State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

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To: DISTRICT DIRECTORS
DIVISION CHIEFS FOR PROJECT DELIVERY
CHIEF, DIVISION OF LOCAL ASSISTANCE
CHIEF, DIVISION OF MAINTENANCE

Date: August 7, 2006

From: MARK LEJA
Chief
Division of Design

Subject: Design Information Bulletin 84: Guidance for Projects Involving Portland Cement Concrete Pavement Grooving or Grinding

This transmittal memorandum provides notice that the above referenced Design Information Bulletin (DIB) is now available on the website (http://www.dot.ca.gov.hq/oppd/dib/dibprg.htm). This DIB is effective immediately for use on projects that involve PCC pavement grooving or grinding operations. This DIB complements Office Engineer's release of Standard Special Provisions (SSP) 42-600, "Disposal of Portland Cement Concrete (PCC) Pavement Grooving and Grinding Residues."

PURPOSE

DIB 84 provides design guidance for projects that incorporate PCC pavement grooving and grinding operations.

Changes over the past years have precipitated the need for guidance and the development of DIB 84. Projects involving PCC pavement grooving and grinding operations may generate large quantities of residues. The Project Development Team (PDT) should consider early in the design process whether temporary storage within the State right-of-way will be appropriate, and the method to treat and dispose of these residues. Costs associated with the proper disposal of these residues should be included in the project cost estimates. The attached DIB is intended to assist the PDT to address these issues.

BACKGROUND

Historically, disposal requirements for PCC pavement grooving and grinding residues were governed by SSP 42-1.02, [Grooving] Construction, and 42-2.02, [Grinding] Construction, and by contract special provisions incorporated into a specific project.

To achieve consistency in the bidding process, in contract administration, and to meet environmental regulatory requirements, SSP 42-600 "Disposal of Portland Cement Concrete

(PCC) Pavement Grooving and Grinding Residues," has been developed. This SSP requires disposal to an appropriately permitted waste management unit, Class II for the liquids and Class III for the solids; or to a permitted treatment/recycling facility, or within the State right of way if approval is obtained from the Regional Water Quality Control Board.

IMPLEMENTATION

Effective immediately, all applicable projects shall conform to the guidance presented in DIB 84. SSP 42-600 is to be included in all projects having grooving or grinding of PCC pavement that have not already reached ready to list.

DIB 84 supersedes previously issued guidance documents regarding handling and disposal of residues from PCC pavement grooving and grinding operations.

Permits for temporary storage, disposal, or reuse of PCC pavement grooving and grinding residues within the state right of way do not exempt the project from adherence to the Department's statewide storm water permit requirements as described in the Storm Water Management Plan, and management of solid and liquid wastes must protect these non-storm water discharges from entering storm drains and drainages.

This guidance and SSP 42-600 may be modified as additional information regarding waste characterization is obtained, and as environmental permitting streamlining strategies are developed.

SSP 42-600 includes a list of permitted facilities known to accept liquid residues from PCC pavement grooving and grinding operations as well as the requirements for disposal at non-permitted facilities if sought by the Contractor. Although every attempt will be made to keep the list current, it is the responsibility of the project delivery staff to confirm that adequate facilities

are available for transfer of the proposed residue type and quantity anticipated with the proposed project.

If you have questions, please contact the Design Coordinator.

DISTRIBUTION

It is recommended that copies of this bulletin be distributed to Project Delivery Staff. Although the DIB focuses on the Design Engineer, there are cross-functional considerations that must be coordinated with other staff for successful project outcome.

c: All Holders of the Highway Design Manual

Attachments

DESIGN INFORMATION BULLETIN NUMBER 84

California Department of Transportation
Division of Design
Office of Resource Conservation

Guidance for the Removal and Disposal of Concrete Pavement Grooving and Grinding Residues

APPROVED BY

MARK LEJA
DIVISION CHIEF
DIVISION OF DESIGN

August 1, 2006

FORWARD

This document provides information and guidance to the Project Engineer and the Project Development Team (PDT) regarding the removal and disposal of residues from grooving or grinding operations on portland cement concrete (PCC) pavement (otherwise known as rigid pavement). The goal of this document is to provide background information to designers and specification writers during the PS&E process when considering the removal and disposal of these residues. This bulletin is intended to assist the PDT to develop cost-effective contracts and to comply with local water quality requirements.

