DOWNLOAD PDF MAINTENANCE OF MAIN ROADS

Chapter 1 : Road Maintenance - Main Roads Western Australia

This silent movie from overviews the maintenance process for main roads.

The report concluded that the condition of the network had deteriorated since Main Roads contracted out its maintenance function, with the average age of the road increasing and inadequate levels of planned maintenance. This follow-on audit provides an assessment of whether the condition of the state road network has improved and whether reasonable steps have been taken to address the problems identified in the first report. It also includes an assessment of whether Main Roads has addressed the 10 recommendations of the report Appendix 1. Background Road construction and maintenance in Western Australia is the responsibility of either the state or local governments. The state government is responsible for roads classified as highways or main roads â€" cumulatively referred to as the state road network. Contractors and Main Roads regional staff work closely to plan and deliver maintenance, with oversight by Main Roads head office in Perth. Main Roads introduced the ISA model between and to address some of the shortcomings of the TNC model, which were identified in our report. A key focus was regaining influence and control over planning and management of the road asset, which diminished during the TNC period. Main Roads intends to change its contract model again in The design of the new model aims to increase the in-house managed component of maintenance. Works regarded as maintenance include road resurfacing, drainage and line-marking. By comparison, the building of a new road is as a capital works project. Some projects can have both maintenance and capital elements. The context for maintaining the state road network changes over time: Since our last report the number of registered vehicles has increased by The road network is growing. Other factors also impact the budget and delivery timeframes for maintenance. Projects such as capital upgrades can influence maintenance positively. For example, if a road with an identified resurfacing need is instead rebuilt, maintenance resurfacing is no longer required and the overall quality and lifespan of the asset improves. Projects can also impact maintenance negatively. For instance, road diversions needed to enable capital upgrades or maintenance on a specific section of road can cause increased wear and tear on other sections of road.

Chapter 2 : Main Roads WA - Annual Report - Maintenance

*Maintenance of Main Roads [Harcourt Edward William] on theinnatdunvilla.com *FREE* shipping on qualifying offers. This is a pre historical reproduction that was curated for quality. Quality assurance was conducted on each of these books in an attempt to remove books with imperfections introduced by the digitization process.*

