

SAN FRANCISCO-OAKLAND BAY BRIDGE SKYWAY PROJECT



FEDERAL AID PROJECT ACIM-080-1 (085) 8N
CALTRANS CONTRACT 04-012024, EAST SPAN SEISMIC SAFETY PROJECT
BRIDGE No. 34-0006L/R, PIER E5W

QUALITY ASSURANCE - QUALITY CONTROL PROCESS REVIEW

ROY TEAL INC.

METALS CONSULTANT

Quality Assurance - Quality Control Process Review
San Francisco-Oakland Bay Bridge
Skyway Project

Federal Aid Project ACIM-080-1 (085) 8N
CALTRANS Contract 04-012024, East Span Seismic Safety Project
Bridge No. 34-0006L/R, Pier E5W

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QA/QC Process Review

San Francisco-Oakland Bay Bridge Skyway Project

Federal Aid Project ACIM-080-1 (085) 8N
Caltrans Contract 04-012024, East Span Seismic Safety Project
Bridge No. 34-0006L/R, Pier E5W

BACKGROUND:

Each pier foundation typically consists of six (6) battered steel pile shells, each surrounded by a steel pile sleeve within the pier footing box^{1&2}. The steel pile head connection plates are inserted into vertical slots in the pile shell and pile sleeve³ at eight locations per pile⁴. Partial joint penetration (PJP) welds join the vertical pile head connection plates on both sides to the pile sleeve and the pile shell⁵ totaling 32 PJP's per pile, each with a nominal weld size of 35 mm⁶, based on a Contract Change Order (CCO). Joint preparation was such that the PJP welds were made from within the pile and from outside the pile sleeve. Base metal for the pile sleeve and for the pile head connection plates is reported to be ASTM A709, Grade 345 (50). Welding was reportedly done using the FCAW-G weld process with a 90/10 mixture of Argon/CO₂ shielding gas. Access to the far side of the PJP welds is extremely restricted. The annular space between the outside of the pile shell and the inside of the pile sleeve ranges between 100 mm and 250 mm.



Pier E5W

Initially, certain welders alleged that they were instructed by the Contractor to deliberately hide weld defects from the inspectors by covering them with weld metal in certain partial joint penetration (PJP) welds joining the pile head connection plates to the pile sleeves. Two locations, 3G and 5D, in Pier E4W were alleged to contain inferior quality welds and were sampled, plus a baseline sample was randomly selected to be taken at location 2B. Welds joining the pile head connection plate to the pile shell were not alleged to be inferior quality, and were not evaluated. Reportedly the Contractor was ordered to stop work until the allegations were resolved.

¹ See Attachment 1, Foundation Box Plan, Sect. A-A

² See Attachment 2, Pile and Pile Sleeve Plan, Sect. C-C

³ See Attachment 3, Pile Head Connection Plate Slot Detail

⁴ See Attachment 4, Typical Pile Head Connection Plate Location Plan

⁵ See Attachment 5, Pile Head Connection Detail

⁶ See Attachment 6, CCO 50, PJP Weld Detail

The Federal Highway Administration (FHWA) contracted with John W. Fisher and Associates, Inc., Engineering Consultant; Mayes Testing Engineers, Inc.; and Roy Teal Inc. (RTI) to perform an independent testing and evaluation of certain predefined weld locations at Pier E4W of the San-Francisco-Oakland Bay Bridge Skyway project. The consensus of the independent investigations was that the welds sampled and tested were in general conformance with the contract documents, and that there was no evidence of major or unacceptable discontinuities, including porosity or fusion type discontinuities, in any of the weldments inspected.

In addition to the independent evaluation described above, the initial scope of work included an independent review of the quality assurance/quality control welding inspection process at Pier E5W by Roy Teal, Inc. as described below.

SCOPE OF WORK:

Roy Teal, Inc. has been contracted by the Federal Highway Administration (FHWA) to perform an independent process review and evaluation to determine the adequacy of quality assurance (QA) and quality control (QC) procedures and processes for the welding inspection of the pile head connection plates at Pier E5W of the San-Francisco-Oakland Bay Bridge Skyway project, to include work by:

- The California Department of Transportation (Caltrans) quality assurance
- Caltrans third party quality assurance representatives
- The Contractor and personnel for work done at Pier E5W
- Quality control personnel representing the Contractor.

In preparation for this assignment, interviews were conducted with both the owner's and the contractor's personnel, some with positions key to the QA/QC process and some selected at random; certain documents were selected at random for review; and observations were made as the various personnel performed their assigned duties. A list of acronyms used extensively by project personnel and in this report is included for general information. Digital still photography was used to document findings as deemed necessary.

This work is a continuation of independent testing and evaluation of certain predefined weld locations at Pier E4W at the above project site by Roy Teal, Inc. as described in a document entitled *Scope of Work and Services for Independent Testing at SFOBB – Skyway*⁷ dated April 13, 2005 @ 12:32 pm, and as redefined in an April 19, 2005 meeting held at the jobsite.

⁷ See Attachment 7, Scope of Work and Services

Definitions of Acronyms Commonly Used at the SFOBB Skyway Project	
AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BS	Caltrans Branch Senior
Caltrans	State of California Department of Transportation
CMTR	Certified Mill Test Report
COC	Certificate of Compliance
CWI	AWS Certified Welding Inspector
CWII	Critical Weld Inspections, Inc.
CWR	Critical Weld Repair
DCEP	DC Current, Electrode Positive (DC Reverse)
FCAW-G	Flux Cored Arc Welding-External Gas Shielded
FHWA	Federal Highway Administration
FSR	Caltrans Foundation Structure Representative
ISI	Inspection Services, Inc.
KFM	Kiewit, FCI, Manson, a JV
MACTEC	MACTEC Engineering and Consulting, Inc.
METS	Caltrans Division of Materials Engineering and Testing Services
MT	Dry Powder Magnetic Particle Testing
NCR	Nonconformance Report
NDT	Nondestructive Testing
OSM	METS Office of Structural Materials
PJP	Partial Joint Penetration Weld
PMIV	Project Management by Integral Vision Software
PQR	Welding Procedure Qualification Record
PT	Liquid Penetrant Testing
QA	Quality Assurance
QA LI	MACTEC Lead Inspector
QA TL	MACTEC Task Leader
QASI	OSM Quality Assurance and Source Inspection
QC	Quality Control
QCP	KFM Quality Control Plan
RE	Caltrans Resident Engineer
RFI	Request For Information
RT	Radiographic Testing
RTI	Roy Teal, Inc.
SFOBB	San Francisco-Oakland Bay Bridge
SMAW	Shielded Metal Arc Welding
SMR	Caltrans Structural Material Representative
TS	Travel Speed
UT	Ultrasonic Testing
VT	Visual Inspection
WPQR	Welding Procedure Qualification Record
WPS	Welding Procedure Specification
WQCP	KFM Welding Quality Control Plan

OBSERVATIONS: Quality Assurance

Quality assurance at the San Francisco-Oakland Bay Bridge is the responsibility of the State of California Department of Transportation (Caltrans), Division of Materials Engineering and Testing Services⁸, with the following persons representing the State's interest:

- Philip J. Stolarski, PE, Chief, Division of Materials Engineering and Testing Services (METS), Sacramento
- Daniel Speer, Supervising Bridge Engineer, METS Office of Structural Materials (OSM), Sacramento
- Keith Hoffman, Branch Senior, METS OSM Quality Assurance & Source Inspection (QASI), Vallejo
- * Peter Siegenthaler, District 4 Principal Transportation Engineer, SFOBB
- * Douglas Coe, Supervising Engineer, Resident Engineer, Bridge Representative, SFOBB
- Mark Woods, Senior Bridge Engineer, Foundation Structure Representative (FSR), SFOBB
 - * Included in Caltrans chain of command, but not directly involved in routine, daily QA functions.

Caltrans contracts with MACTEC Engineering and Consulting, Inc. (MACTEC) to provide routine quality assurance at the SFOBB. MACTEC also provides Level II and Level III PT, MT, UT and RT services under contract to the State. MACTEC personnel appear to work seamlessly with Caltrans personnel to complete their respective QA responsibilities, with supervisory personnel offices located in the same building with Caltrans in Vallejo, CA. MACTEC provided an organization chart entitled *Caltrans Materials Inspection*⁹ that does not differentiate between Caltrans and MACTEC employees. MACTEC personnel with responsibility for quality assurance at the SFOBB Skyway project at the time of this process review include:

- James Merrill, Vice President, Senior Principal Engineer, Project Manager, San Diego
- Venkatesh Iyer, Principal Materials and Structural Engineer, Vallejo (assumes the role of Caltrans Project Structural Material Representative (SMR) for the SFOBB.
- Eric Hobson, Bay Area Manager, Senior Professional, Vallejo
- John Kinsey, Principal Scientist, Senior Level III NDT, Vallejo
- Robert Mertz, Senior Task Leader, Vallejo (assumes the role of Caltrans Office Inspector, and provides direct on-site supervision of QA personnel)
- William Levell, On-site QA Supervisor

⁸ See Attachment 8, Caltrans Organization Chart

⁹ See Attachment 9, MACTEC Organization Chart

The California Department of Transportation (Caltrans), Material Engineering and Testing Services (METS), Division of Engineering Services, publishes an *Office of Structural Materials Practices and Procedures Manual (OSMPP)*, last updated in April 2005. A summary of changes is issued with each update. This document serves as the basis for quality assurance functions for all work done in and for the State of California. Since the OSMPP does not include provisions for education, training and experience of QA personnel, Caltrans has approved a document prepared by MACTEC entitled *Written Practice for the Qualification & Certification of Nondestructive Testing Personnel Assigned to Quality Assurance and Source Inspection, Nondestructive Testing Procedure WP-002* dated 22 January, 2003, which describes minimum qualification, training and experience for nondestructive testing personnel. MACTEC maintains a document entitled *Nondestructive Examination Procedure for Personnel Qualification and Certification, Revision 7* dated January 8, 2003, which describes minimum qualification, training and experience for nondestructive testing personnel, including visual testing (VT). Based on interviews conducted with members of Caltrans/MACTEC personnel, all persons were aware of the OSMPP, had access to the document and appeared to be well informed of its contents. Personnel appeared to have a very positive attitude about their role as QA representatives, seemed to have pride in their well versed knowledge of codes and specifications, and were aware of the very structured quality goals.

MACTEC maintains a spreadsheet summarizing the technicians assigned to the SFOBB project¹⁰ that includes individual certification for the test method, certification level, certification number, renewal frequency and expiration date. Based on the documented certification¹¹ and observation of the QA personnel during performance of their duties, it is reasonable to conclude that these persons are qualified for the performance of their assigned duties. All QA personnel interviewed were familiar with the designated codes and specifications. It was interesting to note a somewhat unique training tool...MACTEC regularly conducts written quizzes, given at each inspection meeting held every two weeks, that include questions about the codes; specifications; and updates and modifications to the contract documents. Although these quizzes are not graded, they are reviewed and discussed upon completion.

General project quality requirements are determined by the contract documents, including designated codes and specifications. Quality requirements for all work not specified in the contract documents such as repairs also appear to be specified in accordance with designated codes and specifications.