This document is not a textbook or a substitute for engineering knowledge, experience or judgment. Many of the instructions given herein are subject to amendment as conditions and experience may warrant. Special situations may call for variations from the procedures described.

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1.0 PDT Considerations for PCC Pavement Grooving and Grinding

1.1 Purpose

This document provides information and guidance to the Project Engineer and the Project Development Team (PDT) regarding the removal and disposal of residues from portland cement concrete (PCC) pavement grooving or grinding operations. PCC pavement is also referred to as rigid pavement or concrete pavement in the Highway Design Manual and other support guidance. PCC pavement is divided into two types: Jointed Plain Concrete Pavement and Continuously Reinforced Concrete Pavement. Further discussion on these types can be found in Topic 621 of the Highway Design Manual. The goal of this document is to assist the PDT during the PS&E process to develop cost-effective contracts and to comply with water quality requirements; these requirements are incorporated into an SSP that should be used with these projects, SSP 42-600, "Disposal of Portland Cement Concrete (PCC) Pavement Grooving and Grinding Residues."

Due to the potentially large volumes of residues that can be generated during PCC pavement grooving and grinding operations, the PDT early in the design process should assess the feasibility of allowing temporary storage and treatment of residues within the State right-of-way, and the optimum method for disposal of these residues; this assessment should include a thorough cost analysis, including both short and long-term costs.

A team consisting of Project Delivery functions, with the Division of Design as lead, prepared these guidelines. These guidelines do not constitute a standard, and the issuance of these guidelines does not eliminate the need for sound engineering judgment. Special situations may call for methods, procedures, or techniques not discussed in this guidance and for editing of the SSP, for which approval must be obtained from the Project Manager of the Pavement Standards Program. (See the nSSP Process Guidance for pavements at http://www.dot.ca.gov/hq/oppd/pavement/nssps.htm for procedures.) General guidance on pavement design may be found in the Highway Design Manual Chapters 600 to 670 and pavement rehabilitation strategies are discussed in Pavement Tech Notes: Interim PCC Pavement Rehabilitation Guidelines. Specific guidance on these topics is otherwise beyond the scope of this document.

If you have any questions, please contact your Project Manager or Design Coordinator.

2.0 Regulatory Overview of PCC Pavement Grooving and Grinding Residues

Many of the design issues that are presented below result from regulatory issues that affect the disposal of PCC pavement grooving and grinding residues, as such, the regulatory issues are discussed first.

The California State Water Resources Regional Water Quality Control Board (SWRCB) has regulatory authority related to protection of water quality from waste discharges, and this is administered for an individual project through the applicable Regional Water Quality Control

Board (RWQCB). The Department has conducted characterization studies of residues from pavement grooving and grinding operations that indicate PCC pavement grooving and grinding wastes are non-hazardous, but contain constituents that may have the potential to impact water quality and therefore are subject to regulation by the applicable RWQCB.

When temporary storage or permanent disposal within the State right-of-way is considered, the Project Engineer should seek assistance from District/Region NPDES Coordinator or District Environmental who will coordinate with the local RWQCB for approval (permit, waiver, or letter of instruction). Adequate lead-time is necessary to allow the local RWQCB to consider the application, as the RWQCB has up to 30 days to respond initially to an application, but up to 180 days for final resolution. Temporary storage or disposal of the residues may be subject to conditions imposed by the RWQCB, and such conditions would have to be clearly indicated in the contract documents and implemented during the work. Another potential condition is a requirement for monitoring of the residues if disposed with the State right-of-way; such monitoring can significantly increase the construction and long-term costs of the project. Permits obtained for the temporary storage, disposal, or reuse of PCC pavement grooving and grinding residues does not exempt the project from adherence to the Department's statewide storm water permit requirements. General guidance on this and other construction site BMPs are found in Reference 6.