Advancements in methods with which these materials are characterized and applied to pavement structural design has accompanied this advancement in materials. Underneath this wearing course are material layers that give structural support for the pavement system. These underlying surfaces may include either the aggregate base and subbase layers, or treated base and subbase layers, and additionally the underlying natural or treated subgrade. These treated layers may be cement-treated, asphalt-treated, or lime-treated for additional support. Road surface A flexible, or asphalt , or Tarmac pavement typically consists of three or four layers. For a four layer flexible pavement, there is a surface course, base course, and subbase course constructed over a compacted, natural soil subgrade. When building a three layer flexible pavement, the subbase layer is not used and the base course is placed directly on the natural subgrade. The subbase is generally constructed from local aggregate material, while the top of the subgrade is often stabilized with cement or lime. Therefore, the highest quality material needs to be used for the surface, while lower quality materials can be used as the depth of the pavement increases. The term "flexible" is used because of the asphalts ability to bend and deform slightly, then return to its original position as each traffic load is applied and removed. It is possible for these small deformations to become permanent, which can lead to rutting in the wheel path over an extended time. Factors such as these are taken into consideration during the design process so that the pavement will last for the designed life without excessive distresses. In addition, they commonly serve as heavy-duty industrial floor slabs, port and harbor yard pavements, and heavy-vehicle park or terminal pavements. Like flexible pavements, rigid highway pavements are designed as all-weather, long-lasting structures to serve modern day high-speed traffic. Offering high quality riding surfaces for safe vehicular travel, they function as structural layers to distribute vehicular wheel loads in such a manner that the induced stresses transmitted to the subgrade soil are of acceptable magnitudes. The reason for its popularity is due to its availability and the economy. Rigid pavements must be designed to endure frequently repeated traffic loadings. The typical designed service life of a rigid pavement is between 30 and 40 years, lasting about twice as long as a flexible pavement. Fatigue failure is common among major roads because a typical highway will experience millions of wheel passes throughout its service life. In addition to design criteria such as traffic loadings, tensile stresses due to thermal energy must also be taken into consideration. As pavement design has progressed, many highway engineers have noted that thermally induced stresses in rigid pavements can be just as intense as those imposed by wheel loadings. Due to the relatively low tensile strength of concrete, thermal stresses are extremely important to the design considerations of rigid pavements. The concrete slab is constructed according to a designed choice of plan dimensions for the slab panels, directly influencing the intensity of thermal stresses occurring within the pavement. In addition to the slab panels, temperature reinforcements must be designed to control cracking behavior in the slab. Joint spacing is determined by the slab panel dimensions. These pavements do not use any reinforcing steel. High temperatures and moisture stresses within the pavement creates cracking, which the reinforcing steel holds tightly together. At transverse joints, dowel bars are typically placed to assist with transferring the load of the vehicle across the cracking. Prestressed concrete pavements have also been used in the construction of highways; however, they are not as common as the other three. Prestressed pavements allow for a thinner slab thickness by partly or wholly neutralizing thermally induced stresses or loadings. These problems can be avoided by adequately maintaining the pavement, but the solution usually has excessive maintenance costs, or the pavement may have an inadequate structural capacity for the projected traffic loads. The concrete layer in a conventional PCC overlay is placed unbonded on top of the flexible surface. Considering an overlay can be constructed on a rigid pavement that has not reached the end of its service life, it is often more economically attractive to apply overlay layers more frequently. The required overlay thickness for a structurally sound rigid pavement is much smaller than for one that has reached the end of its service life. Regardless of how well other aspects of a road are designed and constructed, adequate drainage is mandatory for a road to survive its entire service life. Excess water in the highway structure can inevitably lead to premature failure, even if the failure is not catastrophic. Depending on the geography of the region, many methods for proper drainage may not be applicable. The highway engineer must determine which situations a particular design process should be applied, usually a combination of several appropriate methods and materials to direct water away from the structure. Surface drainage must be allowed for precipitation to drain away from the structure. Highways must be designed with a slope or crown so that runoff water will be directed to the shoulder of the road, into a ditch, and away from the site. Designing a drainage system requires the prediction of runoff and infiltration, open channel analysis, and culvert design for directing surface water to an appropriate location. This advancement in technology has raised the level of skill sets required to manage highway construction projects.

DOWNLOAD PDF MAINTENANCE OF MAIN ROADS

Chapter 3 : Home (Department of Transport and Main Roads)

CHAPTER 7 ROAD MAINTENANCE Introduction. Road maintenance is essential in order to (1) preserve the road in its originally constructed condition, (2) protect adjacent resources and user safety, and (3) provide efficient, convenient travel along the route.