The quality assurance needs and schedule are established by the FSR based on a 5 week look-ahead schedule provided by the Contractor and maintained and updated as necessary from the actual construction schedule. This schedule is provided to the SMR for distribution and scheduling of QA personnel. The SMR provides a six month schedule to task leaders. The five week look-ahead schedule is also maintained and updated weekly by the SMR. A week-in-advance schedule is maintained by the SMR's staff that both schedules and tracks every inspector's assignment on a daily basis. A weekly owners meeting is also held to discuss the project, but does not necessarily discuss QA issues. Multiple methods are used to communicate

¹⁰ See Attachment 10, Current QA Certifications

¹¹ See Attachment 11, Sample QA Technician Certification Selected at Random

quality requirements to subordinates, including weekly task leader meetings¹² and biweekly QA personnel meetings. These meetings include job site issues and occasionally multi-contractor issues. There appears to be a consensus that adequate instruction is provided for technicians to perform their required duties. QA at all levels has a general complaint that the contractor's project superintendent does not provide sufficient notification of the need for QA, or modifications to the schedule, and constantly revises the schedule. QA claims to accommodate the schedule revisions on short term notice, but sometimes with difficulty.

QA supervision appears to be adequate. The on-site inspector is mandated to follow the chain of command, with all communications thru the on-site lead inspector to the task leader, SMR and FSR for resolution.

A library of current codes, specifications and contract documents is maintained in the FSR office and in Caltrans and MACTEC offices in Vallejo. Codes and specifications are obtainable on-site by request, if necessary. Each inspector has a copy of the AASHTO/AWS D1.1 Structural Welding Code-Steel and D1.5 Bridge Welding Code, plus Caltrans specifications. The Caltrans library is available to MACTEC. The lead inspector maintains a complete set of contract drawings and specifications both in the on-site office and electronically. Access to all contract documents, both hard copy and electronic, is provided in the Caltrans field office. Notification of revisions is provided by e-mail and hard copy from the SMR.

Revisions to the contract documents occur thru change order. The FSR forwards change orders to the SMR, and informs Caltrans staff. The SMR is responsible to inform the QA staff. There is an unwritten policy to either destroy the outdated document, or to mark it superseded. However, treatment of obsolete drawings is at the discretion of the staff member receiving the updated version.

Acceptance and rejection of fabricated products received at the jobsite is the responsibility of the Resident Engineer (RE), or the FSR on behalf of the RE. METS is responsible for in-process shop inspection and acceptance at the fabrication shop or suppliers plant. Release of fabricated products from suppliers is controlled by procedures described in the OSMPP that include a tagging system, whereby the shop inspector places a green tag¹³ on stock products or accepted products when shipping from fabricator to fabricator for continuation of work, or an orange tag when shipping accepted products from the fabricator to the jobsite¹⁴. Materials in lots are tagged and stamped on the packing lists. Major fabricated steel components are received with appropriate tags from the in-process inspection, along with die stamped identification. Copies of release forms, Certificates of Compliance, etc. are sent to the jobsite by the inspection agency, and emailed to the FSR with original forms filed by MACTEC. There does not appear to be any routine verification of acceptance of fabricated products when received on the job-site by QA, other than random inspection for damage of fabricated products.

¹² See Attachment 12, Typical Scheduling Meetings

¹³ See Attachment 13, Sample Green Tag

¹⁴ See Attachment 14, Sample Orange Tag

Certificates of Compliance (COC)¹⁵ for all welding within a given pier footing box are submitted by the contractor to the FSR and SMR at the completion of that pier footing box. This documentation is reviewed by the FSR, SMR and staff. Certified Material Test Reports (CMTR's) are submitted separately in a COC for fabricated products¹⁶, welding consumables, etc. Initially, 100% of CMTR's were reviewed, and is now reduced to at least 50%. The Special Provisions of the contract documents provide direction for submittal and review of these documents. COC's and CMTR's receive a final review and are kept on file at the Transportation Laboratory in Sacramento.

Individual welder/welding operator qualification is witnessed by METS, and records are readily available to QA. QA personnel appear to be aware of the contract requirements for qualification of welding procedures, welders and welding operators, including AWS specifications, and apply that knowledge in performance of their duties. Based on interview, the lead inspector routinely witnesses most welders qualified by test, although some welders are tested at the Carpenter Training Center. Welder/welding operator certification is reviewed and records, including approval and limitations, are maintained at the jobsite by QA. Individual welder or welding operator certification documentation (i.e., a certification card with work record) is not issued. METS witnesses supplemental tests and a lot number is issued. METS then reviews and approves tests, and issues a Caltrans letter as appropriate.¹⁷ A master welder qualification and inspector list is maintained by the FSR¹⁸ and by the Contractor, available to QA.

MACTEC witnesses welding procedure qualification (PQR) tests on behalf of Caltrans. After testing and approval of the PQR, welding procedure specifications (WPS's) are prepared by the contractor and submitted for approval. WPS's are routinely reviewed by the QA task leader, with a second level review done by the lead inspector at the jobsite. QA verifies appropriateness of the WPS for the work. After verification that the WPS is based on an approved PQR, including heat input, it is recommended to the SMR and FSR for use in the work. The FSR then reviews and approves tests, and issues a Caltrans letter as appropriate.¹⁹ The supporting PQR is on file in the field office and METS office. METS maintains a list of approved WPS's, including locations where specific WPS's were used in the work.²⁰ WPS's are typically posted on power supplies or adjacent boards/walls, or at the top of the footing box, except that WPS's for critical weld repairs are posted inside the box. WPS's are readily available to the welder and to QA. Welders have the ability to adjust welding parameters within the limits of the WPS.

QA does random visual and photographic verification of welding consumables in the field as part of the daily report. The inspector physically checks identification on packaging, checks gas regulators, mixture and flow. Use and operation of consumable ovens are verified on a random basis with violations included in the inspector's daily report. Generally, all electrodes not used within the specified time after removal from the ovens are discarded, and not rebaked. Handling of SMAW electrodes appears to conform to AWS specifications.

¹⁵ See Attachment 15, Sample Certificate of Compliance, Pier E8W Pile 1 Only

¹⁶ See Attachment 16, Sample KFM Certificate of Compliance for Fabricated Products, Pier E8W

¹⁷ See Attachment 17, Typical Welder/Welder Operator Certification Documents

¹⁸ See Attachment 18, Typical QA List of Certified Welders

¹⁹ See Attachment 19, Typical WPS-WPQR Documents

²⁰ See Attachment 20, QA Log of Approved WPS's

The QA inspector is typically assigned to one specific site for any given day. In general, the Contractor assigns about ten welders to work on six piles at a given pier footing box. An enhanced QA policy²¹ was initiated by Caltrans letter of May 17, 2005 and approved by FHWA letter of May 19, 2005, to be applied to the remainder of the SFOBB foundation welding. Since initiation of the enhanced QA policy, three QA personnel are assigned to a pier footing box consisting of 6 piles, supervised by the lead inspector. Specific pile assignments are split between QA inspectors, with each inspector generally responsible for two piles. The enhanced policy requires that the QA inspector provide photographic documentation, including date and location, of every root pass, selected middle fill pass layers and cap passes, and each defect, including the completed repair excavation prior to rewelding demonstrating the complete removal of the associated defect and the means of identifying positive removal of the defect by the appropriate nondestructive testing method; documentation of the depth and length of all weld repair excavations; photographic documentation of the amp-probe gauge while reading amps or volts, to be included in the daily inspection report; verification and recording of the actual WPS parameters for each welder at least one time per shift along with a description of the weld pass or area of the joint being welded in a newly created WPS verification report. Prior to the enhanced QA procedures, QA responsibility included verification of welder/welding operator certification; verification that welders are conforming to the WPS, as posted at the work station (pier footing box attendant's station or in pile), including preheat, amperage, voltage and gas flow; reviews the activities of QC to verify that they are performing their required functions; and witnesses MT done by QC. MT inspection was done by QA for buttering of sleeves; 10% to 100% of root passes; 10% of the length of the intermediate weld passes; repaired areas, and cover passes. METS maintains lists of QA and QC personnel assigned to specific pier locations.²²

Welds are traceable to the welder/welding operator that welded them. Each welder has their initials marked at the weld site with paint marker, traceable to a QA document. QA verifies that the contractor maintains records, including welder location maps, weld joint fit up, welding parameters and NDT for welds that they have observed. METS maintains an inspection record for each pile at each pier, and summarizes these records in tabular form.²³

Weld repair procedures are defined by the OSMPP and the contractor's WQCP. Typical non-critical defects, including additional weld metal to compensate for insufficient weld size or underfill; and excavations limited to 65% of the specified weld size or throat to repair unacceptable undercut and unacceptable surface or edge discontinuities, found by QC during routine inspection of each pass are documented, repaired prior to welding subsequent passes, and reported in the inspector's daily inspection report. Critical Weld Repairs (CWR) are considered to be all repairs not described in the Contractor's WQCP as non-critical weld repairs, and require specific approval for each repair. CWR's are evaluated by visual inspection and NDT, and a CWR report is written by the contractor and submitted to the SMR and FSR for resolution. The SMR, after solicitation of input from designers or other experts as necessary to determine fitness for repair, testing requirements, etc., may recommend approval, but does not approve the

²¹ See Attachment 21, Enhanced QA Documentation

²² See Attachment 22, Typical METS List of QA/QC Personnel

²³ See Attachment 23, Typical METS Inspection Records

proposed repair procedure. The recommendation is forwarded to the FSR for response from Caltrans. Resolution is by letter form Caltrans²⁴. METS maintains a submittal log of CWR documents along with their status.²⁵

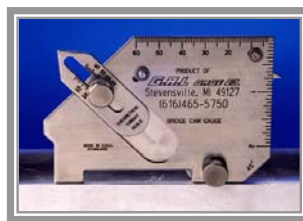
For nonconformance issues, the QA inspector will first contact the lead inspector, and then the task leader, SMR and FSR will be notified. QA does not have the authority to stop nonconforming work. The process in place is to notify the Structures Representative on occasion that QC does not take the action deemed appropriate. The contractor responds to a NCR with a proposal, which may include a proposed procedure for repair or other resolution, to the SMR and FSR. The SMR, after solicitation of input from designers or other experts as necessary to determine fitness for repair, testing requirements, etc., may recommend approval, but does not approve the proposed repair procedure. The recommendation is forwarded to the FSR for response from Caltrans. Resolution is by letter form Caltrans. A typical NCR Report, prepared by QA, is attached which describes two nonconformance occasions. The Contractor responded with a resolution which included additional training for supervisory and QA personnel, which satisfied Caltrans requirements.²⁶ The FSR maintains a spreadsheet to track NCR's and their resolution.²⁷

Requests for Information (RFI) are handled by a formal procedure. The Contractor submits detailed requests in writing to the FSR. The RFI is reviewed with the assistance of the SMR as necessary, and responds in writing. The FSR maintains an RFI Log to track the RFI's and their resolution.²⁸

QA reviews weld joint fit up only after QC inspection, and keeps a log that documents bevel depths and joint buttering. Information is gathered from a log maintained by QC or the welder or from the wall adjacent to the weld joint that includes the welder, weld date and root welding process (SMAW or FCAW). QC maintains a hard copy of this information. Each CWI is issued sufficient equipment to perform the assigned duties. The list includes a flashlight, steel ruler, 10' and 25' tapes, fillet weld gauges, bridge cam gauge, root gap gauge, picks, heat indicating crayons, magnifying glass, digital camera, Fluke Model 336 Clamp Meter and laptop computer.



