

QUALITY ASSURANCE PROGRAM
FOR
VERMONT AGENCY OF TRANSPORTATION

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Approved By: *Mladen Gagulic*
Mladen Gagulic
Materials & Certification Manager

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1.0 INTRODUCTION

The *Quality Assurance Program* (QAP) will provide for a fair, accurate, adequate, accountable, consistent, effective and sustainable set of practices for construction inspection and compliance in accordance with the Code of Federal Regulations (CFR) Parts 635 and 637. The specific elements of this program include Contractor Quality Control, Acceptance, Independent Assurance, certification and qualification of personnel and laboratories and *clarification and resolution of material test results*.

The aforementioned set of practices will be directly related to the levels of risk, material quality, public safety, and project scope and funding requirements associated with each transportation construction project. Toward this end, the QAP is organized into four levels; refer to Section 4 for further information. Quality will be assured at the applicable level noting that a project will be addressed at only one level and not from multiple levels.

The *Quality Assurance Program* including the Materials Sampling Manual (MSM) has been developed to clearly articulate the processes for *acceptance* of materials in construction and maintenance.

This document is written primarily for use by Vermont Agency of Transportation (Agency) personnel, or designated representatives, who administer projects that involve construction or maintenance of the Vermont highway system. However, consideration has been given to present terms or wording in the document that would allow for both an effective and efficient use of this document by other public, non-profit, or private sector entities. Given this consideration when the term “Owner” is used it implies, or is in reference to, the owner of the facility. When the term “Agency” is utilized it is in sole reference to a process, document, or service provided by the State of Vermont, and more specifically the Agency of Transportation, and is not intended to be interpreted as anything different. Furthermore, this document can not be used to diminish the statutory authority and responsibilities of the State of Vermont or the Vermont Agency of Transportation.

2.0 POLICY

This *Quality Assurance Program* (QAP) identifies the various elements of the Owner’s sampling, testing and inspection programs that are in place to assure that the materials and workmanship incorporated into construction projects are in conformity with the requirements of the approved plans and specifications including approved changes. It is the intent of the Owner, to the extent possible, that all sampling will be performed in a random manner. In addition, the QAP will be periodically reviewed and revised to ensure that its contents reflect current Agency policies and practices while continuing to meet the criteria contained in 23 CFR 637B.

The motivation for the development of this *Quality Assurance Program*, as prepared by the Agency, lies within the Code of Federal Regulations (CFR) Title 23, Sections 637.205(a) and 635.105(a) as follows:

Supervising Agency: 23CFR 635.105(a). *The STD* [State Transportation Department, in this case the Vermont Agency of Transportation] *has responsibility for the construction of all Federal-aid projects,*



and is not relieved of such responsibility by authorizing performance of the work by a local public agency or other Federal agency. The STD shall be responsible for insuring that such projects receive adequate supervision and inspection to insure that projects are completed in conformance with approved plans and specifications.

Quality Assurance Program: 23CFR 637.205(a) Each STD shall develop a quality assurance program which will assure that the materials and workmanship incorporated into each Federal-aid highway construction project on the NHS are in conformity with the requirements of the approved plans and specifications, including approved changes. The program must meet the criteria in §637.207 and be approved by the FHWA.

In addition to complying with the requirements of 23 CFR 637.205(a) each STD is directed to comply with additional requirements in 23 CFR 637.205, including maintaining adequate and qualified staff to administer its *quality assurance program* and maintaining a *central laboratory* meeting the requirements of 23 CFR 637.209(a)(2). Another requirement of 23 CFR 637.205 stipulates that *Independent Assurance samples* and tests or other procedures will be performed by qualified sampling and testing personnel employed by the Agency, or its designated Agent. It also requires that all samples used for *quality control* or acceptance sampling and testing purposes will be random samples.

The Vermont Agency of Transportation, through the Materials and Research Section, maintains and monitors a sampling and testing program that consists of two parts:

- a) An *Acceptance program* which conforms to Article 637.207(a)(1) and,
- b) An *Independent Assurance program* which conforms to Article 637.207(a)(2) in which samples are systems based.

It is understood that the Agency's Material Sampling Manual (MSM) will meet the requirements of 23 CFR 637.207. The MSM provides documentation of sampling frequency guide schedules, identification of sampling locations in the construction operation and identification of tests to be performed. It is current Agency policy that *quality control* sampling and testing results are not to be used in the Acceptance process for Level 1, 2, and 3 projects with the exception of design build projects.

In addition, the Agency's Quality Assurance Program applies to all VTrans' Design-Build projects. Each Design-Build project will have a separate project specific acceptance sampling and testing plan that will be developed based on the site specific risks associated with the project.

3.0 TERMINOLOGY

For the purpose of this document;

where the term "Agency" is referenced it is in sole reference to a process, document, or service provided by the State of Vermont, and more specifically the Agency of Transportation, and is not intended to be interpreted as anything different.



VTrans Quality Assurance Program

where the term Agency Division Director is referenced it may also mean Municipality's or project Owner's Representative, or

where the term Agency Representative is referenced, it may also mean Resident Engineer or District Project Manager for Agency administered projects or the Municipality's Representative for municipally led projects or Project Owner's representative for V.S.A Section 1111 permitted work, or

where the Construction Engineer is referenced it may also mean Construction Engineer or DTA for Agency projects or the Municipality or Owner's representative, or

where the Materials & Research Engineer is referenced it may also mean Materials & Research Engineer or DTA for Agency projects or the Municipality or the Owner's representative, or

where the term Owner is referenced it is meant to define the owner of the facility. It may also mean the Vermont Agency of Transportation, Permit Holder, Municipality, or Owner's representative, or

where the term "Project" is referenced, it may also mean the work conducted in accordance with a Title 19 V.S.A. Section 1111 permit on a state owned facility, or the work being accomplished by a municipality pursuant to a signed Cooperative Agreement with the Agency's LTF Section, or

where the Regional Construction Engineer is referenced it may also mean Regional Construction Engineer or District Transportation Administrator (DTA) for Agency projects or the Municipality or the Owner's representative, or

where the Resident Engineer is referenced it may mean Resident Engineer or District Project Manager for Agency projects or the Municipality or the Owner's representative, or

where the Structures Engineer is referenced it may also mean Structures or DTA for Agency projects or the Municipality or the Owner's representative, or

where the term Transportation Board is referenced, it may also mean Municipal Selectboard, Council, Board of Trustees or Sponsor Board of Trustees.

3.1 Definitions

The definitions in this section are italicized throughout the text of this document.

Acceptance



The determination to allow materials and work incorporated into a project to remain in the project with or without payment being made to the *Contractor*.

Acceptance Program

A thorough and consistent evaluation of all factors that are to be used by the Owner to determine the quality and acceptability of the product or work as specified in the contract requirements. These factors include, but are not necessarily limited to, *material certifications, acceptance sampling and testing* and inspection.

Acceptance Sampling and Testing

Sampling, testing, and the assessment of test results to determine the quality of produced material or construction is acceptable, in terms of the specifications.

Agency Laboratory

An Agency owned laboratory other than the *central laboratory* where *acceptance* samples are processed by Agency personnel or representatives.

Accredited Laboratory

It is a laboratory that is accredited by the AASHTO Material Reference Laboratory (AMRL).

Consultant Laboratory

An Independent Laboratory in which independent and *qualified personnel* process *acceptance* samples.

Central Laboratory

The Agency's primary laboratory is an *accredited laboratory* located in Berlin, Vermont.

Certified Personnel

Any person determined qualified by an appropriate certification program, as determined by the Owner.

Clarification and Resolution of Material Test Results

The procedure, see Section 9.0, used to resolve disagreements between the Owner and its *Contractor* regarding material quality and material test results.



Confirmation

The act of determining whether the product supplied matches the product identified in the material certification submitted.

Contractor

The individual, partnership, firm, corporation, any acceptable combination thereof, or a joint venture which is a party to the Contract with the Owner which is undertaking the performance of the work under the terms of the Contract and acting directly or through its agent(s) or employee(s). The term “*Contractor*” means the prime *Contractor* as differentiated from a *Subcontractor*.

Contractor Laboratory

A laboratory which may be owned and/or operated by a *Producer or Contractor*. This laboratory may be located on a construction site for the purpose of processing *Acceptance or quality control* samples.

Independent Assurance (IA) Comparison

The act of evaluating the variation between the Acceptance and IA test results. The results of a comparison are documented in an IA Comparison Report.

Independent Assurance (IA) Sampling and Testing

Sampling and testing that is conducted by the Certifications and Independent Assurance (C&IA) Unit of the Materials & Research Section to provide an unbiased and independent evaluation of the Acceptance Program.

Independent Assurance (IA) Program

Unbiased activities that are performed by *certified personnel* that are not directly responsible for *quality control* or *acceptance*. These activities provide for an independent assessment of equipment, and evaluation of the sampling and testing methods employed during the *Acceptance Program* to ensure conformance with established procedures. Test procedures used in the *Acceptance Program* performed at the *central laboratory* are exempted from this program. Test results of IA tests are not be used as basis of material *acceptance*.

Lot

A defined quantity of material from a single source assumed to be produced and/or placed essentially by the same controlled process.

Manufacturer

A company that manufactures and supplies *standard manufactured materials* or fabricated materials for use on a project.