3.0 Design Considerations for Removal and Disposal of Concrete Grooving and Grinding Residues

PCC pavement grinding is an operation used to preserve pavement ride quality/friction, rehabilitate pavements, or facilitate construction widening by removing or reducing undulations in the pavement from curling within a slab or step offs between slabs (a.k.a. faulting). PCC pavement grooving is used to increase friction by imparting grooves that act to improve the performance of tires when the pavement is wet. Grooving may also be performed on new pavements to increase the coefficient of friction, and grinding and grooving are being investigated as potential methods for reducing tire/pavement noise. Further discussion on PCC grinding and grooving can be found in the Pavement Tech Notes: Interim PCC Pavement Rehabilitation Guidelines and HDM Topic 635, and on the "Quieter Pavements" website.

Grooving or grinding operations can be performed as an item of work during a construction contract (and SSP 42-600, "Disposal of Portland Cement Concrete (PCC) Pavement Grooving and Grinding Residues," should be used in the contract special provisions) or can be performed as a mitigation measure by the Contractor (non-pay work item) if friction and roughness ('high points') requirements do not meet Standard Specifications 40-1.10, "Final Finishing."

Large motorized equipment is used for both grooving and grinding operations, employing multiple diamond-studded blades operating on a single shaft, to impart a groove of varying depth (typically between ¼ inch to ½ inch [6 mm and 13 mm]). The equipment uses water applied to the pavement both as a cooling agent for the cutting blades, and to capture the dust generated for later collection by vacuum equipment (usually using a separate piece of equipment). This

combination of grindings is known as grinding (or grooving) residue and must be disposed of in a safe and environmentally friendly manner. This section discusses measures that should be taken to address the disposal of these residues.

3.1 Volume of PCC Pavement Grooving and Grinding Residues

As a rough guide, the volume of residues generated is four to six times the volume of the pavement material to be removed during grooving and grinding operations. Volumes of residues (mixed solids and liquid) between 1,400 to 2,100 ft^3 (40 and 60 m^3) per work shift would not be uncommon, assuming no recycling of water. As can be noted using these rates, PCC pavement grooving and grinding contracts have the potential to generate large quantities of wastes, however, the quantities may vary depending upon: the condition of the pavement; the Contractor's operations, methods and equipment; the allowed hours of work; the number of lanes that may be worked at one time; and the aggregate hardness. Due to these variables, District Construction should be consulted for likely production rates.

3.2 Disposal of PCC Pavement Grooving and Grinding Residues

The preferred permanent disposal location of the residues is outside of the State right-of-way. However, to minimize project costs, the Project Engineer may consider permanently incorporating these residues within the project (e.g., into an embankment) or within the right of way. To do so, the Department must obtain prior approval (permit or waiver) from the applicable RWQCB. When disposal within the State right-of-way is considered, the Project Engineer should seek assistance from District Environmental or the District/Region NPDES Coordinator for obtaining RWQCB approval (permit, waiver, or letter of instruction). Reuse of solid and liquid components of the residues may be subject to conditions imposed by the RWQCB, such as depth of cover over the residues, type of cover material (e.g., using a pavement structural section), and vertical separation of residues from groundwater; such conditions would have to be clearly indicated in the contract documents and implemented during the work. Another potential condition is a requirement for monitoring of the residues, which might significantly increase the short and long-term costs of the project. Adequate lead-time is necessary to allow the local RWQCB to consider the application, as the RWQCB has up to 30 days to respond initially, but up to 180 days for final resolution. Items required along with the application may include, but are not limited to, application fee, project description, location of the temporary storage or disposal site, section drawing of the site, characterization of the waste stream, and quantity of wastes. RWQCBs typically consider such environmental factors as depth to ground water, soil cover, and protection from surface waters as well as the characteristic of the waste, and it is advisable that this information be developed for the project.