Fillet Weld Gauges



Bridge Cam Gauge



Fluke Model 336 Clamp Meter

²⁴ See Attachment 24, Typical CWR with Resolution

²⁵ See Attachment 25, Typical CWR Log and Pier E5W CWR

²⁶ See Attachment 26, Typical TL-15 Nonconformance Report with Resolution

²⁷ See Attachment 27, Typical PMIV NCR Tracking Sheet and Submittal Log with Resolution

²⁸ See Attachment 28, Typical RFI with Resolution



**Model B-100
AC Parker Probe**

Each NDT inspector selects equipment from a pool, including a B-100 or DA-400 Parker Probe for MT and Krautkramer-Branson USN 52 R or L for UT. Maintenance and calibration of NDT equipment is the responsibility of the SMR's staff in Vallejo. Stickers on the equipment document the last calibration.



**Model DA-400
AC/DC Parker Probe**

The OSMPP provides direction for creating various reports. CWI's records are kept in a bound or spiral bound notebook, and then transferred to an electronic daily report at the discretion of the inspector. QA Daily Reports (TL-6031)²⁹ and Nonconformance Reports (NCR) [TL-15] are written by the inspecting CWI in cooperation with the lead inspector. The daily reports are reviewed by the task leader and then issued to the structures representative, resident engineer, branch senior and SMR. The FSR and SMR are typically notified verbally by phone and in writing by e-mail of daily reports containing nonconforming issues or nonconformance reports. Based on interview, all QA files are submitted electronically, with hard copy following.

On-site document control is provided by scanning and uploading documents to a database in the server via *Project Management by Integral Vision Software* (PMIV). Every document is assigned an individual PMIV number, referenced by the date of the report, date, footing box number or reference to the report subject, inspector's name, CWI name and QC name. After uploading to the server, QA documents are reviewed by the lead inspector, who signs the report as a 2nd signature. Depending on the contents of the report, it may be forwarded to a higher level for the necessary action. Both the SMR and FSR receive copies of all reports. Document retrieval of specific reports is both difficult and uncertain using the PMIV system.

- A log of contract drawings and specifications is intended to be maintained in the PMIV Plan Sheet library. It was found that the latest version of the contract documents is not on the PMIV, but a current set is available in the server. The old version is removed from the master set when updated.
- A typical NCR report was selected at random. This report was initially e-mailed from METS to the FSR for resolution. A search was launched in PMIV. It was found that no PMIV number had been issued to date, and that the document had not been uploaded to the server as of June 7th, nearly four months after issuance of the report. Based on hard copy files and use of the spreadsheet maintained by the FSR, the NCR report was found to have been resolved by the FSR by letter 5.03.1-006999 on February 28th, with a reply by KFM letter 1173, and approved by Caltrans letter 5.03.1-007396, as documented in previous Attachment 26.

²⁹ See Attachment 29, Typical TL-6031 QA Daily Report

- A routine report was requested at random. After approximately 15 minutes, the FSR could not produce the specific requested report. The FSR commented that their normal procedure is to contact the task leader, lead inspector or a specific inspector for a copy of the report. As an example, UT report 15 & 16E (an informational report on a weld in a pile head connection plate) was requested. The FSR called the task leader that performed the review and left a message. A phone response was received approximately 3 hours later and a faxed copy was received shortly thereafter.
- Electronic files are kept on the server and in a PC spreadsheet by individuals to provide for their own search based on the perceived difficulty using the PMIV system.

OBSERVATIONS: Quality Control

Quality control at the San Francisco-Oakland Bay Bridge is the responsibility of the general contractor, Kiewit, FCI, Manson, a JV (KFM), with the following persons representing their interest:

- * Thomas Skoro, Project Director
 - ** Lee Zink, Construction Manager
 - Scott Thompson, Supervising Quality Control Manager
 - Richard Bienek, Welding Quality Control Manager, Welding and Fabrication Operations
 - Dennis Winter, Lead CWI, Pile Splice
 - David Riggs, On-site QC Supervisor, Inspection Services, Inc.
- * Included in KFM chain of command, but not directly involved in routine, daily QA functions.
- ** Included in KFM Production Chain of Command with no involvement with QC functions.

KFM employs two CWI's in a supervisory capacity for visual inspection only. All other QC personnel, including certified Level II and III NDT personnel, are provided under contract with Inspection Services, Inc. (ISI) for work on this project, as approved in the contractor's quality control plan (QCP).

KFM has a commitment to quality on this project, based on a written policy statement included in their *Skyway Project Quality Management Program*³⁰, the Welding Quality Control Plan (WQCP) and observation. QC functions are completely separate from other management functions. The approved WQCP includes an organizational chart for KFM personnel in Section D³¹ and an organizational chart for ISI personnel in Section B³². Job descriptions are defined in the WQCP; education, training and experience requirements are as described in ASNT-TC1A. Two independent companies, Inspection Services, Inc. (ISI) and Critical Weld Inspections, Inc.

³⁰ See Attachment 30, KFM Quality Policy Statement

³¹ See Attachment 31, KFM QC Organizational Chart

³² See Attachment 32, ISI QC Organizational Chart

(CWII) provide the necessary training and updates for QC personnel. The QC inspectors report directly to the ISI lead CWI for all tasks, including scheduling. The on-site QC inspector is mandated to follow the chain of command with all communications thru the on-site QC Supervisor to the QC Manager. Those persons reviewed were qualified by certification to perform their assigned duties. QC managers and personnel are not responsible to production management, except at the executive level; and production management does not have direct influence on day to day QC operations, other than to request QC services as necessary. QC personnel appear to have a competent knowledge of requirements for welding consumables and qualification requirements for welders and welding operators, are conversant with AWS specifications for welding, and apply that knowledge in performance of their duties. QC supervision appears to be adequate.

Quality requirements are reviewed for all work prior to beginning the task. Both QC and production management personnel perform the quality review. The line supervisor is responsible for reviewing project specifications and putting together a quality request for routine needs such as visual inspection or MT as part of operations planning, whereas QC supervision is responsible for assuring the quality control program is put together properly, including assuring that qualified personnel provide the proper QC inspection method for the work assigned. QC personnel are allocated for the work based on the Welding Quality Control Plan (WQCP).

A library of contract documents, codes and specifications is maintained in the QC field office. QC also has access to complete sets of contract documents in the QA office. Quality requirements, quality issues and current events are routinely discussed with all QC personnel at meetings held the first Monday of each month. Otherwise, it is the QC supervisor's responsibility to update QC personnel as necessary. New KFM employees are required to participate in orientation meetings that include discussions on quality requirements. The Quality Control Manager for Welding Operations is responsible to obtain other QC expertise when necessary for special applications.

The production management staff is responsible for creating requests for information (RFI), with exception of an occasional QC RFI. It is understood on this project that the process is to send RFI's to the owner for a response. Generally the issues are discussed with the Engineer, and a verbal response is returned. In-house meetings are often held with the owner and their designer and RFI's are routinely handled informally, without written response. When necessary, the contractor generally hires Matthew Nousak of Middough Consulting, Inc. or other consultants with expertise relative to the specific needs.

A listing of all plan sheets, including all revisions, is maintained. Revised contract documents are distributed to key personnel as necessary. A representative of Contract Administration distributes revisions to all plan holders on the jobsite. There is no set way for treatment of superseded drawings. Individual plan holders may choose to keep obsolete drawings or discard them.

Fabricated products are accepted based on in-process shop inspection provided by the State. METS releases all fabricated products, with exception of welding consumables. QC has responsibility only to review the tags on incoming fabricated products and inspect for damage.

All received CMTR's, COC's and other certification documents are reviewed and kept on file for submittal of the COC at the completion of work for each pier footing box.

The contractor has an on-site welding engineer that appears to be competent based on observation. The contractor generally hires Matthew Nousak of Middough Consulting, Inc. when there is a need for a welding consultant.

Every welder is qualified for SMAW and every welding operator is qualified for FCAW in the 3G position (vertical groove). Some welders performing critical weld repairs are qualified for SMAW in the 2G (horizontal groove) or 4G (overhead groove) position. All tacking is done by certified welders; hence, no tacker qualification certification is necessary. Random welder/welding operator certification documentation was reviewed. The certification documents for two persons selected at random are attached.³³ It is interesting to note that QC generated an interoffice memo for one of the persons selected which questions the welder's abilities, and recommends retesting. Based on both the Contractor's records and QA records, as shown in Attachment 18, this person was never retested but the certification was carried forward based on the Contractor's records. Otherwise, welding and welding operator certifications appear to be current. A master list of currently qualified welders and welding operators, along with a welder/welding operator ID log, is maintained by the Contractor,³⁴ and available to QA. Individual welder or welding operator certification documentation (i.e., a certification card with work record) is not issued. METS witnesses supplemental tests and a lot number is issued. METS then reviews and approves tests, and issues a Caltrans letter as appropriate.

A five week schedule is created by project supervision based on the job schedule, which is updated weekly based on project needs. Welders rotate work locations as necessary. QC personnel are currently assigned to specific locations at a rate of two welders per VT inspector to document the work of the welder. The QC inspector is typically assigned to one specific site for any given day, is assigned the work of two welders, and inspects every weld pass. In general, the Contractor assigns about ten welders to work on 6 piles at a given pier footing box. QC assigned to the fit-up crew inspects the surface preparation prior to plate installation, verifies weld joint fit-up, inspection of buttering operations and verifies welding parameters. When assigned to the welding crew, QC verifies that the proper WPS is used, verifies joint fit-up, consumables, welding parameters, and preheat, inspects root, intermediate and cover passes and weld terminations. Hold points include root passes, intermediate passes and cover passes and weld discontinuities. An enhanced QC policy³⁵ was initiated by Caltrans letter of May 17, 2005 and approved by FHWA letter of May 19, 2005, to be applied to the remainder of the SFOBB foundation welding. The enhanced policy restated that QC must perform inspection and testing before, during and after welding as specified in Section 8-3 of the Special Provisions and other contract documents; inspect and approve the joint preparation, joint fit-up, assembly practice, welding techniques and performance of each welder, welding operator and tack welder and ensure that the applicable requirements of the contract documents and the approved WPS are met. Enhanced QC procedures include establishment of a production hold point at the

³³ See Attachment 33, Welder/Welding Operator Certification Documents

³⁴ See Attachment 34, Welder Certification List

³⁵ See Attachment 35, Enhanced QC Policy

completion of each pass to insure 100 percent visual inspection (VT) of all passes; ensure current WPS's and revisions are posted in the immediate work area; photographic documentation, including date and specific work location of every root pass, selected middle fill pass layer and cap passes; photographic documentation of each defect and completed repair excavation prior to rewelding, demonstrating the complete removal of the associated defect and the means of identifying positive removal of the defect by the appropriate non-destructive testing method; documentation of the depth and length of all weld repair excavations; and measurement and recording of the actual welding parameters for each welder/welding operator or welding station a minimum of four times per eight-hour shift. Based on observation at Pier E5W, the QC inspectors work conforms to the requirements of the enhanced policy. QC personnel have absolute authority to stop work when necessary for critical weld repairs and nonconformance issues by immediately informing the foreman. Generally, these issues are discussed with the FSR, QA and a CWR is prepared by the QC Manager, submitted to the FSR and SMR for resolution and authority to proceed. Work is resumed on verbal authority or informal e-mail, but is not halted for receipt of the official written document. KFM commented that they have a good working relationship with Caltrans for the benefit of the project.