Material Certifications

Documents submitted pursuant to Subsection 700.02 of the Agency’s “Standard Specifications for Construction” by the *Manufacturer* or *Producer* of a product that assures (or certifies) that the product used in the work conforms to all applicable requirements of the Owner’s standard specifications, drawings, and contract provisions for the intended project.

National Highway System

The *National Highway System* (NHS) includes the Interstate Highway System as well as other roads important to the nation’s economy, defense, and mobility. The NHS was developed by the United States Department of Transportation (USDOT) in cooperation with the states, local officials, and metropolitan planning organizations (MPOs).

Population

All of the specimens obtained from a *lot* that are used to represent the entire *lot* of material.

Producer

A company that produces or fabricates materials for use on a specific project (i.e. Aggregate, Hot Mix Asphalt (HMA), Portland Cement Concrete (PCC), Precast/Prestressed Concrete) by either the *Contractor* or *Subcontractor*.

Qualified Laboratory

A non-accredited, Owner approved laboratory that provides test results used to determine acceptance.

Qualified Personnel

Personnel that have successfully completed the Agency’s Qualified Technician Program or an Owner approved qualified technician program.

Quality Assurance Program

Documented, predicted, and systematic actions conducted to provide sufficient confidence that a product or service will satisfy given or specified requirements.

For example, it identifies the various elements of the Owner’s sampling, testing and inspection programs that are in place to assure that the materials and workmanship incorporated into the Owner’s construction projects are in conformity with the requirements of the approved plans and specifications including approved changes.



Quality Characteristics

The specific material properties evaluated by *quality control* and *acceptance sampling and testing*.

Quality Control

All activities performed by the *Contractor*, *Producer*, and *Manufacturer* in the manufacturing, production, transport and placement to ensure the materials incorporated and work performed on a project meet or exceed contract specification requirements. These activities include material handling, construction/manufacturing procedures, calibration and maintenance of equipment, production process control, sampling and testing, and inspection that are accomplished to complete the work involved in an Owner project.

Quality Control Plan

A detailed document prepared by the *Contractor* or *Producer* identifying the processes to ensure the quality of material.

Referee Sample

A split or replicate sample that is taken, prepared and stored in an agreed upon manner for the purpose of settling a dispute.

Replicate Samples

Two or more material samples taken at the same location and time. These samples are taken to estimate sampling and testing variability.

Split Sample

A split sample is a single material sample that has been divided into two or more portions. These samples are taken to estimate testing variability.

Standard Manufactured Materials

These are items produced routinely (i.e. not for a specific project) by a *Manufacturer*.

Subcontractor

An individual or legal entity to whom or which the *Contractor* sublets part of the work.

Validation

The process of comparing two independently obtained sets of test results to determine whether they came from the same *population*.

3.2 Acronyms

AASHTO	American Association of State Highway and Transportation Officials
AMRL	AASHTO Materials Reference Laboratory
CFR	Code of Federal Regulations
FHWA	Federal Highway Administration
HMA	Hot Mix Asphalt
IA	Independent Assurance
MSM	Material Sampling Manual
NHS	National Highway System
PCC	Portland Cement Concrete
QA	Quality Assurance
QAP	Quality Assurance Program
QC	Quality Control
QCP	Quality Control Plan
SHS	State Highway System
V.S.A	Vermont Statutes Annotated

4.0 LEVEL DETERMINATION

There are four inspection levels identified in Figure 4.1. There are three different project characteristics that are used to assist in the determination of the appropriate inspection level. The three project specific characteristics are degree of FHWA oversight, project funding source and the highway system on which the project lies. These inspection levels may be subject to change, either up or down, based on a technical assessment performed and recommendations made by the Project Management Team. Projects shall be assigned to the highest level applicable unless a waiver is granted.

The Inspection Level Determination Flow Chart, Figure 4.1, shall be used to determine the most appropriate inspection level for each project under the Owner’s jurisdiction. Projects that are privately or locally funded and which do not impact the State Highway System are outside the scope of this document, however, project managers are encouraged to use Figure 4.1 to determine an appropriate inspection level to ensure quality materials and workmanship for their projects.



4.1 FHWA Oversight

This project characteristic refers to whether or not the project has FHWA oversight. FHWA oversight is the compliance, or verification, component of FHWA stewardship activities. FHWA oversight can be defined as follows:

FHWA oversight is the act of ensuring that the Federal highway program is delivered consistent with laws, regulations and policies by direct FHWA involvement in project review activity.

Projects which have been deemed to require FHWA oversight are classified as Level 1 projects regardless of the funding source or highway system.

4.2 Primary Funding

A funding source as mentioned herein is defined as the origin of the monies used for highway construction and maintenance. Funding sources are commonly federal, state or local governments or combinations of any or all. Other funding sources might be entities - such as private utilities, property owners, businesses or other non-governmental entities. Identifying the project's funding sources is integral to the process of identifying the appropriate inspection level as outlined in Figure 4.1. For example, if the funding source is the FHWA (federal aid) then the project will may be classified as Level 1, 2, or 3 depending upon whether or not the project is located on the NHS, SHS, or Class I Town Highway.

Likewise for projects that may be privately funded but lie on or within the limits of the NHS the requirements for Level 2 shall be applied. These projects are anticipated to be monitored through the Agency's Access Management Program administered via the Agency's Utilities Section, Construction Section, and Operations Division. The funding source may also assist in identifying which projects are assigned to a specific inspection level; i.e., low risk state and federally funded construction projects may tend to fall into Level 3 while construction projects funded solely with local or private funds may be considered Level 4 projects. Level 4 is also reserved for all maintenance activities conducted by the Agency's Operations Division

4.3 Highways Systems

4.3.1 State Highway System

The State Highway System (SHS) as defined in Vermont's Highway System Policy Plan, represents the entire set of highways that are under the Agency's jurisdiction. Class 1 Town Highways are not on the SHS but they are extensions of the state highway system through towns and represent an important complement to this system. These Class 1 facilities are owned and operated by municipalities. These segments create a continuous system of routes that are used for intrastate travel, even if they are not directly under Agency jurisdiction.

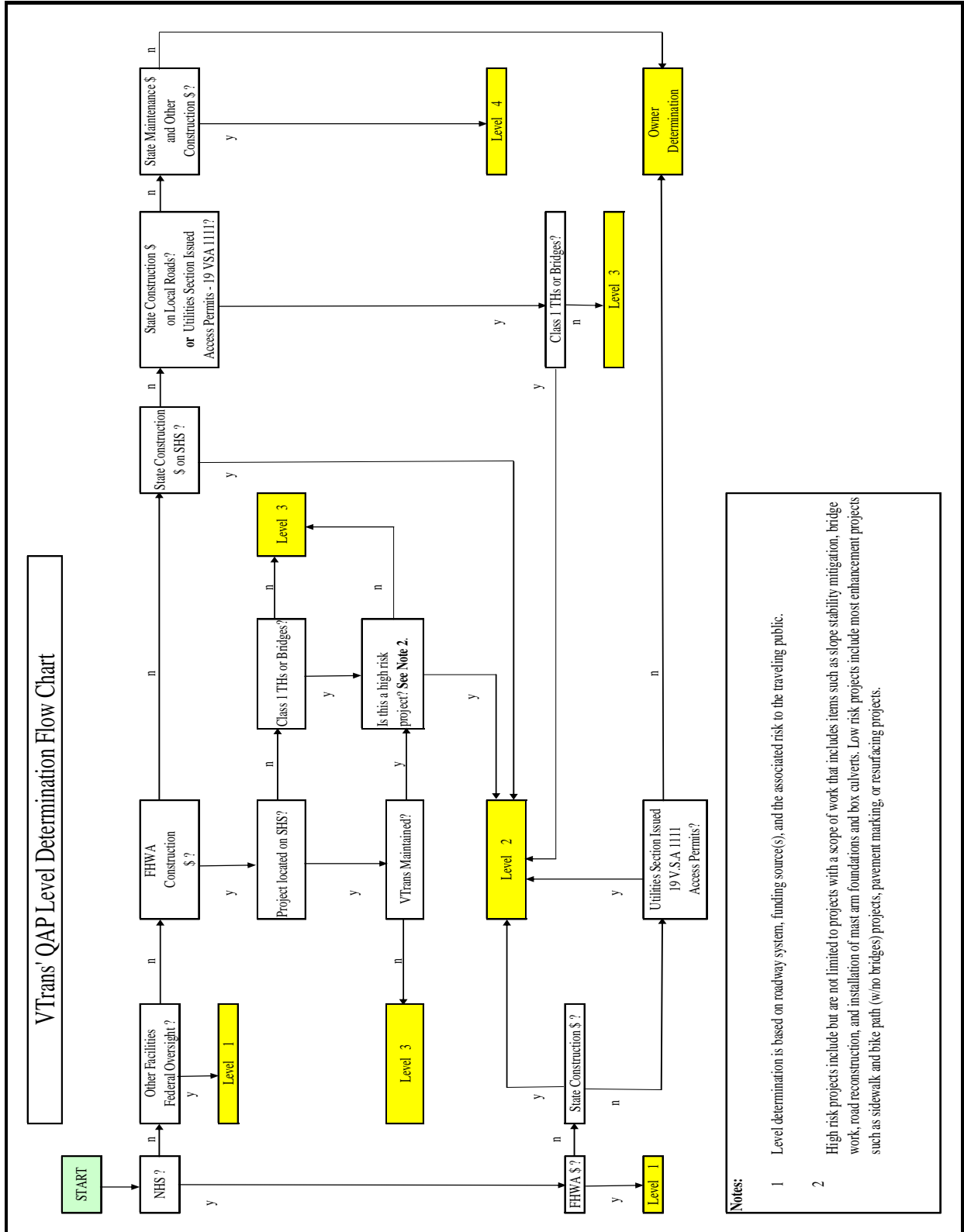
4.3.2 National Highway System

The *National Highway System* (NHS) in Vermont can be reviewed at the following hyperlink: <http://www.aot.state.vt.us/planning/documents/planning/hspch2.2aa.pdf>. Vermont's NHS consists of 320 miles of Interstate highways, 374 miles of principal arterials, and 9.5 miles of intermodal connectors. A brief description of these subsystems is included below:

- **Interstate:** The Eisenhower Interstate System of highways retains its separate identity within the NHS.
- **Other Principal Arterials:** These are highways in rural and urban areas which provide access between an arterial and a major port, airport, public transportation facility, or other intermodal transportation facilities.
- **Intermodal Connectors:** These highways provide access between major intermodal facilities and the National Highway System. A list of these intermodal connectors can be found in Table 2.8 of Section 2.3 of the Agency's *Highway System Policy Plan*. Table 2.8 can be accessed from the following hyperlink: <http://www.aot.state.vt.us/planning/documents/planning/hspch2.3.pdf>.

4.4 Waivers

For those projects where the project manager or owner can identify a lower risk and desires to lower the level of inspection, appropriate justification shall be provided on a waiver form which must be completed and submitted to the Program Manager. Ten working days is required to allow for an adequate review of the waiver request and to seek concurrence from the FHWA for federal aid projects. Once a decision has been made a written response will be sent to the requestor with a copy sent to the Materials & Research Engineer, Project Manager, Program Manager and Program Development Director. Appeals of the decision rendered by the Program Manager can be made to the Director of Program Development.



Notes:

- 1 Level determination is based on roadway system, funding source(s), and the associated risk to the traveling public.
- 2 High risk projects include but are not limited to projects with a scope of work that includes items such as slope stability mitigation, bridge work, road reconstruction, and installation of mast arm foundations and box culverts. Low risk projects include most enhancement projects such as sidewalk and bike path (w/no bridges) projects, pavement marking, or resurfacing projects.

Figure 4.1: Inspection Level Determination Flow Chart



5.0 LEVEL 1 PROJECTS

5.1 Owner Acceptance Program

5.1.1 Acceptance Sampling and Testing

Materials incorporated into highway construction projects shall be subject to *acceptance sampling and testing*, as well as *Quality Control (QC)* sampling and testing as required by specification. Acceptance testing functions shall be conducted by qualified Owner personnel, Non-Owner personnel conducting *acceptance sampling and testing* shall be certified. Laboratory acceptance testing must be performed in a qualified laboratory.

As a minimum, *acceptance sampling and testing* is to be conducted in accordance with the Frequency Guide Schedules found in the Agency's Material Sampling Manual (MSM) for Level 1 Projects. **The Owner reserves the right to sample or test more frequently if deemed necessary to ensure material quality.** As indicated in the MSM, sampling locations may vary.

For QC/QA items of work, the Contract and the MSM guidance shall apply. All *acceptance sampling and testing* will be conducted in accordance with the procedures outlined in the Agency's MSM.

In case of a conflict between Contract requirements and the MSM, the Contract shall govern.

5.1.2 Determination of Acceptance

The Resident Engineer is responsible for *acceptance*. The Resident Engineer will use one or more of the following to determine *acceptance*; material certifications, material test results, and visual observation or inspection of the material and work. Materials will be sampled and tested prior to *acceptance*.

Materials requiring certifications for *acceptance* will have certifications submitted prior to being incorporated into Owner projects.

5.1.3 Materials Record and Certification Checklist

Prior to the preconstruction conference, Agency personnel within the *Certification and Independent Assurance (C&IA) Unit* will compile lists of contract items which require certification, and/or sampling and testing for the *Contractor* and Resident Engineer of each project. These items will be included in the project's Materials Record. The minimum number of samples and tests required will be determined by the contract and the frequency guide schedule in the Agency's MSM.

For municipality managed projects the Project Engineer shall be responsible for the development of the materials record and certification checklist.

The Construction and Materials & Research Sections will develop an annual list of certification-verification items based on the levels of importance and risk. These items will require field *confirmation* or verification of the paper certification prior to incorporating the materials into the project.

At notice of final inspection the materials record and certification checklist will be evaluated for compliance with this QAP.

5.1.4 Completion & Acceptance Memorandum

The Completion & Acceptance Memorandum is issued by the Regional Construction Engineer. After the Completion & Acceptance Memorandum is received by the Materials and Research Section a final review of the project tests and product certifications takes place to verify that all requirements have been accomplished. During this review it may be necessary for the Resident Engineer to provide further clarification or justification on explanations for any material which deviated from the specifications. See Appendix A for examples of material explanations and justifications. VTrans' Construction Manual, Section 4 - 120.10 provides additional guidance, see the following hyperlink;

<http://www.aot.state.vt.us/progdev/Documents/2009ConstructionManual/G-SectionIV-ConstructionandInspection.pdf>. For example, justification may consist of an explanation on the use or incorporation of a product for which insufficient tests were performed, failing results were obtained, or the lack of proper certification was documented.

5.1.5 23CFR 637 Certificate

For those projects on the NHS or with FHWA oversight, the Agency will prepare and submit to the FHWA a 23 CFR 637 Certificate. Each 23 CFR 637 Certificate will conform to the "Guide Letter of Certification By State Engineer" indicated in 23 CFR 637, and the requirements of the Agency's MSM. Appendix B details an example of the Certificate.

The following documents are used to support the Certificate statement that materials incorporated into the project meet the required Contract specifications:

- Materials Record
- Materials Certification Checklist
- Results of Acceptance Sampling and Testing

The Materials and Research Engineer will prepare the 23CFR637 Certificate as a signed letter stating, with any exceptions noted, that the materials used on the project comply with approved plans and specifications. After the Materials and Research Engineer has reviewed and approved the project documentation, the 23CFR637 Certificate is prepared and sent to the Construction Engineer with a copy sent to FHWA.

5.1.6 Prioritization of Plant Based Materials Testing

Plant-based materials testing include materials tested for *acceptance* at hot-mix asphalt (HMA) plants, Portland cement concrete (PCC) plants, precast concrete manufacturing facilities and steel fabrication plants. In the event that sampling and testing personnel can not be dedicated to all projects, a determination shall be made to identify which projects and materials receive full sampling and testing or other appropriate methods for determining *Acceptance*. This determination shall be made by the Materials & Research Engineer for those materials produced by the HMA, PCC, and precast concrete *Producers*. Likewise, the Structures Engineer shall make the determination for inspection activities executed at steel fabrication facilities. Documentation of any decision to reduce, eliminate, or suspend plant-based material testing should be made in writing or by e-mail to the Resident Engineer.

5.2 Contractor Quality Control

The Agency is committed to developing a partnering relationship with its *Contractors* and material *Producers*. *Quality Control* will be performed by *Contractors* and *Producers*, even if the specifications do not require formal approval of the *Quality Control Plans*.

In the future the Agency, or the Owner, may choose to use Contractor *quality control* test results in the *Acceptance decision*. In order to bring this concept to realization the Agency must continue to develop and increase its confidence in *quality control* sampling and testing. There are several steps and more than a few challenges to overcome along the way, however, the common goal that the Agency, the Owner, and the *Contractor/Producer* share is to construct the very best product possible, with the best materials available, ensuring the best quality possible for the public investment made.

5.2.1 Quality Control Plans

The Owner recommends that there be Quality Control Plans for all materials incorporated into Owner projects. In accordance with the Agency's specifications, Quality Control Plans are required for specific materials.

5.2.2 Quality Control Processes

The *Producer* or *Manufacturer* through the *Contractor* shall provide documentation that the *quality control* processes used to manufacture or produce material supplied to the Owner conform to the provisions identified in the project's *Quality Control Plan*.

Unless required by specification, *Manufacturers* may submit annual *quality control plans* to the Owner for *Acceptance*, and do not need to be project specific. Examples of these manufactured products which require an annual QCP include; Hydraulic cement, P.G. Binder, pipes, gates, valves, joint materials, durable pavement markings, lumber and timber, geotextiles, fencing materials, guardrail, delineators, traffic signs and posts, and traffic control signals.

5.2.3 Quality Control Personnel and Laboratories

Contractor and *Producer* QC sampling and testing personnel shall be *certified personnel*. Laboratories provided under this subsection shall be meet the definition of a *qualified laboratory*

5.2.4 Quality Control Sampling and Testing used in the Acceptance Decision

Section reserved for future use.

5.2.5 Validation of QC Data Used for Acceptance

Section reserved for future use.