Hand clearing with a shovel is effective when the work load is light or the presence of structures e. With a grader, the following procedure is followed: Flag all culverts and cross drains 2. Remove snags, rocks, and other hazards before grading begins 3. Cut only the ditch bottom and shoulder; avoid undercutting the cut slope; do not redress the cut slope 4. Spread fines into the road with surface reworking 5. Avoid working around culverts or other channel crossing structures so as to minimize damage to inlets Debris in and around culverts should be removed by hand or by grapples or tongs rather than by heavy equipment working directly in the stream. Stream channels should be completely free of floatable debris branches, leaves, small logs, construction material, garbage, etc. If plugging of a particular culvert occurs frequently and a debris deflector or "trash rack" was not included in the original design, one should be installed as part of the maintenance program. All-season roads will require continual monitoring for surface and subgrade wear or deterioration. Rutting and loss of ballast often occur during rainy season use. Snow removal equipment can also destroy the road surface by removing or altering the crown and removing ballast. A plan should be in place to provide ballast when necessary to maintain continued use of the road. On non-surfaced roads, a grader on the first pass should move material from the shoulder to a windrow in the center of the roadway. On the second pass, the blade should be centered on the windrow and continue working along the roadway. The blade should be adjusted so as to provide a slight slope or crown and should avoid cutting too deep into the road surface. Any excess material should be stored in the berm--not sidecast over the edge of the fill. A wide variety of chemicals are commonly used to treat road surfaces to minimize wear, reduce dust, or de-ice. However, many of these products provide only minimal benefit and represent a potential hazard to water quality US Environmental Protection Agency, Oil based dust palliatives must be used very carefully where the potential for entering surface or groundwater exists. Likewise, salts such as sodium chloride NaCI and calcium chloride CaCl2 , along with additives to prevent caking, rust, and corrosion, can cause acute and chronic toxicity in aquatic organisms and fish, contamination of groundwater supplying public and domestic water users, and death to vegetation adjacent to the road. Maximum salt concentrations can be found at soil surfaces nearest the road, but because they can be readily leached, salts can easily enter groundwater. High concentrations of salts have been found in streams during dry season low flows when the major component contributing to stream flow consists of groundwater. Sulfite waste liquor from pulping operations is used extensively for dust abatement, however, it too has a potential for adversely impacting water quality through its high biochemical oxygen demand. Fortunately, though, the BOD-containing agents in pulping liquors will oxidize rapidly on the road surface. Controlled application during dry weather to prevent runoff will minimize impacts. Herbicides used to control roadside vegetation represent the final class of road maintenance compounds that present a potential health or water pollution hazard if used incorrectly. Compounds such as dioxin, contained in 2,4-D and 2,4,5-T, are extremely toxic even in minute quantities. Practices and methods to help minimize impacts from road chemicals include: Use only as much chemical as needed, both in concentration and rate of application, to provide the desired effect. Chemical manufacturers provide detailed information on the label of the container concerning dilution requirement, application rate and method, worker safety precautions, spill cleanup procedures, and other useful information. Be aware of weather conditions. Do not apply chemicals immediately prior to or during rainfall. Provide adequate training, performance standards, and supervision of application personnel and equipment. Perform trial applications to determine if calculated application rate is adequate. Keep records of chemical compounds used, the target species identified, concentration and application rates, vegetative growth stage pre- or post-emergent , any unusual vegetative or environmental factors present during the application, and results of the application. Use extra caution near streams. Avoid applying chemicals where the road crosses a channel and for 20 m 60 ft on either side. If necessary, provide a filter strip between the road and the stream. Prevent spillage near or into streams. Do not, under any circumstances, discharge unused chemical into a stream. Disposal of excess chemical and container treatment. Clean and rinse equipment and storage containers in an area where waste water can be safely collected and treated. If necessary, collect and ship excess hazardous chemicals to an authorized hazardous waste disposal facility. This concept is similar in practice to that dealing with emergency measures used in fire control. The purpose of the plan is to: Prevent loss of life or injury 2. Prevent damage to soils, streams, fisheries, and other resources 3. Provide for efficient, economical, and necessary use of available finances, equipment, and personnel 5. Evaluate structural and resource damage when it occurs and determine needs for corrective measures to prevent further damage Necessary items to include in a storm response action plan are: A system to collect and analyze weather, soil, and road conditions 2. A communication system between personnel responsible for activating the storm action plan 