SMAW consumables are received in hermetically sealed containers, and FCAW electrodes are received in unopened packages. All consumables are stored at the dock in a warehouse initially, and moved to a container on the barge as necessary. Welding ovens are located in the on-barge storage containers. H4R electrodes are transferred to the ovens as necessary. The ovens have an electrode sign out sheet which is monitored by the QC inspector. QC inspectors typically remove SMAW electrodes and distribute them to the welders as needed. The inspector verifies that the oven temperature is set at 250 degrees F. Once SMAW consumables are removed from the oven for use, they are not returned for rebaking. Unused electrodes are discarded. The gas mixture is purchased in bottles and stored in banks on the barge. QC personnel verify that proper consumables are being used on a random basis based on labels on the product, and based on Certificates of Analysis provided by the manufacturers.³⁶ In general, handling of SMAW electrodes appears to conform to AWS specifications.



Welding Gas Mixture Storage

Each CWI is issued a flashlight, a 6" steel ruler, a 25' tape, fillet weld gauges, bridge cam gauge, root gap gauge, pit gauge, picks, stop watch, heat indicating crayons, magnifying glass, mirror, digital camera and a Fluke Model 336 Clamp Meter. CWI's records are kept in a bound notebook, and then transferred to a daily inspection report. ISI inspectors keep their own diaries. The contractor commented that ISI provides all NDT equipment required at the project site. The contractor commented that the frequency of calibrating equipment is included in the QCP. ISI is responsible for calibration as required.

³⁶ See Attachment 36, Consumable Certificates of Analysis

The QC inspector is responsible for completing daily reports, which include the *Daily Visual Inspection Report*³⁷, *Daily Productivity Report*³⁸ and *Report of Magnetic Particle Examination of Welds*³⁹. The daily reports are submitted to the QC Manager, who scans for irregularities and submits to the Caltrans Lead Inspector and FSR weekly. Nonconformance issues included in the daily report require future acceptance by Caltrans. Since QC enhancements procedures have gone into effect, this review is done twice weekly. All reports are filed in a packet specific to that footing location. A Certificate of Compliance (COC) cover page is added to all documents in the binder and submitted to Caltrans for review. When accepted, Caltrans signs a letter of compliance acknowledging acceptance of reports for that specific pier footing box. Generally, verbal acknowledgement is given to continue with the work. QC records are maintained at the jobsite. At my request, the contractor was able to retrieve hard copies of requested documents quite easily.

Welding equipment except the D600 welding machines are provided maintenance when needed by the contractor's maintenance personnel. D600 electric welding machines are rebuilt by the manufacturer when necessary. NDT equipment is maintained by ISI. The contractor uses automatic welding equipment and burning equipment in preparation and welding of the pile head connection plates that is suitable for the intended work. The same tractor and track system is used for both burning and welding equipment, and is interchanged quickly as necessary. The equipment functioned as intended, and appeared to be maintained in excellent condition. When necessary, hand held burning equipment and grinding equipment is used. The equipment functioned as intended, and appeared to be maintained in excellent condition.

The contractor utilizes tower cranes dedicated to each pair (East and West) of piers. In addition, each pier footing box utilizes individual lifts from within, and come-a-longs as necessary. There was no evidence of damage to the work as a result of inadequate handling practices. The contractor maintains each pier footing box in excellent condition.

Construction waste is removed regularly, and each individual work site is cleaned promptly both during and after completion of the work. The air supply appears to be adequate to support all gouging needs. The electrical supply required to power the D600 welding machines is taken from shore, and appears to be adequate to supply all the necessary equipment at the pier footing box.

All work related to pile head connection plate welding receives a final QC inspection and is documented in daily reports as appropriate. A permanent record of all inspection is kept and added to a package that is destined to become a COC submittal at the completion of welding the pile head connection plates at each pier footing box.

Based on general observation and interview of QC personnel at all levels, the quality policy appears to be implemented in accordance with or better than mandated by the WQCP.

³⁷ See Attachment 37, Typical Daily Visual Inspection Report

³⁸ See Attachment 38, Typical Daily Production Report

³⁹ See Attachment 39, Typical Report of Magnetic Particle Examination of Welds

OBSERVATIONS: Welding

RTI witnessed weld joint preparation, welding and MT at various locations within the pier footing box at Pier E5W. WPS FCV-015-R1, approved by Caltrans on January 14, 2004 was used for the witnessed welding, supported by approved PQR FCV-015 (see Attachment 19). The actual welding parameters were compared to the approved WPS for certain weld joints joining the pile head connection plate to the pile sleeve.

Comparison of WPS to Actual Welding Parameters at Pier E5W						
Weld Joint	2D1	1A1	4E2	6G1	6G1	6G1
Location	Root Pass 1	Intermediate Fill Pass 5	Intermediate Fill Pass 11	Intermediate Fill Pass 19	Cover Pass 21	Final Cover Pass 24
WPS No.	FCV-015					
Root Process	FCAW-G, E71T-1M					
Fill Process	FCAW-G, E71T-1M					
Electrode	1.6mm ESAB Dual Shield 70 Ultra Plus E71T-1M					
Shielding	90% Argon/10% CO ²					
Polarity	DCEP	DCEP	DCEP	DCEP	DCEP	DCEP
Welder	V. Ochoa	M. Aguire	T. Peeler	A. Bjeloglavic	A. Bjeloglavic	A. Bjeloglavic
QC	M. Genosick	M. Genosick	A. Coffman	A. Coffman	A. Coffman	A. Coffman
QA	R. Mertz	R. Mertz	R. Mertz	R. Mertz	R. Mertz	R. Mertz
Preheat/Int	>150, < 450 F	>150, < 450 F	>150, < 450 F	225 F	>150, < 450 F	>150, < 450 F
WPS Amps	252 – 308A	270-330A	270-330A	270-330A	270-330A	270-330A
Actual Amps	285A	292A	305A	320A	295A	285A
WPS Volts	22-26V	24.5-26V	24.5-26V	24.5-26V	24.5-26V	24.5-26V
Actual Volts	23V	25.4V	25.3V	24.6V	25.7V	24.8V
WPS TS	10-13 cpm	13.5-16.5 cpm	13.5-16.5 cpm	13.5-16.5 cpm	13.5-16.5 cpm	13.5-16.5 cpm
Actual TS	13 cpm	15.8 cpm	14.5 cpm	14.5 cpm	15.4 cpm	15.4 cpm
Pass Width	NA	18 mm	NA	18.5 mm	20 mm	63 mm overall
VT	Accept	Accept	Accept	Accept	Accept	Accept

The following summarizes RTI observation of the work of the welders, QA and QC at above locations. The weld joint fit up was inspected and the tack welds were tested by MT prior to beginning the weld. Preheat was verified to be at least 150⁰ F. The root pass was welded, cleaned and tested hot by MT. The interpass temperature was maintained between 150⁰ F and 450⁰ F and, after acceptance of the root pass by QC, subsequent intermediate weld passes were completed. The joint was cleaned using hand and power equipment as necessary, and there was a hold at the end of each pass for QC/QA inspection. In general, each weld joint required approximately 24 weld passes to complete. The cover pass was tested by MT immediately at the completion of welding and again after the joint had cooled to ambient temperature. The welding operator’s technique conformed to the requirements of AASHTO/AWS D1.6-96 Bridge Welding Code. QA and QC personnel performed their respective duties as assigned in accordance with the enhanced QA/QC policies. All work witnessed by RTI appeared to conform to the governing plans and specifications.

QA, QC and Welding Operations at Pier E5W, SFOBB Skyway Project



QC Inspecting Joint Fitup Prior to Root Pass, 5E1 & 5E2



**Welding Root Pass
 Pile 5, Joint E2**



**Typical PPJ
 Pile 5, Joint E1**



**MT Root Pass
 Pile 5, Joint E1**



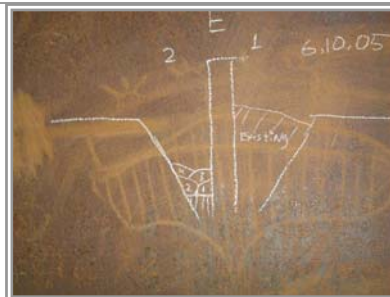
**QC Inspecting PJP Access Area,
 Pile 5, Joint E1**



**QC Inspecting Weld Pass
 Joint 5E1**

ID	EVENT	SETUP	INVT
2	1	1	1
4C	36	31	4-1
4D	37	33	4-1
4E	40	34	4-1

**QC Log of Joint Parameters on
 Pile Wall Adjacent to PJP 4E2**



**Record of Weld Pass Progression
 on Pile Wall, PJP 4E2**

Amps	Volts	TIS	Time
315	25.0	MS	1:02.4
240	25.4		1:06.7
305	20.9	14.0	2:10
300	25.5	12.5	5:10

**QC Record of Weld Parameters
 on Pile Wall, PJP 4E2**

QA, QC and Welding Operations at Pier E5W, SFOBB Skyway Project



Typical Welding Machine Set Up Inside Pile, Joints 3 & 4



WPS Posted on Pile Adjacent to Worksite



QC Monitoring Weld Parameters

	BD	VT-MT	FIT-UP	VT-MT	VT- BUT
	2	1	RAD-BEV	2	1
				T	TACKS
6A	45, 38 40, 36 38, 36 4/1	3-30	4	5	015 4-1 5-11 A1, A2,
6H	39, 38 38, 36 36, 36 4/1	3-30	5	5	015 4-1
6G	37, 37 37, 35 38, 36 4/1	3-30	T	3, 3	015 4-1 G25L

QC Log of Joint Parameters on Pile Wall Adjacent to PJP 6G1



Fill Passes, PJP 6G1



Fill Passes and Transition Radius, Measuring Pass Width, PJP 6G1



FCAW Welding PJP 6G1



Record of Weld Pass Progression on Pile Wall, PJP 6G1 & 6G2



QA Measuring Travel Speed PJP 6G1

QA, QC and Welding Operations at Pier E5W, SFOBB Skyway Project

	BD	VT-MT	FIT-UP	VT-MT
	1	2	1	TACKS
IG	35.40	32.9	2.8	5.3
	35.37	32.9	3	5
	35.37	32.9	5/11	5/11
IH	36.35	4-1	5-12	KC
	38.35	4-1	5	4
	36.35	5/11	5/11	
IA	43.35	3 > 5	5-13	KC
	38.36	4-1		
	40.40	5/11		

WELD VISTOK QC 015 01/00

QC Log of Joint Parameters on Pile Wall, PJP 1A1 & 1A2



Record of Weld Pass Progression on Pile Wall, PJP 1A1 & 1A2



Welding Intermediate FCAW Weld Pass 9, PJP 1A1



Intermediate FCAW Weld Pass 4 PJP 1A2



Measuring Pass Width Pass 9 PJP 1A1



Fill Pass 9 PJP 1A1



Typical Spool of FCAW Electrode ESAB Dual Shield 70 UltraPlus



Typical LN-25 FCAW Wire Feeder



Verifying MT Sensitivity of B-100 Parker Probe with Pie Guage

QA, QC and Welding Operations at Pier E5W, SFOBB Skyway Project



PJP 2D1 Tack Welded in Preparation for Root Pass



Typical Tack Weld PJP 2D1



Typical Joint Preparation PJP 2D2



QC MT Tack Welds PJP 2D1



QC Visual Inspection of PJP 2D1 Prior to Welding Root Pass



Welding Root Pass, PJP 2D1 Timing Travel Speed

QA, QC and Welding Operations at Pier E5W, SFOBB Skyway Project



**QC MT of Root Pass
PJP 2D1**



**MT Final Cover Pass While Hot
PJP 6G1**



**Typical MT of PJP
with Model B-100 Parker Probe**



Pier E5W Foundation Box

RECOMMENDATIONS

Based on interview and observation of all personnel during performance of their assigned duties, I offer the following comments that, in my opinion, would further enhance the QA/QC process and should be implemented on this and future projects:

- Caltrans has approved a document prepared by MACTEC entitled *Written Practice for the Qualification & Certification of Nondestructive Testing Personnel Assigned to Quality Assurance and Source Inspection, Nondestructive Testing Procedure WP-002* dated 22 January, 2003, which describes minimum qualification, training and experience for nondestructive testing personnel to supplement the OSMPP. MACTEC maintains a document entitled *Nondestructive Examination Procedure for Personnel Qualification and Certification, Revision 7* dated January 8, 2003, which describes minimum qualification, training and experience for nondestructive testing personnel, including visual testing (VT). Although these documents are applied to Caltrans work, similar requirements may be better placed within the confines of the OSMPP.
- Welding consumables are received at the jobsite, stored in the warehouse and transferred to the work location as needed. In general, welding consumable handling appears to conform to the contract documents. Based on interview and observation, QA/QC personnel are aware of the requirements for consumables, and may provide random verification of packaging labels. A standardized procedure should be provided for verification and documentation of welding consumables, including electrodes, wire and gas mixture, prior to use in the work.
- When revisions to the contract documents occur, Caltrans and KFM personnel receive updated documentation in the form of revised drawings, procedures or policies, as appropriate. There appears to be an unwritten policy to either destroy the outdated document, or to mark it superceded. However, treatment of obsolete documents is at the discretion of the staff member receiving the updated version. A policy should be implemented to assure that superceded documents are not confused with the updated documents.
- QA at all levels commented that the contractor does not provide sufficient notification of the need for QA inspection, and constantly revises the schedule provided, making it difficult to provide the necessary QA in a timely manner. This complaint should be investigated and resolved as appropriate.
- Random welder/welding operator certification documents were reviewed. A 2003 interoffice memo from QC questions the abilities of one of the welders selected and recommends retesting. Based on both the Contractor's QC records and Caltrans QA records, this person was never retested, but the certification was carried forward and was valid at the time of the process review. Since this person is still employed as a welder/welding operator at the SFOBB Skyway project, and appears to be working and producing weld metal that is acceptable to QC and QA inspectors, the file and certification documents should be reviewed and resolved as deemed appropriate to satisfy the contract documents.

- Caltrans on-site document control is provided by scanning and uploading documents to a database in the server via *Project Management by Integral Vision Software* (PMIV). Every document is assigned an individual PMIV number, referenced by the date of the report, date, footing box number or reference to the report subject, inspector's name, CWI name and QC name. After uploading, Caltrans management and QA personnel are intended to have access to search for any document of their choosing. However, based on sample searches, tracking certain documents from submission to approval was incomplete or not available. In part, this problem may be the delay in uploading documents to the system. Many QA personnel maintain their own spreadsheets to track documents related to their assigned function. Based on the difficulty in producing and tracking sample documents during the interview process, the problems associated with the PMIV document control system should be reviewed with its users, and the system efficiency resolved.

SUMMARY

The first general impression on arrival at the site at the San Francisco-Oakland Bay Bridge Skyway project was that of a professionally well organized effort on the part of the State of California Department of Transportation (Caltrans) and Kiewit, FCI, Manson, a JV (KFM).

Caltrans quality assurance policies are very structured, clear and concise, in terms of published direction to QA personnel, QC personnel and Contractors, and leave little for interpretation by others. The *Office of Structural Materials Practices and Procedures Manual (OSMPP)* is a living document with procedures that provide for updating QA policies on an as needed basis. It includes detailed written descriptions for inspection of various types of work to assure uniformity of the final QA product, and provides standard forms for reporting. Job descriptions are clear. Caltrans contracts with MACTEC Engineering and Consulting, Inc. (MACTEC) to provide routine quality assurance at the SFOBB, including Level II and Level III PT, MT and UT services. MACTEC personnel appear to work seamlessly with Caltrans personnel to complete their respective QA responsibilities, to the point that an organizational chart provided by MACTEC entitled *Caltrans Materials Inspection* does not differentiate between Caltrans and MACTEC employees. All QA personnel possessed current documented certification for their assigned duties and received updates and additional training as required. Routine communication between upper QA management and subordinates appeared to be professional and be well organized. Inspectors were provided with all necessary tools and equipment to perform their assigned functions. Personnel appeared to have a very positive attitude about their role as QA representatives, seemed to have pride in their well versed knowledge of codes and specifications, and were aware of the very structured quality goals.

KFM employs two CWI's in a supervisory capacity for visual inspection only. All other QC personnel, including certified Level II and III NDT personnel, are provided under contract with Inspection Services, Inc. (ISI) for work on this project, as approved in the contractor's Welding Quality Control Plan (WQCP). All QC personnel possessed current documented certification for their assigned duties and received updates and additional training as required. Inspectors were provided with all necessary tools and equipment to perform their assigned functions. Personnel appeared to have a very positive attitude about their role as QC representatives, and seemed to

have pride in their well versed knowledge of codes and specifications. Based on both statement and observation, it is apparent that KFM has a commitment to quality on this project, as evidenced by worksite meetings each morning and prior to beginning a new task to discuss procedures and quality requirements with the work force. The contractor appeared to provide proper, well maintained equipment to complete the work satisfactorily. The worksite was maintained in a clean and orderly manner.

There appeared to be excellent communication and cooperation between Caltrans management/QA staff and the contractor's production staff/QC staff. Inquiries, approval of welding qualifications, nonconformance reports, critical weld repairs and Certificates of Compliance appear to be resolved quickly, without unnecessary delay to the work. Both Caltrans and KFM personnel commented that resolution of these issues was generally handled informally by direct meeting or e-mail initially, and then followed by formal documentation submission and approval.

The workmanship, quality assurance and quality control practices and procedures in place and observed before and after implementation of the enhanced quality assurance/quality control policy are excellent, and certainly appear to meet or exceed the requirements of the contract documents and governing specifications. Both the State of California Department of Transportation (Caltrans) and Kiewit, FCI, Manson, a JV (KFM) should be commended for their well organized approach to project needs; the positive attitude of all personnel; their professional relationship to resolve project related issues; the overall quality and completeness of QA/QC documents; and the overall quality of work at the SFOBB Skyway project.

Based on this quality assurance/quality control process review, workmanship, quality standards and the owner/contractor relationship appear to be excellent, and conform to or exceed the requirements of the contract documents and industry standards.

APPENDIX A

QUALITY ASSURANCE INTERVIEW

The quality assurance process review was conducted based on interviews with key personnel performing various QA functions. A list of standard questions as follows was developed prior to the interviews to maintain consistency throughout the review process.

QA-A. Policy:

Inquiry QA-A1: Is there a written policy statement adequately describing State policy, goals and commitment to quality?

Inquiry QA-A2: Has the statement been disseminated to proper levels of personnel as reflected by their attitude, activities and awareness of quality goals?

QA-B. Organization

Inquiry QA-B1: Is there an organization chart clearly defining the chain of command and positions related to quality assurance?

Inquiry QA-B2: Are positions adequately defined by job descriptions?

Inquiry QA-B3: Does the job description include education, training and experience requirements?

Inquiry QA-B4: Is there evidence that personnel in these positions are qualified for performance of their duties? Qualifications include education, training and certification requirements.

Inquiry QA-B5: Are qualified personnel actively on-site during performance of their duties?

Inquiry QA-B6: Are QA personnel familiar with appropriate codes and specifications?

Inquiry QA-B7: Is there adequate QA supervision?

QA-C. General Quality Assurance Procedures

Inquiry QA-C1: Does management review project quality requirements prior to beginning the work?

Inquiry QA-C2: If yes, at what level is this review done?

Inquiry QA-C3: Does QA management assign or allocate adequate qualified personnel for project activities?

Inquiry QA-C4: Does QA management determine the necessary quality procedures for work not described in the contract documents, including repairs?

Inquiry QA-C5: Are quality requirements particular to the project's needs?

Inquiry QA-C6: Are quality requirements effectively communicated to personnel?

Inquiry QA-C7: Are QA requirements and priorities (construction schedule, sequencing of NDT) reviewed prior to the beginning of work?

Inquiry QA-C8: Is there effective technical support for meeting quality requirements from higher management or from sources outside the jobsite?

Inquiry QA-C9: Is there evidence the goals set in the quality policy have been implemented, communicated and achieved?

Inquiry QA-C10: Is construction progress scheduled and are schedules disseminated to appropriate personnel?

Inquiry QA-C11: Are schedules maintained and current throughout the year?

Inquiry QA-C12: Are QA meetings held on a regular basis to discuss the status of schedules?

Inquiry QA-C13: Are quality issues discussed at regular meetings?

Inquiry QA-C14: Are requests for information documented?

Inquiry QA-C15: Are QA records easily obtainable for review?

Inquiry QA-C16: Are QA records kept on file at the jobsite?

QA-D. Resource Availability

Inquiry QA-D1: Is there an appropriate and adequate library of relevant codes and specifications available to QA personnel, including State DOT Contract documents, including general specifications, plans, contract proposal, and special provisions; AASHTO Material Specifications for Design Specifications for Highway Bridges; appropriate AASHTO/AWS D1.5 Bridge Welding Code; AASHTO/AWS A2.4 Symbols; ASTM specifications based on material used in the work; ASNT-TC-1A documents?

QA-E. On-site Contract Documents

Inquiry QA-E1: Are contract drawings available on-site?

Inquiry QA-E2: Is there a current log of contract drawings and specifications available, including the latest revisions and dispositions?

Inquiry QA-E3: Do available contract documents include the latest revisions?

Inquiry QA-E4: Is there a procedure for the control, distribution and revision of contract drawings to appropriate QA personnel?

Inquiry QA-E5: Are there provisions to assure that obsolete drawings are destroyed or isolated from use at the site?

Inquiry QA-E6: Is there a log of change orders to the contract documents?

Inquiry QA-E7: Are copies of change orders to the contract documents available to QA personnel, including the latest approved?

QA-F. Materials

Inquiry QA-F1: Are procedures in effect to ensure that fabricated products materials received are in accordance with the design drawings and specifications?

Inquiry QA-F2: Are procedures in effect to assure subcontract fabrications are in accordance with contract requirements?

Inquiry QA-F3: Is all other purchased material checked for conformance with the contract documents upon receipt?

Inquiry QA-F4: Are controls set up to assure adequate identification of incoming purchased items?

Inquiry QA-F5: Is a written procedure in place to assure traceability of materials, including grade, heat numbers, and material test reports, etc. as appropriate?

Inquiry QA-F6: Are records maintained to assure traceability of materials, including grade, heat numbers, material test reports, etc. as appropriate?

Inquiry QA-F7: Is material inspected for conformance to ASTM A6?

Inquiry QA-F8: Are manufacturers' Certified Material Test Reports (CMTR's) for metal or other structural components, or Certificates of Compliance for bolts, welding consumables, etc., reviewed for conformance to the contract documents?

Inquiry QA-F9: Are manufacturers' CMTR's or Certificates of Compliance of base metal, welding consumables, etc., kept on file?

Inquiry QA-F10: Is material identity retained during the construction process?

QA-G. Welding

Inquiry QA-G1: Are QA personnel conversant with current qualification provisions of AWS specifications for welding consumables, welders and welding operators?

Inquiry QA-G2: Are QA personnel conversant with current workmanship provisions of AWS specifications for welding?

Inquiry QA-G3: Is the grade of steel to be welded verified?

Inquiry QA-G4: Are welding consumables identified and stored properly?

Inquiry QA-G5: Are welding consumable ovens adequate and operating in accordance with AWS specifications?