3.3 Drying Methods for Residues Prior to Disposal

Residues have high initial moisture content and will typically be reduced by evaporation or dewatering prior to disposal of the solid residues. Evaporation can occur in temporary storage facilities but evaporation is more effective when the impoundment is constructed as shallow as possible. The evaporation process also proceeds faster in dry, arid conditions than cool and

humid conditions. One or more impoundments may be placed to optimize evaporation; if placed as a series, the first in the series being used primarily for the initial placement and settling of the heavier solids, then the clearer liquid is decanted to succeeding impoundments. The liquid may be reused several times prior to disposal as long as it is relatively free from the solids generated by the work. Water remaining at the end of the project can be decanted when sufficiently free of sediments, and given disposal at a waste (non-sewage) treatment/reprocessing facility and some Class II landfills, although in some instances arrangements can be made with a sewer treatment plant for handling and treatment. Information concerning the 'pan evaporation rates' for the project area may be obtained from several sources (e.g., Reference 9) to estimate the evaporation that may occur.

Numerous other techniques besides impoundments (temporary ponds) are also available to separate the liquids from the solid material, and these techniques are usually more efficient than impoundments at separating the liquids from the solids (for example, using centrifuges, filters, or chemical precipitation). However, these other techniques are not yet commonly used for PCC pavement grinding or grooving projects. An advantage to these techniques is that they often require a smaller physical space than a large impoundment, usually between ½ and 1 acre (0.20 and 0.40 ha) and can treat a large amount of waste in a shorter period of time than evaporation. One separation technique applicable to these residues employs in series a dewatering tank, sand media particulate filter, pressurized bag filter, and/or cartridge filter. Several separation techniques are discussed further in the Department's *Construction Site Best Management Practices (BMP) Manual* under "NS-2, Dewatering Operations" and the Department's *Field Guide to Construction Site Dewatering.*

Air-dried residues may have some degree of surface drying and hardness within a short period of time once the free water is removed, while still retaining considerable moisture below the surface. For the residues to be accepted as a non-liquid waste at a Class III landfill there must be no free water present during spreading or compaction, and actions such as disking of the residues may be needed to sufficiently remove the remaining moisture.

3.4 Temporary Storage of PCC Pavement Grooving and Grinding Residues within the State Right of Way

If residues are not handled using the separation techniques mentioned above, ponds are usually used as the temporary storage facilities to allow settlement of solids to occur. The water separated from the solids may be reused to minimize the total volume of waste (solids and liquid) for disposal. By allowing temporary storage of the residues within the State right-of-way, project costs will be reduced because the Contractor would not need to rent and obtain regulatory approval for land outside of the State right-of-way. Use of State right-of-way for temporary storage must be in accordance with the Highway Design Manual Topic 111, "Materials Sites and Disposal Sites," and Topic 112, "Contractor's Yard and Plant Sites." It is also in accordance with Public Resources Code Section 42920, wherein the Department is required to recycle and reduce the amount of waste sent to landfills.

The entirety of the residues from the project should be estimated when considering the size of the temporary storage facility, and more than one impoundment may be needed for the project. When considering locating temporary storage facilities within the project limits, other issues that should always be considered are traffic safety, and local environmental agency requirements.

3.5 Temporary PCC Pavement Grooving and Grinding Storage Facilities

Smaller temporary storage facilities should follow the requirements of SSP 07-405, "Temporary Concrete Washout Facility," and its associated Standard Detail sheet, "Water Pollution Control Sheet: Temporary Water Pollution Control Details (Temporary Concrete Washout Facility)" as listed in the References section of this document.[1] Several temporary facilities could be placed, if siting allowed, and each would contain about 360 ft^3 to 880 ft^3 (10 to 25 m^3) of wastes, however, PCC pavement grooving or grinding operations can generate these quantities very quickly. Ideally, the entire estimated volume of residues from the project would be contained within the area allowed for the temporary storage facility. Allowance within the project limits or right of way of temporary storage does not imply nor obligate the Department to provide as much area as might be required.