3. Establishment of organizational plans and responsibilities for prevention and control of storm damage 4. Methods of financing and documenting costs of personnel and equipment; outline of individuals authorized to use finances, personnel, and equipment 5. Telephone numbers for providing public information and communication with law enforcement and other public agencies 6. Provisions for monitoring the effects of storms and efforts to prevent damage; reconnaissance and estimates of extent of damage to structures and resources; preliminary cost estimates 7. Storm damage reporting procedures Weather data should be collected daily and should include daily amounts of precipitation, cumulative precipitation per storm, total per season, month, etc. Additional or more frequent information updates can be requested as conditions warrant. For each condition, a specific set of activities ranging from observation to full region-wide patrols and work teams will be identified. In the first instance, if the interval of non-use is relatively short, a physical barricade blocking all entrances to the road may be all that is required provided that periodic checks are made throughout the non-use period to ensure that road drainage structures, erosion control measures, and other slope protection measures are functioning properly. A barricade may consist of a locked gate or a variety of crude barriers constructed of native materials--rock, slash, cull logs, etc. If periodic checks and maintenance cannot be performed e. These measures might include installing a system of rolling dips or water bars, outsloping, and stabilizing all cut and fill slopes see Chapter 4. Scarification and revegetation of exposed surfaces, including the roadway itself, may be appropriate depending on the type of road surface, the potential for erosion, and the non-use period. When an extended non-use period is planned and the risk of environmental damage from failure is significant, a partial restoration of the original ground profile may be considered. The objective here is to convert a portion of surface water flow back to subsurface flow and to provide more efficient surface runoff capacity. An effective method, called "Kanisku" closure, can be used on sideslopes less than 60 percent and is illustrated in Figure If terrain and road conditions permit the use of this technique without significant loss of soil over the edge of the fill, this procedure can be accomplished with an angle-blade bulldozer. This technique is not appropriate on end haul constructed roads, on ballasted or surfaced roads, on some soil types, or in regions with high precipitation. Stream crossings on intermittent-use roads require special attention. In addition to guidelines presented elsewhere in this book, design, construction, and maintenance considerations for intermittent-use roads include: Minimize the amount of culvert fill. Use generous culvert end area estimates. Design for permanent installation. Plan for supplemental maintenance checks if there is any doubt as to the ability of the installation to withstand heavy storm events. If a stable installation is technically or economically infeasible, include subsequent culvert removal if it can be accomplished with minimal water quality impact. If not, avoid the site. Temporary log stringer bridges can be used when a stream crossing installation would require a large amount of fill. With short non-use periods, it may be more economical to design a "longer life" temporary bridge and leave it in place. With longer non-use periods, it is advisable to use a minimal cost structure and remove it after use. For channel crossing structures that have functioned satisfactorily for years, the best solution, in most cases, is to leave it in place and restore it to its original condition remove debris, clean ditches, revegetate side slopes, reshape road surface crown. For those crossings having a high failure risk, continued maintenance or partial or entire removal are the only choices, difficult as they may be. If removal is chosen, the use of proper equipment and attention to timing can aid in reducing the severity of water quality impacts. If total removal cannot be accomplished for technical or economic reasons, a possible solution is a relief dip in the culvert fill Figure A relief dip does not preclude the need for stabilization, but, rather, reduces the water quality impact upon failure by directing the course of overflow water and reducing the amount of available sediment. In the case of permanent closure, methods described above may be appropriate, making sure that all culverts and bridges are removed and excess fill is hauled to a safe disposal area. Additionally, it is also desirable to break up the road surface with deep penetrating hydraulic ripper teeth. This aids in restoring soil permeability and enhancing revegetation. For esthetic reasons, it may be desirable to completely restore the original ground profile, or "deconstruct" the road. One way to accomplish this is to temporarily store excavated material and then pack it back into the roadway following use. More commonly, excavated material is side cast, and following use, pulled back up into the road prism with hydraulic shovel or dragline. On slopes greater than 60 percent, it is highly recommended that excavation and side cast pullback be accomplished during the same dry season. After deconstruction, the site is revegetated including tree establishment where appropriate. Follow-up planting or fertilizing may be necessary for several years following restoration. Relief dip reduces the potential impact of culvert failure by reducing the amount of potential sediment. Logging roads and protection of water quality.

