealed maintenance. A smooth transition should be maintained over a 20 metre distance within the unsealed carriageway. Meanwhile the sealed section is to be swept and kept clear of the unsealed carriageways aggregate.

As with sealed roads drainage is a major issue. Water ways need to be operating correctly and are not to be blocked with roading aggregates.