Smaller PCC pavement grooving and grinding projects should consider listing the Temporary Concrete Washout Facility as an item of work, rather than as part of the Lump Sum payment made for Water Pollution Control (SSP 07-340 or 07-345), which should result in better bidding and more efficient contract administration.

Where a sufficiently large area within the State right-of-way is available for use as a temporary storage facility, the Project Engineer should consider including in the contract package a design for a larger temporary storage facility to be paid as an item of work, while recalling that all impoundments may be subject to requirements imposed by a RWQCB, including liner requirements more typically used at a liquid containment facility. Preliminary design guidance for these large impoundments is provided below. If design assistance if required it should be requested and coordinated through the HQ Design Office of Storm Water Management and DES Geotechnical Services. The plans and specifications for the larger temporary facility would be based upon SSP 07-405, "Temporary Concrete Washout Facility," with consideration typically given to these additional items:

- Subject to revision per project-specific RWQCB permit, in order to provide more assurance that leakage is prevented, a minimum liner thickness of 0.020 inches (0.50 mm) is suggested, and a thickness of 0.030 inches (0.75 mm) for facilities that will use large construction equipment on the residues to mix the residues (to aid drying) or to remove the residues from the temporary storage facility;
- The liner must be installed per the manufacturer's requirements;
- The liner must be resistant to non-acidic liquids;

1 It may be preferable to rename the contract special provisions and the contract detail sheet showing the facility as "Temporary PCC Grinding [Grooving] Residue Facility".

- The seams of the liner must be watertight and installed in accordance with the manufacturer's requirements;
- Sloping of the ground to the temporary storage facility invert (below ground configuration) at 1V:3H side slope ratios or flatter are typical;
- Installation of a 'cushion layer' consisting of a select imported sand material with prior removal of rocks and foreign objects that could puncture the liner should be required below the invert elevation of the liner;
- Storm water and irrigation run-on should not be allowed into the storage facility during the life of the temporary storage facility;
- Restoration and re-grading of the ground surface to the project specific requirements or returning the area to the original conditions, including any highway planting and temporary changes to the irrigation system, should be required following removal of the temporary storage facility;
- Security fencing and locked access to the temporary storage facility should be considered to prevent intrusion and to prevent illicit discharge of other wastes;
- Ingress and egress using stabilized construction entrance/exit, approved Caltrans construction site BMP TC-1 should also be shown on the plans or referenced in the contract special provisions; and
- Signs directing the equipment to the site should be employed, and details as specified in SSP 07-405.

The Project Engineer should consider the cost and effects of contract time for the removal of the dried PCC residues and liner to an approved disposal facility at the end of the contract (assuming disposal outside of the State right-of-way is required).

3.6 Storm Water Pollution Prevention Plan/Water Pollution Control Plan (SWPPP/WPCP)

The disturbed soil area (DSA) for the PCC pavement grooving or grinding projects would not include the paved areas that will receive the work, as the underlying soils will not be exposed and the residues are required to be picked up concurrent with the work. However, areas allowed for temporary storage and any other areas exposing soils as a result of construction activities within the construction limits (e.g. often construction entrances/exits) should be included in the calculation of the DSA. Once the DSA is determined the appropriate "Water Pollution Control" standard special provision would be selected for the project based on DSA: SSP 07-340 for DSAs up to 1.0 acre [0.4 ha] (which requires a WPCP) or SSP 07-345 for greater DSAs (which requires a SWPPP). As the RWQCB may require a SWPPP in some situations even if the project does not meet the DSA threshold, the Project Engineer should consult with the District/Region NPDES Coordinator.