5.3 Independent Assurance Program

The Vermont Agency of Transportation conducts an *Independent Assurance (IA) Program* in accordance with 23 CFR Part 637.207 to provide an unbiased and independent evaluation of the *Acceptance Program*. IA is used to independently assess the process not the product. The results of IA sampling, testing, or inspection are used to affirm the integrity of acceptance data. If IA testing or inspections indicate a potential problem with the quality of the material or workmanship then the findings may be used to initiate additional sampling, testing or inspections.

The IA Program shall be administered by certified technicians assigned to, or contracted by, the Agency's C&IA Unit. IA laboratory testing shall be performed in an *Accredited Laboratory* except when the testing procedure requires that a step must be performed within a certain timeframe or temperature after sampling. In this case the necessary step(s) will be performed at a qualified lab or directly in the field. The Agency's *Central Laboratory* (Materials and Research Laboratory) located in Berlin, Vermont is an *accredited laboratory* and therefore is not evaluated by the Agency's IA program.

The IA Program uses a *system based approach*, as described below, to evaluate the *Acceptance Program*. Sampling and testing personnel procedures and laboratories from which results are used in the acceptance decision are evaluated by the IA Program for compliance with applicable procedures and standards.

5.3.1 Evaluation of Sampling and Testing Personnel

The IA Program is responsible for evaluating the procedures used by sampling and testing personnel. The evaluation of sampling and testing personnel will be determined by using a combination of field observations and *split, or replicate, samples*. For all materials, other than structural concrete, it is the Agency's goal that proficiency evaluations will be conducted, at least once per calendar year, for each test procedure performed by each technician that is used for *acceptance*.

For structural concrete it is the IA program's goal to evaluate 75% of the total number of field personnel who sample concrete more than 2 days per calendar year. It is the Agency's goal that this effort will represent 90% of the total concrete quantity placed. Proficiency evaluations will be conducted for each test procedure performed that is used in the *Acceptance* decision. These proficiency evaluations will also be used in re-qualification of the technicians as detailed in the Agency's Qualified Technician Program. Evaluations conducted for Level 1

5.3.1.1 Field Observations

IA technicians will observe personnel performing *acceptance sampling and testing* for conformance to specified sampling and testing procedures and protocols to evaluate technician proficiency. Inconsistencies will be documented in a Technician Proficiency Report. Results will be verbally communicated along with a copy provided to the acceptance technician. A gross failure to comply with sampling and testing procedures will be reported to the Materials & Research Engineer for determination of appropriate action.

For technicians continuing to perform acceptance sampling and testing, the IA technicians will perform a follow-up inspection within 30 days to verify that the acceptance technician has corrected identified deficiencies. Should any of the same deficiencies be noted during the follow-up inspection then they will be noted in the technician's follow-up Proficiency Report. The Materials and Research Engineer will determine whether or not corrective action is warranted. They should not be permitted to continue sampling and testing until all issues are resolved.

5.3.1.2 Independent Assurance Comparisons

The IA comparison process compares the material test results of the Acceptance and IA technicians to identify possible equipment or procedural anomalies. The samples used in the IA comparison process are typically obtained by Acceptance and IA personnel. *IA comparisons* of Hot Mix Asphalt and Portland cement concrete are *replicate samples*, and *IA comparisons* of aggregates are *split samples*. The samples are designated as an "Acceptance Sample" and an "IA Sample" and are associated to each other by a cross reference number.

Upon sampling, a chain of custody is maintained for each sample to reduce the possibility of contamination and to maintain the integrity of the sample until testing is completed. The test results of the Acceptance and IA samples are compared to determine if the difference between the test results are within the tolerable limits designated in the MSM. An IA Comparison Report is prepared by the IA technician within 10 working days upon receipt of the acceptance test results.

IA comparison results that are outside the tolerable limits are addressed by investigating the equipment used during Acceptance and IA testing. If an apparent discrepancy cannot be found in either the IA or the Acceptance equipment then the Acceptance technician's

proficiency is evaluated by observation. If no deficiencies are observed during the testing procedure and past results indicate that comparisons have been consistently within the tolerable limits, the discrepancy may be treated as an anomaly. However, if future comparisons indicate a trend then a thorough investigation of the *acceptance sampling and testing* process will be conducted that may include, but not be limited to, additional sampling and testing, observation of procedures and calibration checks of equipment by the C&IA Unit.

5.3.2 IA Comparison Reports and Technician Proficiency Reports

IA Comparison Reports and Technician Proficiency Reports are completed, and then distributed under the authority of the Materials & Research Engineer to the Acceptance Technician, Certifications & Independent Assurance (C&IA) Supervisor (Systems Based File), and the Acceptance Technician's Supervisor within 15 working days upon receipt of the acceptance test results.

5.3.3 Independent Assurance Laboratory Assessments

Agency, Consultant, and Contractor laboratories that perform *acceptance sampling and testing* will be assessed a minimum of once per year as determined by the Certifications & Independent Assurance (C&IA) Supervisor. Inspections will be conducted at random intervals throughout the construction season.

The IA technician will review a list of equipment to verify that all testing equipment is present and complies with all applicable equipment calibration requirements. The C&IA Supervisor may direct the IA technicians to perform mandatory equipment checks for those pieces of equipment that in the past have demonstrated a higher risk to the Owner. The list of mandatory equipment will be developed by the Materials & Research Section. Equipment calibration shall be verified selectively on a minimum of five pieces of equipment during each assessment to confirm the laboratory equipment calibration records. Mandatory equipment checks are not included in the required number of selective equipment calibration checks.

Any deficiencies found during the laboratory assessment process will be documented in the Laboratory Assessment Report, which will be discussed with the Laboratory Manager. For Agency purposes, the Laboratory Manager is the Regional Construction Engineer. The Laboratory Manager will have 5 working days to report a schedule for correction. Unless otherwise approved by the Owner, the Laboratory Manager will have no more than 10 working days from the date of the receipt of the report to correct the deficiencies. After correction the Laboratory Manager will provide written notice to the C&IA Supervisor of the correction and steps to prevent reoccurrence. If in the judgment of the IA technician, with concurrence of the Material and Research Engineer, the evaluation of the equipment is such that the acceptability of the material can not be dependably determined, acceptance of the material will be suspended and a corrective action plan developed by the Laboratory Manager.

Laboratory Assessment Reports are required to be kept on file with the Materials & Research Section and the Acceptance Testing Laboratory for a minimum period of 7 years.

5.3.4 Product Certification-Verification

The C&IA Unit administers the Agency's certification process. In addition, the IA program verifies the Resident Engineer's determination of acceptance for certifications of products used on a project. This activity assures that the certification documents supplied by the *Contractor, Producer, Manufacturer, or Supplier* represent the actual product delivered to and incorporated into the project.

Additionally the C&IA Unit will, to the extent possible, verify that the certified product meets the intended specifications required by the approved plans and specifications. The certification-verification function of the Agency's IA program is designed to detect inconsistent or potentially fraudulent practices by performing "spot checks" on materials delivered to a project. If a discrepancy between the certification and the material is noted, or an inconsistency in the inspection process is identified, the Resident Engineer shall be notified. The C&IA Unit will work together with the Resident Engineer to resolve the discrepancy. The Resident Engineer shall provide written documentation to the C&IA Supervisor describing what actions were taken to resolve the discrepancy.

5.3.5 Project Document Review

The C&IA Unit will review test results for completeness, accuracy and inconsistency ensuring that the required number of samples are obtained, that the required tests are performed, and that the test results comply with the provisions of the *Acceptance Program*.

5.3.6 Annual Report to FHWA

The Materials & Research Engineer will submit an annual report two months after the end of the reporting period summarizing the results of the IA program's assessment of the Owner's Acceptance Program. The report will include, but not be limited to;

1. The number of technicians evaluated, how often each technician was evaluated and a summary of the results of the evaluations including what test procedures were evaluated by IA comparisons and by observation. The resolutions of any noted deficiencies will also be reported.
2. The report will detail the test results of split samples, noting any deficiencies, an analysis of any problems encountered and how they were resolved.
3. The summary of annual assessments of laboratories including names and locations of the Agency Laboratories, Consultant Laboratories, and Contractor Laboratories inspected. The date of each laboratory inspection along with a summary of the results of the inspections including what equipment was inspected. The report will

also identify the material(s) tested at each Laboratory. The resolutions of any problems identified will also be reported.

4. An assessment of the effectiveness of the qualification process, to include the resolutions of any problems that were identified. The assessment will note any specific training needs.
5. A summary of any identifiable trends including any recommendations for overall systematic improvements to the Quality Assurance Program.

5.4 Laboratory Qualifications

The Agency's *Central Laboratory* located in Berlin, VT is an AMRL *accredited laboratory* and is not evaluated under the Agency's Qualified Laboratory Program.

All other laboratories, including all other Agency, Consultant, Producer, or Contractor laboratories where acceptance sampling and testing is performed are required to be qualified in accordance with the Agency's Qualified Laboratory Program.

6.0 LEVEL 2 PROJECTS

6.1 Introduction

The terminology used herein references specific position descriptions, documents, and processes as they apply to projects under construction by the Vermont Agency of Transportation. It is recognized that there will be projects assigned to Level 2 that are administered by the VTrans Operations Division, local Municipalities, or private entities. It is the responsibility of the Title 19 VSA 1111 Permitting or Contracting Authority to verify that their personnel, process, and documentation meet the general requirements of each of the following subsections.