Inquiry QA-G6: Is consumable handling in accordance with AWS specifications?

Inquiry QA-G7: Are welders qualified in accordance with AASHTO/ AWS D1.5 specifications?

Inquiry QA-G8: Are welder/welding operator certifications reviewed for appropriate application and position?

Inquiry QA-G9: Are welder/welding operator certifications current?

Inquiry QA-G10: During the QA inspection process, are the welds traceable to the welders who produce them?

Inquiry QA-G11: Have welding procedure qualification tests been reviewed and approved prior to beginning the work?

Inquiry QA-G12: Are approved welding procedure qualification tests in place for the appropriate consumables?

Inquiry QA-G13: Are approved welding procedure qualification tests in place for the appropriate weld joints?

Inquiry QA-G14: Are welding procedure specifications (WPS's) appropriately prepared for each application?

Inquiry QA-G15: Are approved written welding procedure specifications posted conspicuously at each welding site in close proximity to the welders?

Inquiry QA-G16: Are approved written weld procedures used by the welders?

Inquiry QA-G17: Does the frequency of QA inspection conform to the requirements of the appropriate policy?

QA-H. Nonconformance Procedures

Inquiry QA-H1: Is there a functioning, written procedure for disposition of nonconforming material or work in process rejected by QA personnel?

QA-I. Quality Assurance Inspection

Inquiry QA-I1: Does the State have qualified QA inspectors?

Inquiry QA-I2: Is there a functioning program for training QA inspectors?

Inquiry QA-I3: Does the State have at least one Certified Level III NDT administrator in-house or available under contract certified in accordance with ASNT-TC-1A?

Inquiry QA-I4: Does the State's on-site QA department have a welding inspector who holds an AWS CWI certificate?

Inquiry QA-I5: Does the State's on-site QA department have at least one Certified Level II technician certified in accordance with ASNT-TC-1A for the test methods to be used in the work, including PT, MT, UT and RT, either on staff or available from outside sources?

Inquiry QA-I6: Are there procedures for certifying and updating NDT personnel?

Inquiry QA-I7: Does NDT equipment receive periodic inspections, performance or certification?

Inquiry QA-I8: Are welding machines checked to ensure correct amp and volt readings and is a record kept?

Inquiry QA-I9: Does all work receive a final inspection?

Inquiry QA-II0: Is a permanent, written record kept for all inspection?

Inquiry QA-II1: Does Quality Assurance personnel have authority to stop and responsibility to inform the operating supervisor of nonconforming work?

Inquiry QA-II2: Is joint fit-up checked prior to welding?

Inquiry QA-II3: Does each inspector carry adequate tools to perform the required inspections (flashlights, heat indicating crayons, welding gauges, tape, marking equipment, etc.)?

Inquiry QA-II4: Does each inspector keep daily records in a bound diary?

Inquiry QA-II5: Is the following NDT equipment available: RT, including viewing room and viewer, UT, MT, LP?

Inquiry QA-II6: Are there reference standards for periodically calibrating equipment?

Inquiry QA-II7: Are inspection tools calibrated as required to perform the intended use?

QA-J. Documentation

Inquiry QA-J1: Is there a process in place for creating QA documents, including daily reports, nonconformance reports, etc.?

Inquiry QA-J2: Is there a process in place for submittal of QA documents for review and filing?

Inquiry QA-J3: Is there a procedure in place to review QA documents, including welder/welding operator qualification documents, daily jobsite reports, nonconformance reports, final acceptance reports, etc.?

Inquiry QA-J4: Is there a procedure in place for filing QA documents?

Inquiry QA-J5: Are QA documents easily retrieved?

QA-K. QA Comments and Concerns

QUALITY CONTROL INTERVIEW

The quality control process review was conducted based on interviews with key personnel performing various QC functions. A list of standard questions as follows was developed to maintain consistency throughout the review process. All interviews were conducted in the presence of the representing attorneys as they determined necessary. KFM's attorneys, George Niespolo and Stephen Suttro of Duane Morris Attorneys opted to attend a portion of the interview with KFM personnel. ISI's attorney, Ethan Balough, spoke to Roy Teal by telephone and elected to waive attendance during the interview with the QC inspector. Julie Salamon represented the welders, and was present during the interview with a welder.

QC-A. Policy

Inquiry QC-A1: Is there a written policy statement adequately describing the Contractor's policy, goals and commitment to quality?

Inquiry QC-A2: Has the statement been disseminated to proper levels of personnel as reflected by their attitude, activities and awareness of quality goals?

QC-B. Organization

Inquiry QC-B1: Is there an organization chart clearly defining the chain of command and positions related to quality workmanship and quality control?

Inquiry QC-B2: Are positions adequately defined by job descriptions?

Inquiry QC-B3: Does the job description include education, training and experience requirements?

Inquiry QC-B4: Is there evidence that personnel in these positions are qualified for performance of their duties? Qualifications include education, training and certification requirements.

Inquiry QC-B5: Are qualified personnel in these positions on-site and capable of performing their duties?

Inquiry QC-B6: Are QC personnel familiar with appropriate codes and specifications?

Inquiry QC-B7: Is there adequate QA supervision?

Inquiry QC-B8: Are quality control personnel responsible to general production management personnel?

QC-C. General Quality Control Procedures

Inquiry QC-C1: Does management review project quality requirements prior to beginning the work?

Inquiry QC-C2: If yes, at what level is this review done?

Inquiry QC-C3: Does management assign or allocate adequate qualified QC personnel for project activities?

Inquiry QC-C4: Does QC management determine the necessary quality procedures for work not described in the contract documents, including repairs??

Inquiry QC-C5: Are quality requirements effectively communicated to personnel?

Inquiry QC-C6: Are QC requirements and priorities (construction schedule, sequencing of NDT) reviewed prior to the beginning of work?

Inquiry QC-C7: Is there effective technical support for meeting quality requirements from higher management or from sources outside the jobsite?

Inquiry QC-C8: Is there evidence the goals set in the quality policy have been implemented, communicated and achieved or approached?

Inquiry QC-C9: Is construction progress scheduled and are schedules disseminated to appropriate personnel?

Inquiry QC-C10: Are schedules maintained and current throughout the year?

Inquiry QC-C11: Are production and QC meetings held on a regular basis to discuss the status of schedules?

Inquiry QC-C12: Are requests for information (RFI's) documented?

Inquiry QC-C13: Are QC records easily obtainable for review?

Inquiry QC-C14: Are QC records kept on file at the jobsite?

QC-D. Resource Availability

Inquiry QC-D1: Is there an appropriate and adequate library of relevant codes and specifications available to QA personnel, including State DOT Contract documents, including general specifications, plans, contract proposal, and special provisions; AASHTO Material Specifications for Design Specifications for Highway Bridges; AASHTO/AWS D1.5 Bridge Welding Code; AASHTO/AWS A2.4 Symbols; ASTM specifications based on material used in the work; ASNT-TC-1A documents?

QC-E. On-site Contract Documents

Inquiry QC-E1: Does the contractor have in-house design engineers or do they consistently use consultants qualified by registration and experience?

Inquiry QC-E2: Does the company have qualified personnel capable of preparing documents for proposed repair procedures?

Inquiry QC-E3: Is there a procedure for the control, distribution and revision of job specifications to appropriate production and quality control personnel?

Inquiry QC-E4: Are there provisions to assure that obsolete drawings are destroyed or isolated from use at the site??

Inquiry QC-E5: Is there a log of current detail drawings for project components with the latest approval, revisions and dispositions?

Inquiry QC-E6: Is there a log of revisions or modifications to contract documents (contract drawings, special provisions, specifications, material requirements)?

QC-F. Materials

Inquiry QC-F1: Are procedures in effect to ensure that fabricated products received are in accordance with the design drawings and specifications?

Inquiry QC-F2: Are procedures in effect to assure subcontract fabrications are in accordance with contract requirements?

Inquiry QC-F3: Is all other purchased material checked for conformance with the contract documents upon receipt?

Inquiry QC-F4: Are controls set up to assure adequate identification of incoming purchased items?

Inquiry QC-F5: Is a written procedure in place to assure traceability of materials, including grade, heat numbers, and material test reports, etc. as appropriate?

Inquiry QC-F6: Are records maintained to assure traceability of materials, including grade, heat numbers, material test reports, etc. as appropriate?

Inquiry QC-F7: Is material inspected for conformance to ASTM A6?

Inquiry QC-F8: Are manufacturers' Certified Material Test Reports (CMTR's) for metal or other structural components, or Certificates of Compliance for bolts, welding consumables, etc., reviewed for conformance to the contract documents?

Inquiry QC-F9: Are manufacturers' CMTR's or Certificates of Compliance of base metal, welding consumables, etc., kept on file?

Inquiry QC-F10: Is material identity retained during the construction process?

QC-G. Welding

Inquiry QC-G1: Does the contractor have a competent welding technician, supervisor or outside expert available on call?

Inquiry QC-G2: Are QC personnel conversant with current qualification provisions of AWS specifications for welding consumables, welders and welding operators?

Inquiry QC-G3: Are QC personnel conversant with current workmanship provisions of AWS specifications for welding?

Inquiry QC-G4: Is the grade of steel to be welded verified?

Inquiry QC-G5: Are welding consumables identified and stored properly?

Inquiry QC-G6: Are welding consumable ovens adequate and operating in accordance with AWS specifications?

Inquiry QC-G7: Is consumable handling in accordance with AWS specifications?

Inquiry QC-G8: Is workmanship checked by QC throughout the welding process for conformance to the contract documents?

Inquiry QC-G9: Does the frequency of QC inspection conform to the requirements of the appropriate policy?

QC-H. Nonconformance Procedures

Inquiry QC-H1: Is there a functioning, written procedure for disposition of nonconforming material or work in process rejected by QC personnel?

QC-I. Equipment Condition

Inquiry QC-I1: Does the contractor have a functioning procedure for maintenance of equipment that includes periodic inspections and performance?

Inquiry QC-I2: Does the contractor have appropriate automatic or semi-automatic equipment for making continuous welds?

Inquiry QC-I3: Does the contractor have mechanically-guided burning equipment?

Inquiry QC-I4: Does the contractor have adequate and accurate cutting and finishing equipment?

Inquiry QC-I5: Does the contractor have adequate material handling equipment including cranes to move material and components without damage?

Inquiry QC-I6: Is housekeeping adequate?

Inquiry QC-I7: Is the air supply adequate to operate equipment as intended?

Inquiry QC-I8: Is the electrical supply adequate?

QC-J. Quality Control Inspection

Inquiry QC-J1: Does the contractor have qualified QC inspectors?

Inquiry QC-J2: Is there a functioning program for training QC inspectors?

Inquiry QC-J3: Does the contractor have at least one Certified Level III NDT administrator in-house or available under contract certified in accordance with ASNT-TC-1A?

Inquiry QC-J4: Does the contractor's on-site QC department have a welding inspector who holds an AWS CWI certificate?

Inquiry QC-J5: Does the contractor's on-site QC department have at least one Certified Level II technician certified in accordance with ASNT-TC-1A for the test methods to be used in the work, including PT, MT, UT and RT, either on staff or available from outside sources?

Inquiry QC-J6: Are there procedures for certifying and updating NDT personnel?

Inquiry QC-J7: Does NDT equipment receive periodic inspections, performance or certification?

Inquiry QC-J8: Does all work receive a final inspection?

Inquiry QC-J9: Is a permanent, written record kept for all inspection?

Inquiry QC-J10: Does Quality Control personnel have authority to stop and responsibility to inform the operating supervisor of nonconforming work?