3.7 Disposal of Hardened Concrete

Under Standard Specification 15-3.02, "Removal Methods," hardened concrete may be buried into adjacent embankments if certain construction and regulatory requirements are met. This practice is not affected by the new SSP 42-600, "Disposal of Portland Cement Concrete (PCC)

Pavement Grooving and Grinding Residues." However, commingling of washout from transit mix trucks carrying concrete (i.e., concrete used for pavement slabs or structures) and PCC grooving and grinding residues will not result in a hardened material that would qualify under this Standard Specification. Commingling of these wastes may be allowed at the option of the Contractor, with the understanding that all residues/wastes must be removed while meeting the requirements of SSP 42-600, "Disposal of Portland Cement Concrete (PCC) Pavement Grooving and Grinding Residues." As the *Construction Site Best Management Practices (BMPs) Manual* indicates that washout from transit-mix trucks and residues from grooving and grinding operations can be directed to "WM-8, Concrete Waste Management," no changes are needed to the contract special provisions or detail sheets (if included in the contract plans).

3.8 Traffic Stripes And Pavement Markings within Areas Proposed for PCC Pavement Grooving or Grinding

Yellow paint stripes and thermoplastic markings may be present within areas proposed for grooving or grinding operations. Some of these markings in prior years consisted in part of chromium or other constituents which are classified as a hazardous waste in high concentrations. Removal of yellow paint strips and thermoplastic stripping are addressed in the Instruction Notes to SSP 15-300, "Remove Traffic Stripe and Pavement Marking," and this SSP should be included as needed in the contract special provisions.

3.9 Items of Work and Unit Costs

The Basic Engineering Estimating System (BEES) estimate for the unit cost of PCC pavement grooving or grinding can be obtained from the Contract Cost Data Book. However, while the construction industry is adapting to the new disposal requirements in SSP 42-600, "Disposal of Portland Cement Concrete (PCC) Pavement Grooving and Grinding Residues," an additional 20% should be added to the unit cost for either item of work to account for disposal, pending the reflection in the Contract Cost Data Book of contracts fully employing the new requirements.

Costs for the smaller temporary storage facilities should be based upon information obtained in the latest Contract Cost Data Book, if listed as an item of work. Costs for larger temporary storage facilities, when listed as an item of work, should be based upon the latest Contract Cost Data Book and should include all associated costs such as Roadway Excavation.

3.10 Contract Specifications

- The type of contract employed for large PCC pavement grooving or grinding projects can affect the project in various ways, such as:

  a) Contracts usually have a clearly defined number of working days, and a day by which the construction must begin. By contrast, in an "A+B" contract, the successful bidder has the lowest combination of the "A" contract dollar amount (the total bid price of all contract items) plus the "B" contract amount, which represents the total number of working days bid by the successful bidder to complete the work multiplied by the "Cost

per Day" which includes lesser of road user costs (as calculated by the District Traffic Engineer) plus liquidated damages, or 0.01% of the engineer's estimated cost of construction. Original payment to the Contractor is the "A" amount and the original contract duration is the number of working days bid that is used in the calculation of the "B" amount. However, because treatment of residues by evaporation is usually used in the operations, contractual issues related to length of the contract, such use of an "A+B" contract is problematic.

b) If the Project Engineer anticipated that Bidders might wish to apply for a waiver for disposal outside of the State right-of-way at a non-permitted location for a particular project, additional time to begin the work should be allowed to implement this into the contract special provisions, paragraph 2 of SSP S4-030, "Beginning of Work, Time of Completion and Liquidated Damages," could be changed to 120 calendar days, or more, to provide the Bidders sufficient time to obtain a permit.

c) Additional non-work days might be allowed at the end of the contract to provide additional time for drying of the residues and thereby reduce the total volume of residues that must be handled as part of disposal. The effect that these options would have on bonding costs for the Contractor and associated costs to the Resident's Engineers office should be carefully considered.

d) If PCC pavement grooving and grinding were performed during the rainy season, much less evaporation would be expected, and the quantities of liquids to be disposed of would be higher unless separation methods were employed. The required start date for the work could be moved to the end date of the rainy season in order to facilitate evaporation.

e) As usual, all changes of these aspects of the contract should be fully considered.