It is recognized that this document may be used by others with limited personnel who may have overlapping assignments related to the administration of the project; therefore it is highly recommended that an independent review and approval of materials acceptance activities be performed.

Where deemed necessary for clarity, a brief description of the general requirements (in italics) is provided followed by an explanation of how the typical Agency Level 2 project will be administered.

6.2 Owner Acceptance Program

6.2.1 Acceptance Sampling and Testing

Materials incorporated into highway construction projects shall be subject to *acceptance sampling and testing*, as well as *quality control (QC) sampling and testing* as required by the contract. Owner personnel conducting *acceptance sampling and testing* shall, as a minimum, be *qualified*. Non-Owner personnel conducting *acceptance sampling and testing* shall be certified. Qualified technicians must satisfy the requirements for Qualified Technician as defined in the Agency's Qualified Technician Program.

As a minimum, *acceptance sampling and testing* is to be conducted in accordance with the Frequency Guide Schedules found in the Agency's Material Sampling Manual (MSM) for this level of inspection.

For Quality Assurance (QA) items of work, the Contract and the MSM guidance shall apply. *Acceptance sampling and testing* will be conducted in accordance with the procedures outlined in the Agency's MSM.

In case of a conflict between Contract requirements and the MSM, the Contract shall govern.

6.2.2 Determination of Acceptance

The Resident Engineer is responsible for *acceptance*. The Resident Engineer will use one or more of the following to determine *acceptance*; material certifications, material test results, and visual observation or inspection of the material and work.

Materials will be sampled and tested prior to *acceptance*.

Materials requiring certifications for *acceptance* will have certifications submitted prior to being incorporated into Owner projects.

6.2.3 Materials Record and Certification Checklist

A list of materials requiring testing or certification will be prepared prior to construction. When the project has been completed the list shall be reviewed to ensure satisfactory completion.

Prior to the preconstruction conference, on behalf of the Materials & Research Engineer personnel within the Certification and Independent Assurance (C&IA) Unit will compile lists of contract items which require certification, and/or sampling and testing for the *Contractor* and Resident Engineer of each project. These items will be included in the project's Materials Record. The minimum number of samples and tests required will be determined by the Contract and the frequency guide schedule in the MSM.

For municipality managed projects the Project Engineer shall be responsible for the development of the materials record and certification checklist.

The Construction and Materials & Research Sections may jointly develop an annual list of certification-verification items based on the levels of importance and risk. These items will require field *confirmation* or verification of the paper certification prior to incorporating the materials into the project.

At notice of final inspection the materials record and certification checklist will be evaluated for compliance.

6.2.4 Completion & Acceptance Memorandum

A notice stating that the project has been completed in accordance with the contract specifications or permit conditions is required.

The Completion & Acceptance Memorandum is issued by the Regional Construction Engineer. After the Completion & Acceptance Memorandum is received, the Materials and Research Engineer completes a final review of the project tests and product certifications to verify that all requirements have been accomplished. During this review it may be necessary for the Resident Engineer to provide further clarification, justification, or explanations of any material which deviated from the specifications. For example, justification may consist of an explanation on the use or incorporation of a product for which insufficient tests were performed, failing results were obtained, or lack of proper certification documentation. See Appendix A for examples of material explanations and justifications. VTrans' Construction Manual, Section 4 - 120.10 provides additional guidance, see the following hyperlink; <http://www.aot.state.vt.us/progdev/Documents/2009ConstructionManual/G-SectionIV-ConstructionandInspection.pdf>.

6.2.5 Final Materials Memorandum

A letter shall be prepared that documents that the materials incorporated into the work comply with the project requirements. Exceptions to the project requirements shall be noted in this document.

When the Completion & Acceptance Memorandum is received by the Materials and Research Section for Level 2 projects, the Materials and Research Engineer will prepare a letter stating, with the exceptions noted, that the materials used on the project ***are in reasonable conformance*** with the contract. The Final Materials Memorandum will be sent to the Construction Engineer.

The following documents are used to support the statement that the incorporated materials ***are in reasonable conformance*** with the project requirements:

- Materials Record
- Materials Certification Checklist
- Results of Acceptance Sampling and Testing
- Resident's Engineer's Clarifications, Justifications, or Explanations

6.2.6 Prioritization of Plant Based Materials Testing

Plant-based materials testing include materials tested for *acceptance* at hot-mix asphalt (HMA) plants, Portland cement concrete (PCC) plants, precast concrete manufacturing facilities and steel fabrication plants. In the event that sampling and testing personnel can not be dedicated to all projects, a determination shall be made to identify which projects and materials receive full sampling and testing or other appropriate methods for determining *Acceptance*. This determination shall be made by the Materials & Research Engineer for those materials produced by the HMA, PCC, and precast concrete *Producers*. Likewise, the Structures Engineer shall make the determination for inspection activities executed at steel fabrication facilities. Documentation of any decision to reduce, eliminate, or suspend plant-based material testing should be made in writing or by e-mail to the Resident Engineer.

6.3 Contractor Quality Control

The Agency is committed to developing a partnering relationship with its *Contractors* and material *Producers*. *Quality Control* will be performed by *Contractors* and *Producers*, even if the specifications do not require formal approval of the *Quality Control Plans*.

In the future the Agency, or the Owner, may choose to use Contractor *quality control* test results in the *Acceptance decision*. In order to bring this concept to realization the Agency must continue to develop and increase its confidence in *quality control* sampling and testing. There are several steps and more than a few challenges to overcome along the way, however, the common goal that the Agency, the Owner, and the *Contractor/Producer* share is to construct the very best product possible, with the best materials available, ensuring the best quality possible for the public investment made.

6.3.1 Quality Control Plans

The Owner recommends that there be Quality Control Plans (QCP) for all materials incorporated into Owner projects. In accordance with the Agency's specifications, Quality Control Plans are required for specific materials.

6.3.2 Quality Control Processes

The *Producer* or *Manufacturer* through the *Contractor* shall provide documentation that the *quality control* processes used to manufacture or produce material supplied to the Owner conform to the provisions identified in the project's *Quality Control Plan*.

Manufacturers shall submit annual *quality control* plans to the Owner for *Acceptance*, and do not need to be project specific. Examples of these manufactured products which require an annual QCP include; Hydraulic cement, P.G. Binder, pipes, gates, valves, joint materials, durable pavement markings, lumber and timber, geotextiles, fencing materials, guardrail, delineators, traffic signs and posts, and traffic control signals.

6.3.3 Quality Control Personnel and Laboratories

Contractor and Producer QC sampling and testing personnel shall be certified personnel. Contractor Laboratories designated for Owner use or for QC purposes under this subsection shall meet the requirements of a qualified laboratory as referenced in Section 6.5.

6.3.4 Quality Control Sampling and Testing used in the Acceptance Decision

Section reserved for future use.

6.3.5 Validation of QC Data Used for Acceptance

Section reserved for future use.

6.4 Independent Assurance Program

Independent Assurance (IA) is required only for those projects being administered under direct VTrans supervision. IA activities can be provided as a service to municipalities pending a written agreement of scope of work.

The Vermont Agency of Transportation conducts an *Independent Assurance (IA) Program* in accordance with 23 CFR Part 637.207 to provide an unbiased and independent evaluation of the *Acceptance Program*. IA is used to independently assess the process not the product. The results of IA sampling, testing, or inspection are not to be used directly for *acceptance*. If IA testing or inspections indicate a potential problem with the quality of the material or workmanship then the findings may be used to initiate additional sampling, testing or inspections.

The IA Program shall be administered by certified technicians assigned to, or contracted by, the Agency's C&IA Unit. IA laboratory testing shall be performed in an *Accredited Laboratory* except when the testing procedure requires that a step must be performed within a certain timeframe or temperature after sampling. In this case the necessary step(s) will be performed at a qualified lab or directly in the field. The Agency's *Central Laboratory* (Materials and Research Laboratory) located in Berlin, Vermont is an *accredited laboratory* and therefore is not evaluated by the Agency's IA program.

The IA Program, as it is applied at Level 2, will only assess personnel and equipment used for the field sampling and testing of concrete prior to placement on Owner projects. Sampling and testing personnel procedures and equipment which are used in the acceptance decision will be evaluated by the IA Program for compliance with applicable procedures and standards. The IA Program will use a *system based approach*, as described below, to evaluate this component of the Owner's *Acceptance Program*.

6.4.1 Evaluation of Sampling and Testing Personnel

The IA Program is responsible for evaluating the procedures used by sampling and testing personnel. Each calendar year, it is the IA program's goal to evaluate 75% of the total

number of field personnel who sample concrete more than 2 days per calendar year. It is the Agency's goal that this effort will represent 90% of the total concrete quantity placed. Proficiency evaluations will be conducted for each test procedure performed that is used in the *Acceptance* decision. These proficiency evaluations will also be used in re-qualification of the technicians as detailed in the Agency's Qualified Technician Program. Evaluations conducted for Level 1 projects will be included in the determination of achievement of the IA Program's goal(s).