Inquiry QC-J11: Is joint fit-up checked prior to welding?

Inquiry QC-J12: Does each inspector carry adequate tools to perform the required inspections (flashlights, heat indicating crayons, welding gauges, tape, marking equipment, etc.)?

Inquiry QC-J13: Does each inspector keep daily records in a bound diary?

Inquiry QC-J14: Is the following NDT equipment available: RT, including viewing room and viewer, UT, MT, PT?

RTI Assessment: The contractor commented that ISI provides all NDT equipment required at the project site.

Inquiry QC-J15: Are there reference standards for periodically calibrating equipment?

QC-K. Documentation

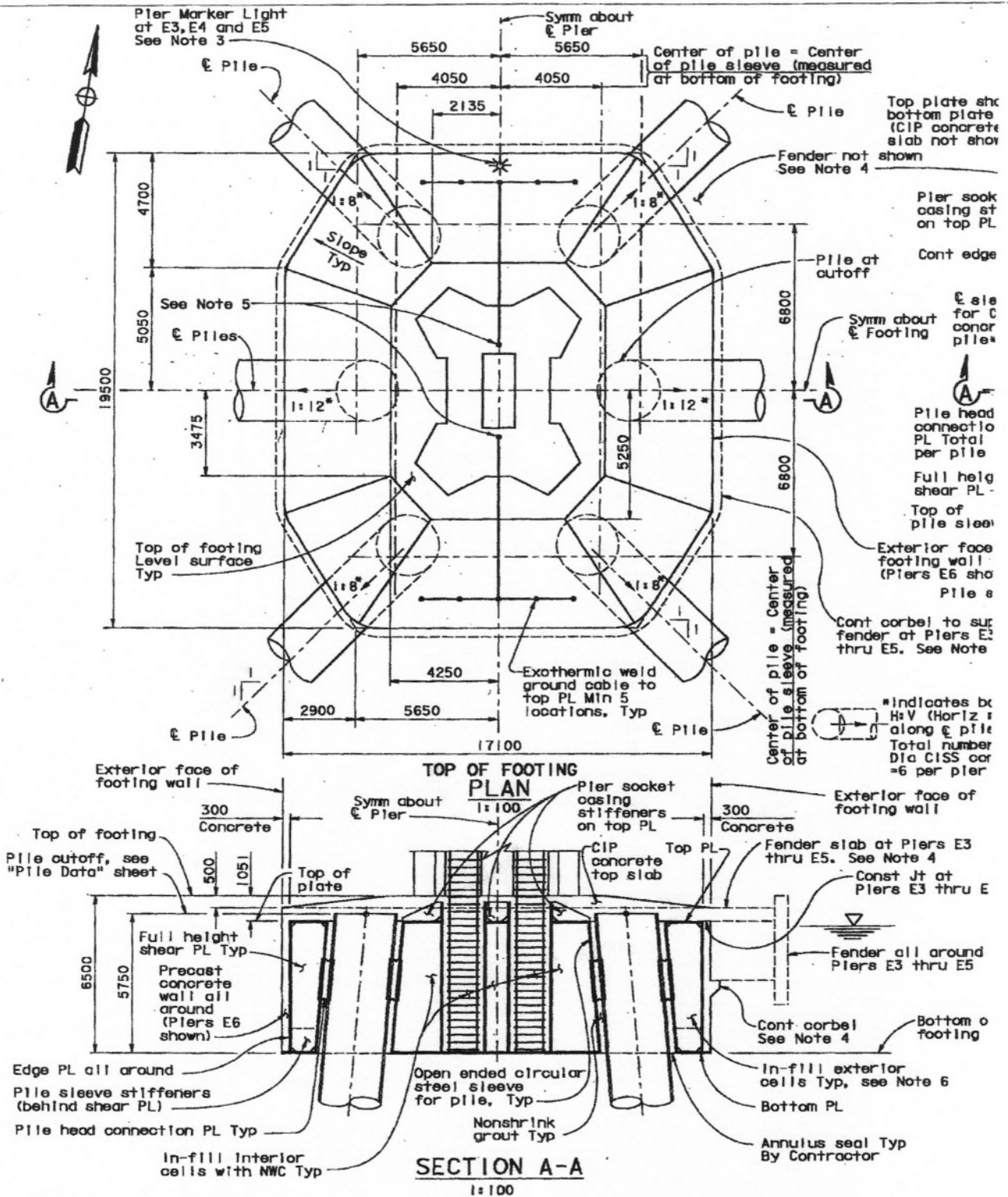
Inquiry QC-K1: Is there a process in place for creating QC documents, including daily reports, nonconformance reports, etc.?

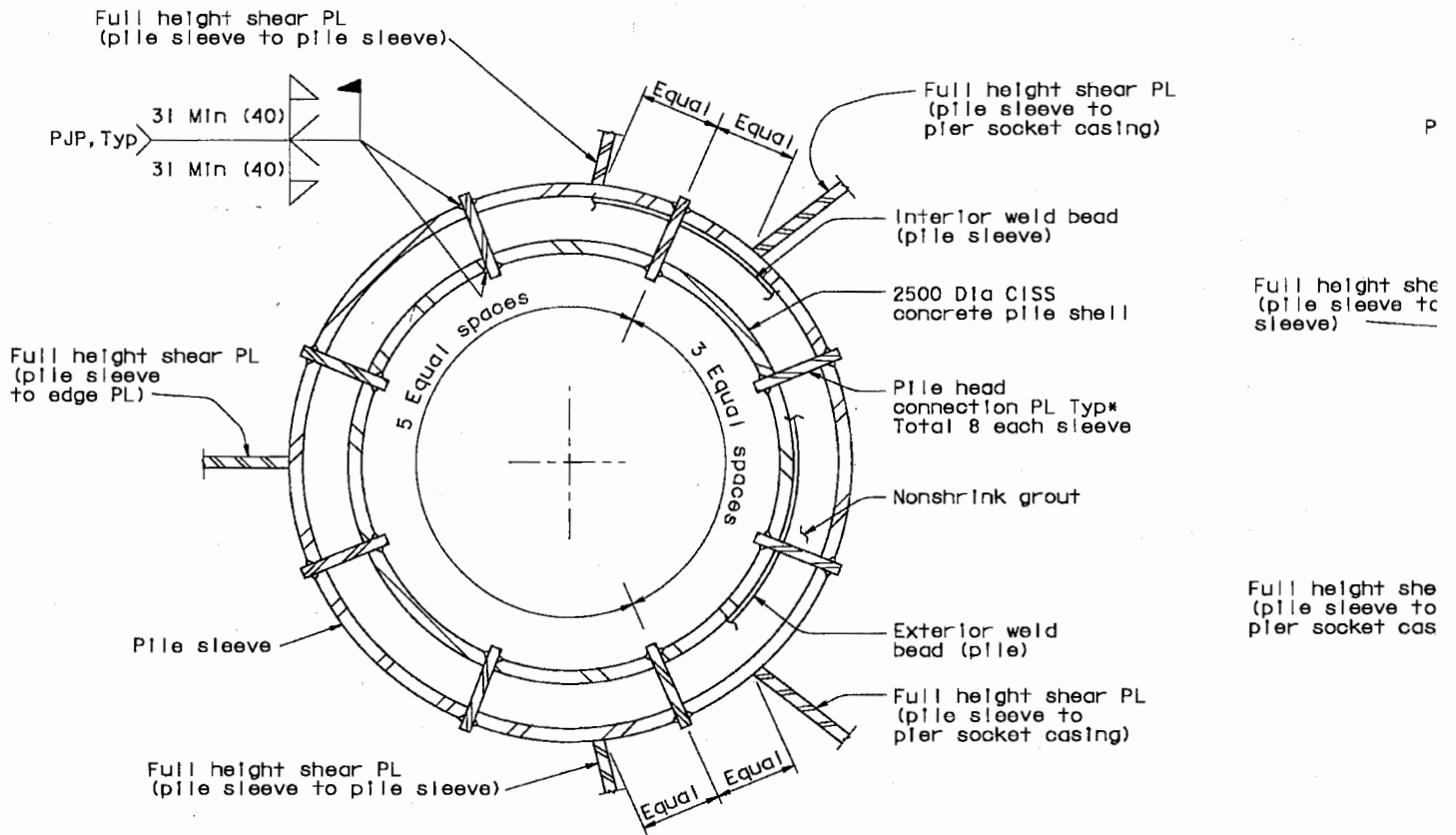
Inquiry QC-K2: Is there a process in place for submittal of QC documents for review and filing?

Inquiry QC-K3: Is there a procedure in place to review QC documents, including welder/welding operator qualification documents, daily jobsite reports, nonconformance reports, final acceptance reports, etc.?

Inquiry QC-K4: Is there a procedure in place for filing QC documents?

Inquiry QC-K5: Are QC documents easily retrieved?





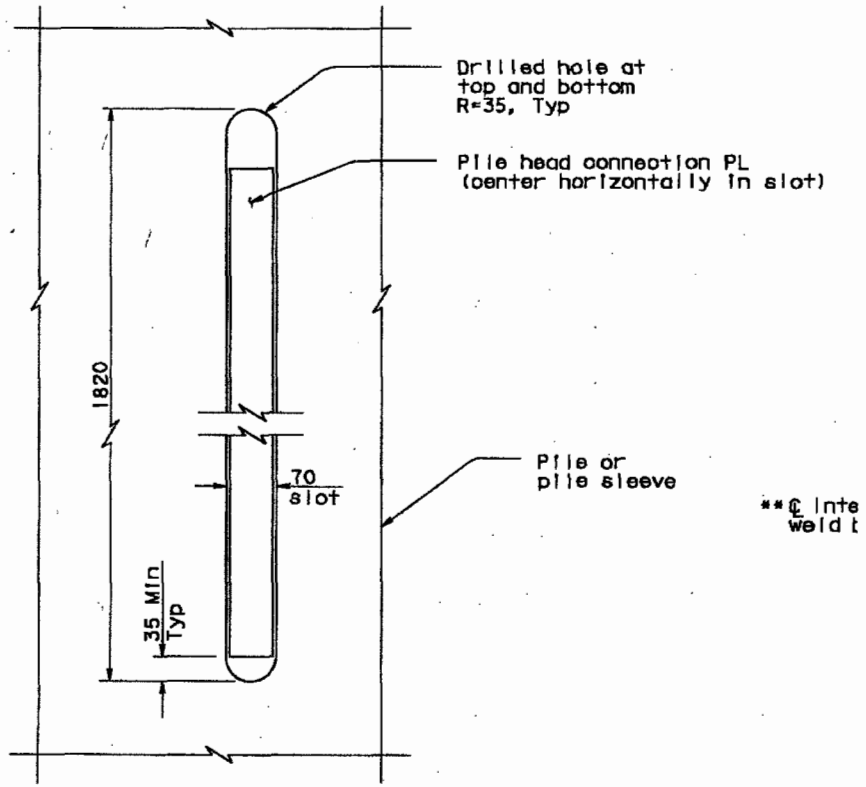
MIDDLE PILE (Piers E3 thru E14)

* Pile head connection PLs are located radial and parallel to center line pile sleeve