Chapter 4 : CHAPTER 7 ROAD MAINTENANCE

Civil construction and maintenance RoadTek provides transport infrastructure solutions throughout Queensland, focusing primarily on the construction, maintenance and rehabilitation of the state's extensive road and bridge network.

Macadam Road construction requires the creation of an engineered continuous right-of-way or roadbed, overcoming geographic obstacles and having grades low enough to permit vehicle or foot travel , [34]: A variety of road building equipment is employed in road building. Storm drainage and environmental considerations are a major concern. Erosion and sediment controls are constructed to prevent detrimental effects. Drainage lines are laid with sealed joints in the road easement with runoff coefficients and characteristics adequate for the land zoning and storm water system. Drainage systems must be capable of carrying the ultimate design flow from the upstream catchment with approval for the outfall from the appropriate authority to a watercourse , creek , river or the sea for drainage discharge. Approval from local authorities may be required to draw water or for working crushing and screening of materials for construction needs. The topsoil and vegetation is removed from the borrow pit and stockpiled for subsequent rehabilitation of the extraction area. Side slopes in the excavation area not steeper than one vertical to two horizontal for safety reasons. Trees in the road construction area may be marked for retention. Compensation or replacement may be required if a protected tree is damaged. Much of the vegetation may be mulched and put aside for use during reinstatement. The topsoil is usually stripped and stockpiled nearby for rehabilitation of newly constructed embankments along the road. Stumps and roots are removed and holes filled as required before the earthwork begins. Final rehabilitation after road construction is completed will include seeding, planting, watering and other activities to reinstate the area to be consistent with the untouched surrounding areas. Blasting is not frequently used to excavate the roadbed as the intact rock structure forms an ideal road base. When a depression must be filled to come up to the road grade the native bed is compacted after the topsoil has been removed. The fill is made by the "compacted layer method" where a layer of fill is spread then compacted to specifications, under saturated conditions. The process is repeated until the desired grade is reached. The lower fill generally comprises sand or a sand-rich mixture with fine gravel, which acts as an inhibitor to the growth of plants or other vegetable matter. The compacted fill also serves as lower-stratum drainage. Select second fill sieved should be composed of gravel , decomposed rock or broken rock below a specified particle size and be free of large lumps of clay. Sand clay fill may also be used. The roadbed must be "proof rolled" after each layer of fill is compacted. If a roller passes over an area without creating visible deformation or spring the section is deemed to comply. These materials and methods are used in low-traffic private roadways as well as public roads and highways. The type of road surface is dependent on economic factors and expected usage. Safety improvements such as traffic signs , crash barriers , raised pavement markers and other forms of road surface marking are installed. When a single carriageway road is converted into dual carriageway by building a second separate carriageway alongside the first, it is usually referred to as duplication, [41] twinning or doubling. The original carriageway is changed from two-way to become one-way, while the new carriageway is one-way in the opposite direction. In the same way as converting railway lines from single track to double track , the new carriageway is not always constructed directly alongside the existing carriageway. Deterioration is primarily due to accumulated damage from vehicles, however environmental effects such as frost heaves , thermal cracking and oxidation often contribute. Potholes on roads are caused by rain damage and vehicle braking or related construction works. Manual road repair taking place in Howrah, India Line marking in rural India Pavements are designed for an expected service life or design life. In some parts of the United Kingdom the standard design life is 40 years for new bitumen and concrete pavement. Maintenance is considered in the whole life cost of the road with service at 10, 20 and 30 year milestones. When pavement lasts longer than its intended life, it may have been overbuilt, and the original costs may have been too high. When a pavement fails before its intended design life, the owner may have excessive repair and rehabilitation costs. Some asphalt pavements are designed as perpetual pavements with an expected structural life in excess of 50 years. Pro-active agencies use pavement management techniques to continually monitor road conditions and schedule preventive maintenance treatments as needed to prolong the lifespan of their roads. These measurements include road curvature , cross slope , asperity , roughness , rutting and texture. Software algorithms use this data to recommend maintenance or new construction. Maintenance treatments for asphalt concrete generally include thin asphalt overlays, crack sealing, surface rejuvenating, fog sealingfo, micro milling or diamond grinding and surface treatments. Thin surfacing preserves, protects and improves the functional condition of the road while reducing