6.4.1.1 Field Observations

IA technicians will observe personnel performing *acceptance sampling and testing* for conformance to specified sampling and testing procedures and protocols to evaluate their proficiency. Inconsistencies will be documented in a Technician Proficiency Report. Results will be verbally communicated along with a copy provided to the acceptance technician. The IA technicians will perform a follow-up inspection within 30 days to verify that the acceptance technician has corrected identified deficiencies. Should any of the same deficiencies be noted during the follow-up inspection then they will be noted in the technician's follow-up Proficiency Report. The Materials and Research Engineer will determine whether or not corrective action is warranted.

6.4.1.2 Independent Assurance Comparison

The IA comparison process compares the material test results of the Acceptance and IA technicians to identify possible equipment or procedural anomalies. The samples used in the IA comparison process are typically obtained by Acceptance and IA personnel. The samples are designated as an "Acceptance Sample" and an "IA Sample" and are associated to each other by a cross reference number.

Upon sampling, a chain of custody is maintained for each sample to reduce the possibility of contamination and to maintain the integrity of the sample until testing is completed. The test results of the Acceptance and IA samples are then compared to determine if the difference between the test results are within the tolerable limits designated in the MSM. An IA Comparison Report is prepared by the IA technician within 10 working days upon receipt of the acceptance test results.

IA comparison results that are outside the tolerable limits are addressed by investigating the equipment used during Acceptance and IA testing. If an apparent discrepancy cannot be found in either the IA or the Acceptance equipment then the Acceptance technician's proficiency is evaluated by observation. If no deficiencies are observed during the testing procedure and past results indicate that comparisons have been consistently within the tolerable limits, the discrepancy may be treated as an anomaly. However, if future comparisons indicate a trend then a thorough investigation of the *acceptance sampling and testing* process will be conducted that may include, but not be limited to, additional sampling and testing, observation of procedures and calibration checks of equipment by the C&IA Unit.

6.4.2 IA Comparison Reports and Technician Proficiency Reports

IA Comparison Reports and Technician Proficiency Reports are completed, and then distributed under the authority of the Materials & Research Engineer to the Acceptance Technician, Certifications & Independent Assurance (C&IA) Supervisor (Systems Based File), and the Acceptance Technician's Supervisor within 15 working days upon receipt of the acceptance test results.

6.4.3 Product Certification-Verification

The C&IA Unit administers the Agency's certification process. In addition, the IA program verifies the Resident Engineer's determination of acceptance for certifications of products used on a project. This activity assures that the certification documents supplied by the *Contractor, Producer, Manufacturer, or Supplier* represent the actual product delivered to and incorporated into the project.

Additionally the C&IA Unit will, to the extent possible, verify that the certified product meets the intended specifications required by the approved plans and specifications.

The certification-verification function of the Agency's IA program is designed to detect inconsistent or potentially fraudulent practices by performing "spot checks" on materials delivered to a project. If a discrepancy between the certification and the material is noted, or an inconsistency in the inspection process is identified, the Resident Engineer shall be notified. The C&IA Unit will work together with the Resident Engineer to resolve the discrepancy. The Resident Engineer shall provide written documentation to the C&IA Supervisor describing what actions were taken to resolve the discrepancy.

6.4.4 Project Document Review

The C&IA Unit will review test results for completeness, accuracy and inconsistency ensuring that the required number of samples are obtained, that the required tests are performed, and that the test results comply with the provisions of the *Acceptance Program*.

6.5 Laboratory Qualifications

The Agency's *Central Laboratory* located in Berlin, VT is an AMRL *accredited laboratory* and is not evaluated under the Agency's Qualified Laboratory Program.

All other laboratories, including all other Agency, Consultant, Producer, or Contractor laboratories where acceptance sampling and testing is performed are required to be qualified in accordance with the Agency's Qualified Laboratory Program.

7.0 LEVEL 3 PROJECTS

7.1 Terms Used in This Section

This document can not be used to diminish the statutory authority of the Vermont Agency of Transportation. Refer to Section 3.0 for additional information. A few key terms are duplicated below for ease of reference.

Where the term “Agency” is referenced it is in sole reference to a process, document, or service provided by the State of Vermont, and more specifically the Agency of Transportation, and is not intended to be interpreted as anything different.

Where the term Owner is referenced it is meant to define the owner of the facility. It may also mean the Vermont Agency of Transportation, Permit Holder, Municipality, or Owner’s representative.

Where the term Agency Representative is referenced, it may also mean Resident Engineer or District Project Manager for Agency administered projects or the Municipality’s Representative for municipally led projects or Project Owner’s representative for Title 19 V.S.A Section 1111 permitted work.

Where the term “Project” is referenced, it may also mean the work conducted in accordance with a Title 19 V.S.A. Section 1111 permit on a state owned facility, or the work being accomplished by a municipality pursuant to a signed Cooperative Agreement with the Agency’s LTF Section.

7.2 Introduction

Projects assigned to Level 3 may be administered pursuant to a Title 19 V.S.A 1111 Permit issued by the Agency’s Utilities Section or pursuant to a local Municipality’s project administered through the Agency’s Local Transportation Facilities (LTF) Section. Personnel from the Agency’s Operations Division or Construction Section may be responsible for ensuring that the Title 19 V.S.A. 1111 permit conditions identified in the issued permits are achieved. For Agency managed projects it is the responsibility of the Utilities or LTF Sections to verify that the process and documentation meet the general requirements of each of the following subsections. For municipality managed projects it is the Municipality’s responsibility to verify that the process and documentation meet the general requirements of each of the following subsections.

It is recognized that this document may be used by others with overlapping assignments in the administration of the project; therefore it is highly recommended that an independent review and approval of materials acceptance activities be performed and maintained.

7.3 Acceptance Program

7.3.1 Acceptance Sampling and Testing

Acceptance sampling and testing shall be conducted in accordance with Level 3 of the Agency's MSM.

Personnel conducting *acceptance sampling and testing* shall, as a minimum, be *qualified*. Qualified technicians must satisfy the experience requirements defined in the Agency's Qualified Technician Program.

In case of a conflict between the Contract plans and specifications and the Agency's MSM, the Contract plans and specifications shall govern.

The Owner reserves the right to sample and test any materials on its projects or for those projects issued permits for work to be accomplished on state owned facilities. For LTF projects *acceptance sampling and testing* may be performed by the Agency or a *qualified laboratory*.

For Title 19 V.S.A 1111 permits, it is the responsibility of the Permittee to ensure that all materials are sampled and tested in accordance with the conditions of the permit. Materials testing must be conducted by a *qualified laboratory*.

7.3.2 Determination of Acceptance

The designated Agency Representative is responsible for *Acceptance* of the materials and work accomplished on or within the Owner's right-of-way, or of any work that will become the property of the Owner upon completion of the work. The Agency Representative may use different approaches or combination of approaches to determine *acceptance*. These approaches may include but not be limited to visual inspection, Owner field and/or laboratory test results, *Contractor* field and/or laboratory test results, and *Manufacturer or Producer* certifications. Pertaining to material certifications; the *Producer's* measured test values may be compared, at any time, against the Owner's verification test results. Regardless of the methods utilized, the Agency Representative shall document the basis for acceptance of those materials listed in the Agency's MSM – Level 3.

7.3.3 Material Checklist

A list of materials requiring testing and/or certification which require submittals will be prepared prior to construction, by the Agency representative. These material items will be included in each project's Materials Checklist. The minimum number of samples and tests required will be determined by the frequency guide schedule in the Agency's MSM. When the project has been completed the list shall be reviewed by the Agency's representative to ensure that satisfactory completion of the requirements has been achieved.

There are five types of material certification identified in the Agency's current specifications. They are listed in ascending importance as follows:

- (1) Type A: A Type A Certification shall certify that the component materials, manufacturing operations, and finished products conform to all requirements of the Agency, the State, pertinent Plans, Special Provisions, and Specifications for the Contract item or items indicated.
- (2) Type B: A Type B Certification shall certify that the material conforms to the requirements of the Agency's current specifications, and is of the same formulation as that previously approved by the Agency.
- (3) Type C: A Type C Certification shall consist of certified test results showing the actual chemical and physical analysis of the material used in the manufacture of products delivered to the project.
- (4) Type D: A Type D Certification shall consist of both a Type A Certification and a Type C Certification.
- (5) Type E: A Type E Certification shall consist of a yearly Type A Certification plus a certification prepared by the manufacturer indicating test results of the required chemical and physical properties of discrete, identifiable quantities of material. The manufacturer's measured test values may be compared against independent assurance test results.

Certified items require field *confirmation* or verification of the paper certification prior to incorporating and/or providing full payment for the materials used on the project. At the notice of final inspection the Materials Checklist and certification checklist will be evaluated for compliance. For any significant discrepancies the Agency Representative, may request written responses from the *Producer* to explain the discrepancy.

7.3.4 Completion & Acceptance Letter

After the completion of the work and before final acceptance of the project, the Agency Representative shall prepare a notice affirming that the project has been completed in accordance with the contract specifications or permit conditions For Title 19 V.S.A Section 1111 issued permits, completion and acceptance is a completed and "signed off" permit documented by District personnel. The notice shall also state whether or not the materials incorporated into the work comply with the project requirements. Exceptions to the project or material requirements shall be noted in this document. This should be submitted to the appropriate personnel within the Agency (or to the Owner) for review and approval/acceptance.