- Any mandatory or optional disposal sites, in addition to in the list following paragraph 6 of SSP 42-600, "Disposal Of Portland Cement Concrete (PCC) Pavement Grooving And Grinding Residues," must be included in the contract special provisions or in a Materials Information handout for Bidders to be aware of the project requirements.

References

1) California Department of Transportation. *Highway Design Manual*, Chapters 600 to 670, Pavement Structural Section. June 2006

2) California Department of Transportation, Pavement Tech Notes, *Interim PCC Pavement Rehabilitation Guidelines.* http://www.dot.ca.gov/hq/oppd/pavement/guidance/PCC-Pavement-Rehabilitation-Guidelines-8-26-04.pdf

3) California Department of Transportation, Standard Special Provision "Disposal of Portland Cement Concrete (PCC) Pavement Grooving and Grinding Residues." http://www.dot.ca.gov/hq/esc/oe/specifications/SSPs/2006-SSPs/Sec_10/22-42/42-600_E_A05-01-06.doc

4) California Department of Transportation, "Quieter Pavements" http://www.dot.ca.gov/hq/oppd/pavement/qpavement.htm

5) California Department of Transportation, April 2005. "*Report of Findings: State-Wide Portland Cement Concrete Cement Waste Supplemental Study.*" http://www.dot.ca.gov/hq/env/haz/index.htm

6) California Department of Transportation. *Storm Water Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual.* March 2003 http://www.dot.ca.gov/hq/construc/stormwater/CSBMPM_303_Final.pdf

7) California Department of Transportation. *Standard Specifications*, May 2006

8) California Department of Transportation, Construction Program Directive 04-5, "Disposal of Portland Cement Concrete Liquid Residues." http://projdel.dot.ca.gov/construction/CPDirectives/CPD04-5DisposalofPCCresidues.pdf

9) California Department of Water Resources, "ETo Zones Map". http://wwwcimis.water.ca.gov/cimis/info.jsp

10) "NS-2, Dewatering Operations." March 2004. California Department of Transportation. *Storm Water Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual.* http://www.dot.ca.gov/hq/construc/stormwater/NS02Update.pdf

11) California Department of Transportation. *Field Guide to Construction Site Dewatering.* October 2001. CTSW-RT-01-010

12) California Department of Transportation, Standard Special Provision "Temporary Concrete Washout Facility." http://www.dot.ca.gov/hq/esc/oe/specifications/SSPs/2006-SSPs/Sec_10/05-12/07-405_E_A05-30-06.doc

13) California Department of Transportation, Water Pollution Control Sheet: Temporary Water Pollution Control Details (Temporary Concrete Washout Facility). http://pd.dot.ca.gov/design/storm/ssps.asp

14) California Department of Transportation, Standard Special Provision "Water Pollution Control." http://www.dot.ca.gov/hq/esc/oe/specifications/SSPs/2006-SSPs/Sec_10/05-12/07-340_E_A05-01-06.doc

15) California Department of Transportation, Standard Special Provision "Water Pollution Control." http://www.dot.ca.gov/hq/esc/oe/specifications/SSPs/2006-SSPs/Sec_10/05-12/07-345_E_A05-01-06.doc

16) "WM-8 Concrete Waste Management." September 2004. California Department of Transportation *Storm Water Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual*. http://www.dot.ca.gov/hq/construc/stormwater/WM-08updated.pdf

17) California Department of Transportation, Standard Special Provision "Remove Traffic Stripe and Pavement Marking." http://www.dot.ca.gov/hq/esc/oe/specifications/SSPs/2006-SSPs/Sec_10/15/15-300_E_A05-01-06.doc

18) California Department of Transportation, Standard Special Provision "Beginning of Work, Time of Completion and Liquidated Damages." http://www.dot.ca.gov/hq/esc/oe/specifications/SSPs/2006-SSPs/Sec_04/S4-030_E_A05-01-06.doc