the need for routing maintenance, leading to extended service life without increasing structural capacity. This can extend the life of the concrete pavement for 15 years. Slab stabilization[edit] Distress and serviceability loss on concrete roads can be caused by loss of support due to voids beneath the concrete pavement slabs. The voids usually occur near cracks or joints due to surface water infiltration. The most common causes of voids are pumping, consolidation, subgrade failure and bridge approach failure. Slab stabilization is a non-destructive method of solving this problem and is usually employed with other Concrete Pavement Restoration CPR methods including patching and diamond grinding. The technique restores support to concrete slabs by filing small voids that develop underneath the concrete slab at joints, cracks or the pavement edge. The process consists of pumping a cementitous grout or polyurethane mixture through holes drilled through the slab. The grout also displaces free water and helps keep water from saturating and weakening support under the joints and slab edge after stabilization is complete. The three steps for this method after finding the voids are locating and drilling holes, grout injection and post-testing the stabilized slabs. Slab stabilization does not correct depressions, increase the design structural capacity, stop erosion or eliminate faulting. It does, however, restore the slab support, therefore, decreasing deflections under the load. Stabilization should only be performed at joints and cracks where loss of support exists. Visual inspection is the simplest manner to find voids. Signs that repair is needed are transverse joint faulting, corner breaks and shoulder drop off and lines at or near joints and cracks. Deflection testing is another common procedure utilized to locate voids. It is recommended to do this testing at night as during cooler temperatures, joints open, aggregate interlock diminishes and load deflections are at their highest. Testing[edit] Ground penetrating radar pulses electromagnetic waves into the pavement and measures and graphically displays the reflected signal. This can reveal voids and other defects. It consists of drilling a 25 to 50 millimeter hole through the pavement into the sub-base with a dry-bit roto-hammer. Next, a two-part epoxy is poured into the hole â€” dyed for visual clarity. Once the epoxy hardens, technicians drill through the hole. If a void is present, the epoxy will stick to the core and provide physical evidence. Common stabilization materials include pozzolan -cement grout and polyurethane. The requirements for slab stabilization are strength and the ability to flow into or expand to fill small voids. Colloidal mixing equipment is necessary to use the pozzolan-cement grouts. The contractor must place the grout using a positive-displacement injection pump or a non-pulsing progressive cavity pump. A drill is also necessary but it must produce a clean hole with no surface spalling or breakouts. The injection devices must include a grout packer capable of sealing the hole. The injection device must also have a return hose or a fast-control reverse switch, in case workers detect slab movement on the uplift gauge. The uplift beam helps to monitor the slab deflection and has to have sensitive dial gauges. Successful resealing consists of old sealant removal, shaping and cleaning the reservoir, installing the backer rod and installing the sealant. Sawing, manual removal, plowing and cutting are methods used to remove the old sealant. Saws are used to shape the reservoir. When cleaning the reservoir, no dust, dirt or traces of old sealant should remain. Thus, it is recommended to water wash, sand-blast and then air blow to remove any sand, dirt or dust. The backer rod installation requires a double-wheeled, steel roller to insert the rod to the desired depth. After inserting the backer rod, the sealant is placed into the joint. There are various materials to choose for this method including hot pour bituminous liquid, silicone and preformed compression seals.

Chapter 5 : Civil construction and maintenance (Department of Transport and Main Roads)

Case Study: Improving Maintenance Management. The development of the Maintenance Management Information System (MMIS) is a first for Main Roads resulting in a streamlined, integrated system that helps capture, manage, *deliver and monitor maintenance works across our road network.*

Chapter 6 : Ventia | Motorway, Tunnel and Road Network Maintenance

Main Roads are responsible for delivering and management of a safe and efficient main road network in Western Australia. Representing one of the world's most expansive road networks, we are committed to working cooperatively and productively across all levels of government, to ensure our road network meets the needs of the community, industry and stakeholders.

Chapter 7 : Maintenance of Main Roads - - SmokStak

EMBED (for theinnatdunvilla.com hosted blogs and theinnatdunvilla.com item tags).

Chapter 8 : Main Roads Annual Report - Maintenance

Maintenance Management - WA Main Roads Welcome This auditor training has been designed to help you gain an understanding on how to audit the Western Australian Heavy Vehicle Accreditation Maintenance Management Module.

Chapter 9 : Florida Department of Transportation - Office of Maintenance Home Page

Main Roads Western Australia manages a network of about 18, kilometres of national highways and major roads across the state - covering an area of some million square kilometres.