In order to complete the Completion and Acceptance Letter it may be necessary for the Agency Representative to provide further clarification, justification, or explanations of any material which deviated from the specifications or permit conditions, or for which the required certifications or tests were not completed. See Appendix A for examples of material explanations and justifications. For projects completed under the Title 19 V.S.A Section 1111 issued permits the Agency may hold the Permittee responsible for such justifications. A

justification may consist of an explanation on the use or incorporation of a product for which insufficient tests were performed, failing results were obtained, or there was a lack of proper certification documentation.

The following documents may be used to support the statement that the incorporated materials meet the project requirements:

- Results of Acceptance Sampling and Testing
- Materials Checklist
- Agency Representative's Clarifications, Justifications, or Explanations

7.4 Contractor Quality Control

The Agency is committed to developing a partnering relationship with its *Contractors* and material *Producers*. *Quality Control* will be performed by *Contractors* and *Producers*, even if the specifications do not require formal approval of the *Quality Control Plans*.

In the future the Agency, or the Owner, may choose to use Contractor *quality control* test results in the *Acceptance decision*. In order to bring this concept to realization the Agency must continue to develop and increase its confidence in *quality control* sampling and testing. There are several steps and more than a few challenges to overcome along the way, however, the common goal that the Agency, the Owner, and the *Contractor/Producer* share is to construct the very best product possible, with the best materials available, ensuring the best quality possible for the public investment made.

7.4.1 Quality Control Personnel and Laboratories

Contractor and *Producer* personnel conducting QC sampling and testing shall be *certified personnel*. *Contractor* Laboratories designated for Owner use or used for acceptance (including Type D certified test results) for QC purposes under this subsection shall meet the requirements of a *qualified laboratory* as referenced in Section 7.5.

7.4.2 Quality Control Sampling and Testing used in the Acceptance Decision

This section applies to field concrete tests only.

Sampling and testing should be conducted in accordance with the *Producer's* approved *quality control plan* with an appropriate level of verification.

7.4.3 Validation of QC Data Used for Acceptance

Section reserved for future use.

7.5 Laboratory Qualifications

The Agency's *Central Laboratory* located in Berlin, VT is an AMRL *accredited laboratory* and is not evaluated under the Agency's Qualified Laboratory Program.

All other laboratories, including all other Agency, Consultant, Producer, or Contractor laboratories where acceptance sampling and testing is performed are required to be qualified in accordance with the Agency's Qualified Laboratory Program.

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8.0 LEVEL 4 PROJECTS

8.1 Introduction

The intent of the following guidance for Level 4 is to assure that an adequate level of material quality is achieved for those significant bridge and roadway items that are used by the Agency's Operations Division. The use of these materials may be during routine maintenance activities or during the construction of special projects. Bridge activities may include but are not be limited to, deck rehabilitation, deck membrane replacement and rehabilitation, joint replacement, bridge railing or deck repairs. Roadway activities may include, but not be limited to, leveling or resurfacing, mainline paving projects (i.e., for long-term "temporary" bridges), construction of turning lanes or widening of existing highways, guardrail replacement projects.

Personnel from the Agency's Operations Division are responsible for ensuring that materials listed in Section 8.2.4 meet the material requirements detailed in the current edition of the Agency's Standard Specifications for Construction or current Agency purchasing contracts and maintenance rental agreements (MRAs).

Although the actual field or laboratory testing may be performed by the *Contractor*, *Producer*, or *Contractor's* Representative the acceptance of the materials is still the responsibility of the Operations' District Representative. The District Representative is the Agency Representative for this Level.

It is recognized that this document may be used by others with overlapping assignments in the administration of the project; therefore it is recommended that an independent or supervisory review and approval of materials acceptance activities be performed by the District Transportation Administrator.

8.2 Acceptance Program

8.2.1 Acceptance Sampling and Testing

In lieu of *Contractor* test results, or for verification purposes, the Owner may elect to sample and test materials normally accepted based on *Contractor* test results. In addition, the Agency's Representative may elect to sample and test at a higher frequency than the sampling frequency detailed in the Agency's MSM – Level 4.

Acceptance sampling and testing, regardless of who performs the tests, should be conducted in accordance with the Agency's MSM – Level 4.

Only qualified personnel should conduct acceptance sampling and testing. Personnel may be considered qualified if they satisfy the experience requirements as defined in the Agency's Qualified Technician Program.

8.2.2 Determination of Acceptance

The Agency Representative is responsible for *acceptance*. The Agency Representative may use different methods or combination of methods to determine acceptance. These methods may include but not be limited to visual inspection, use of materials on the Agency's Approved Products List, Owner field and/or laboratory test results, *Contractor* or *Producer* field and/or laboratory test results, and *material certifications*. Regardless of the methods utilized, the Agency Representative shall document the basis for acceptance of those materials listed in Level 4 of the Agency's MSM.

The Owner's purchasing contracts and Maintenance Rental Agreements (MRAs) should specify a Type A or B certification requirement for HMA and PCC, and Precast Concrete products, see Table 8.1. Aggregates should be sampled and tested in conformance with Table 8.1.

Whenever possible Agency Representatives will use materials included on the current edition of the Agency's Approved Products List (APL). For those projects where an approved product is not readily available the Agency Representative shall contact the Research Engineer at the Materials & Research Laboratory to discuss acquiring written conditional approval.

8.2.3 Materials Certification

Materials may require certification to assure that the Agency or Contractor is incorporating quality materials into the project. Certified items require field *confirmation* and verification of the paper certification prior to incorporating and/or providing full payment for the materials used on the project. The *Producer's* measured test values may be compared, at any time, against Owner verification test results. For any significant discrepancies the Agency Representative, may request written responses from the *Producer* to explain the discrepancy.

There are five types of material certification identified in the Agency's current specifications. They are listed in ascending importance, are as follows:

- (1) Type A: A Type A Certification shall certify that the component materials, manufacturing operations, and finished products conform to all requirements of the Agency, the State, pertinent Plans, Special Provisions, and Specifications for the Contract item or items indicated.
- (2) Type B: A Type B Certification shall certify that the material conforms to the requirements of the Agency's current specifications, and is of the same formulation as that previously approved by the Agency.
- (3) Type C: A Type C Certification shall consist of certified test results showing the actual chemical and physical analysis of the material used in the manufacture of products delivered to the project.

- (4) Type D: A Type D Certification shall consist of both a Type A Certification and a Type C Certification.
- (5) Type E: A Type E Certification shall consist of a yearly Type A Certification plus a certification prepared by the manufacturer indicating test results of the required chemical and physical properties of discrete, identifiable quantities of material. The manufacturer’s measured test values may be compared against independent assurance test results.

8.2.4 Materials List

The acceptance of the materials and corresponding pay items identified in Table 8.1 can be based on an approved source, registration on the Agency’s Approved Products List (QPL), acceptable material test results, or compliant *material certifications* (submitted prior to their use). The Agency Representative should ensure that these material certifications and test results are filed appropriately. **Applicable sections of VTrans Standard Specifications for Construction referenced below are included in the chart below in bold type.**

<i>Material Identification</i>	<i>VTrans Pay Item No.</i>	<i>Recommended Basis for Acceptance</i>
Aggregates	varies	One sample per project is required for each material that possesses a quantity greater than 200 CY.
Bridge Membranes	----	Contract Special Provisions
Cold Patch	----	APL
Culverts (Steel and HDPE)	601	Purchasing Contract – must satisfy material specifications in accordance with 710 and 711 .
Cast-in-Place Culvert Liners	----	Contract Special Provisions or APL
Epoxies	----	APL
Geotextiles	649	Type D Certification — 720.04
Hot Mix Asphalt	400 series	Purchasing Contract – Type B Certification with <i>Contractor’s</i> Test Results. An Owner Approved Mix Design and batch slips are required.
Precast Concrete Items	varies	Purchasing Contract – Type A Certification with <i>Contractor’s</i> Test Results. An Owner Approved Mix Design is required.
Reinforcing Steel	----	Type B Certification
Pavement Markings	646	Must satisfy material specification requirements in Section 708
Structural Bolts	506.19	Type D Certification — 714.05
Structural Concrete	501, 541	Purchasing Contract – Type B Certification or <i>Contractor’s</i> Test Results. An Owner Approved Mix Design and batch slips are required.
Traffic Barriers	621	Must satisfy material specification requirements in Section 728
Traffic Signal Equipment	678	Must satisfy material specification requirements in Section 752
Traffic Signs	675	Must satisfy material specification requirements in Section 750

Table 8.1 – Materials List



8.3 Contractor Quality Control

The Agency is committed to developing a partnering relationship with its *Contractors* and material *Producers*. *Quality Control* will be performed by *Contractors* and *Producers*, even if the specifications do not require formal approval of the *Quality Control Plans*.

In the future the Agency, or the Owner, may choose to use Contractor *quality control* test results in the *Acceptance decision*. In order to bring this concept to realization the Agency must continue to develop and increase its confidence in *quality control* sampling and testing. There are several steps and more than a few challenges to overcome along the way, however, the common goal that the Agency, the Owner, and the *Contractor/Producer* share is to construct the very best product possible, with the best materials available, ensuring the best quality possible for the public investment made.

8.3.1 Quality Control Personnel and Laboratories

Contractor and *Producer* personnel conducting QC sampling and testing shall be *certified personnel*. *Contractor* Laboratories designated for Owner use or used for *acceptance* (including Type D certified test results) for QC purposes under this subsection shall meet the requirements of a *qualified laboratory* as referenced in Section 3.1.

8.3.2 Quality Control Sampling and Testing used in the Acceptance Decision

Refer to Table 8.1.

8.4 Laboratory Qualifications

The Agency's *Central Laboratory* located in Berlin, VT is an AMRL *accredited laboratory* and is not evaluated under the Agency's Qualified Laboratory Program.

All other laboratories, including all other Agency, Consultant, Producer, or Contractor laboratories where acceptance sampling and testing is performed are required to be qualified in accordance with the Agency's Qualified Laboratory Program.

9.0 Clarification and Resolution of Material Test Results - Levels 1, 2, and 3

9.1 Terms Used in This Section

Refer to Section 3.0 for additional information. A few key terms are duplicated below for ease of reference.

Where the term "Agency" is referenced it is in sole reference to a process, document, or service provided by the State of Vermont, and more specifically the Agency of Transportation, and is not intended to be interpreted as anything different.

Where the term Owner is referenced it is meant to define the owner of the facility. It may also mean the Vermont Agency of Transportation, Permit Holder, Municipality, or Owner's representative.

Where the term Agency Representative is referenced, it may also mean Resident Engineer or District Project Manager for Agency administered projects or the Municipality's Representative for municipally led projects or Project Owner's representative for V.S.A Section 1111 permitted work.

Where the term Agency Division Director is referenced it may also mean Municipality's or project Owner's Representative.

Where the term Transportation Board is referenced, it may also mean Municipal Selectboard, Council, Board of Trustees or Sponsor Board of Trustees.

Where the term "Project" is referenced, it may also mean the work conducted in accordance with a Title 19 V.S.A. Section 1111 permit on a state owned facility, or the work being accomplished by a municipality pursuant to a signed Cooperative Agreement with the Agency's LTF Section.

9.2 Introduction

The principles outlined in this section are intended to complement the executed contract or approved permit. If a conflict arises, the requirements specific to the contract govern. The underlying principles include: an accurate description of a deviation from specified materials, a fair assessment of the value of the final product or material and a clear process to promote prompt resolution. The concept of "value" includes several considerations not merely an assessment of production costs. Among them are initial cost, item serviceability, item durability and indirect costs to the public that occur during construction, future maintenance costs (to include the type of maintenance and frequency), or unplanned remediation. The owner of the facility reserves the right to define the individual weighting of these factors based on the facility and specific areas of difference.

Following the *Acceptance Decision* the *Contractor* may request that the appropriate Agency Division Director mediate the dispute. If no agreement on the validity of the combined information (i.e. Owner and *Contractor* supplied) is reached, a *referee sample* may be sent to an independent laboratory for testing.

In accordance with the contract, if the *Contractor* is aggrieved by the decision of the Director, the *Contractor* may appeal the decision in writing to the Transportation Board via the Director.

9.3 Roles and Responsibilities

It is the responsibility of all participants involved with Owner contracts or permits to clarify differences of data, fact, interpretation or opinion relating to materials incorporated into Owner projects so that complete and accurate results will be available for discussion.



9.3.1 Contractor

If the *Contractor* decides to contest the Owner test results, the *Contractor* will be expected to submit any and all relevant test results including those developed by their *Subcontractors* or Producers, to the Owner with notification of the difference of opinion. The *Contractor's* submittal will be expected to include an explanation of the accuracy of the information, effects on cost, serviceability and durability on the project to the Owner for consideration. The *Contractor* is expected to effectively communicate the areas of difference, while providing supporting documentation and conclusions about the existing value provided by performance characteristics of the disputed product.

9.3.2 Owner

The Owner will provide results of all *acceptance sampling and testing* activities to the *Contractor* in a timely manner. The Owner testing protocols and results will conform to the current test methods as identified in the Owner specifications, unless otherwise noted. The Owner will not examine any *Contractor* opinion unless there are corroborating test results. Date, test results, and other *Contractor* supplied information will be analyzed with the purpose of establishing the most accurate and objective determination of material quality of the disputed material.

9.3.3 Independent (Third Party)

Referee samples will be performed by an independent third party laboratory selected by the Owner. The Owner will notify, in writing, the *Contractor* of the selection of the third party laboratory by certified mail. The independent third party laboratory will perform testing by the standard methods defined by the Owner. The independent laboratory must be an *accredited laboratory* for each material test being conducted. The test results and remaining material sample(s) shall be retained by the independent laboratory until the Owner authorizes sample destruction and release of test reports.

9.4 Process

The following procedure shall apply for clarifying the differences in material test results, workmanship or inspection findings, and quality of materials accepted without project specific testing or certification.

The establishment of the *Acceptance decision* and optional description of findings will be performed by the Owner. In case of any dispute arising between the *Contractor* and the Owner regarding the materials furnished or the manner of performing the work, the Agency Representative has the authority to reject the materials and/or to suspend the work until the dispute is decided by the appropriate Agency Division Director.

For Agency projects, the *Contractor* must comply with the contract provisions as stated in Section 105.01 and 105.02 of the current edition of the Agency's Standard Specifications for Construction. For Municipality projects the *Contractor* must comply with the contract plans and

VTrans Quality Assurance Program

specifications. For entities conducting work under an Agency issued Title 19 V.S.A 1111 permit the *Contractor* must comply with the specified permit conditions.

The *Contractor*, after reviewing the Owner's *Acceptance* decision, may determine that a difference in underlying facts warrants clarification under these principles. The *Contractor* must show cause for the difference derived from material test or inspection records associated with the project, production facility, or manufacturing plant. *Quality control plan*, testing practices and test results may be used to further define the *Contractor's* perception relative to the difference in quality materials or workmanship.

The Owner will provide a decision regarding the differences.

APPENDIX A

Examples of Material Explanations / Justifications

Samples

Pay Item No.	Justification for Retention / Disposition
203.31, Sand Borrow	1% high passing the 200 sieve, quantity was 1,000 cy of 29,000 cy. This was considered a minor failure and accepted.
204.30, Granular Backfill for Structures	3% high passing the 100 sieve, quantity was 130 cy of 130 cy on the project. This material was paid at a reduced price.
406.25, Bituminous Concrete Pavement D000652 (failure)	3% high passing the ½” sieve, quantity was 500 tons out of 40,000 tons. Adjusted and retested. Retest #D000653 met specifications, therefore the material was accepted as a minor deviation.
Compaction	The average of the cores was 89.2% which is 0.8% below the acceptable range. The quantity was 578 tons out of 40,000 tons total. A 20% reduction in price was taken on that day’s production.
Asphalt Cement 54 samples required – 53 taken	Original quantity was 40,000 tons and the final quantity was 39,553 tons; therefore less samples were required.
501.25, Concrete Class B Portland Cement 1 sample required – 0 taken	Original quantity was 6 cy; final quantity was 5.3 cy. Resident Engineer called Rick Hale, Structural Concrete Engineer, at 10 a.m. on June 3, 2000, to request a plant inspector for a 2 p.m. concrete placement on June 4, 1999. Rick said he did not have an inspector available. This was the only concrete placement on this project. Results of air and slump tests as well as cylinder breaks were all within specifications.

Certifications

Pay Item No.	Justification For Use Without Certification
616.35, Treated Timber Curb	This item was not used.
649.51, Geotextile for Silt fence	Under the provisions of Section 700.01, the certification of this item is waived. The cost of this item was less than \$2,000 and its use did not directly involve the safety of the roadway.

APPENDIX B

Example 23CFR 637 Certificate



State of Vermont
Materials & Research Lab
National Life Dr. Drawer 33
Montpelier, VT 05633
www.aot.state.vt.us

[phone] 802-828-2561
[fax] 802-828-2792
[ttd] 800-253-0191

Agency of Transportation

TO: Ernie Blais, FHWA Division Administrator, Vermont Division
FROM: William Ahearn, P.E., Materials and Research Engineer
DATE: January 15, 2009
PROJECT: **Richmond IM 089-2(38)**
SUBJECT: LEVEL 1 – 23CFR 637 CERTIFICATE

This is to certify that:

The results of the tests used in the acceptance program indicate that the materials incorporated in the construction work, and the construction operations controlled by sampling and testing, were in conformity with the approved plans and specifications.

- Exceptions to the plans and specifications are explained on the attached sheet
- There are no exceptions to the plans and specifications.

WEA:CFR

Cc Financial Services
David Hoyne, Construction Engineer
Eric Fontana, Finals Eng.
Name, Regional Construction Engineer
Name, Resident Engineer
Project File



DATE: January 15, 2009

Attachment page 1 of 1

Project:

Exceptions to plans and specifications as stated by the Resident Engineer except where noted.

Description of Exception	Determination of Investigation
204.30 Granular Backfill for Structures; 497.5 CY installed, 0 tests performed.	Written Order #2 was issued allowing the use of Dense Graded Crushed Stone in place of Granular Backfill for Structures and waived the compaction testing however the material was placed and compacted as required. The Regional Soils Technician was not available to sample the material for gradation and based on the compaction and the inspection of the installation, the material placed is suitable for its intended purpose.