SECTION C-C

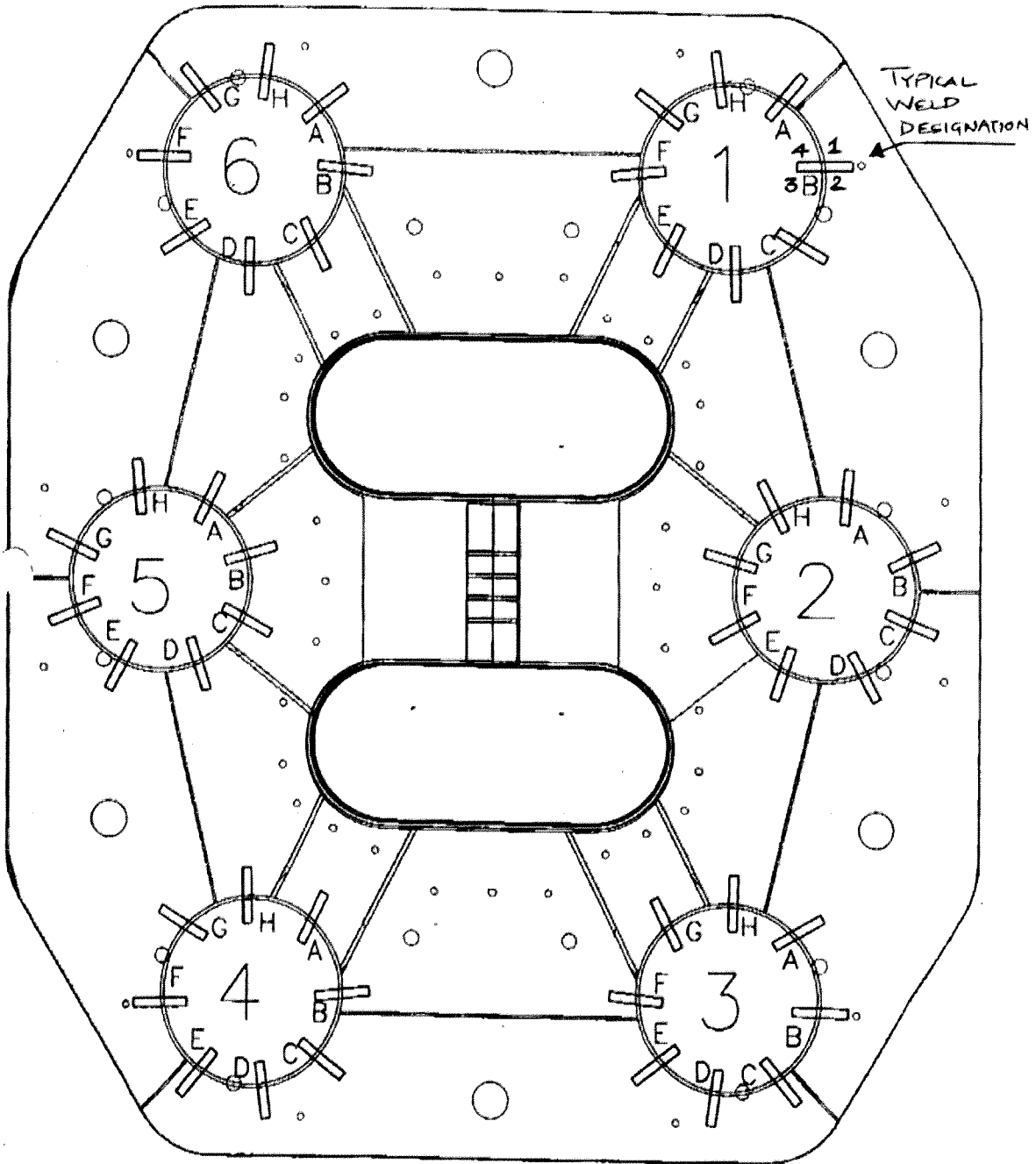
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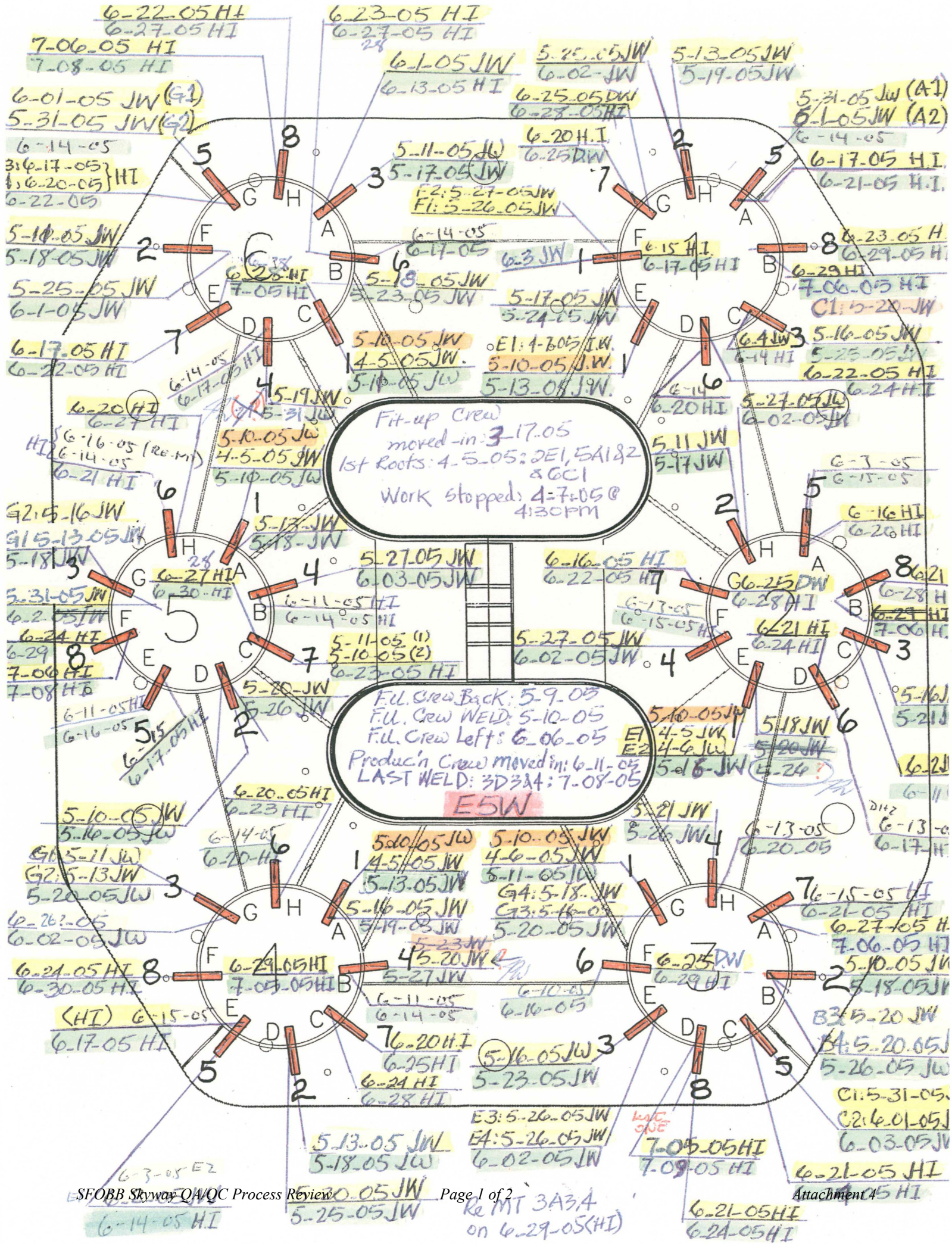
R. S. Bagha DESIGN OVERSIGHT <i>R. S. Bagha</i> SIGN OFF DATE 11/17/00 Rev. Date: 5-18-98	DESIGN	BY M. Sch/R. Nutt/J. Denis	CHECKED T. Ingham
	DETAILS	BY M. Sch	CHECKED T. Ho
	QUANTITIES	BY J. Leventini	CHECKED D. Harrison
	ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS		0 10



VIEW D-D
1:5

Box Weld Nomenclature

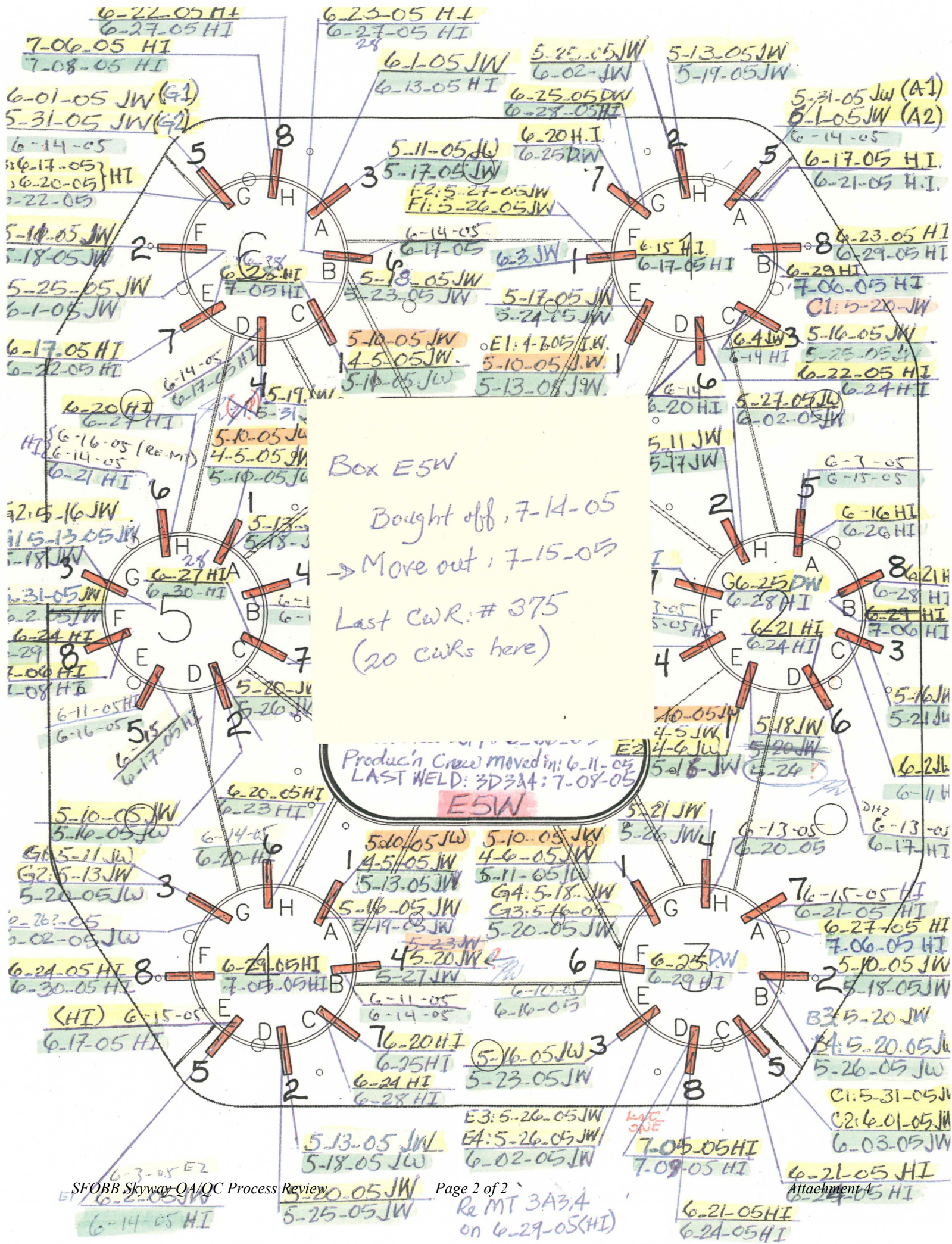


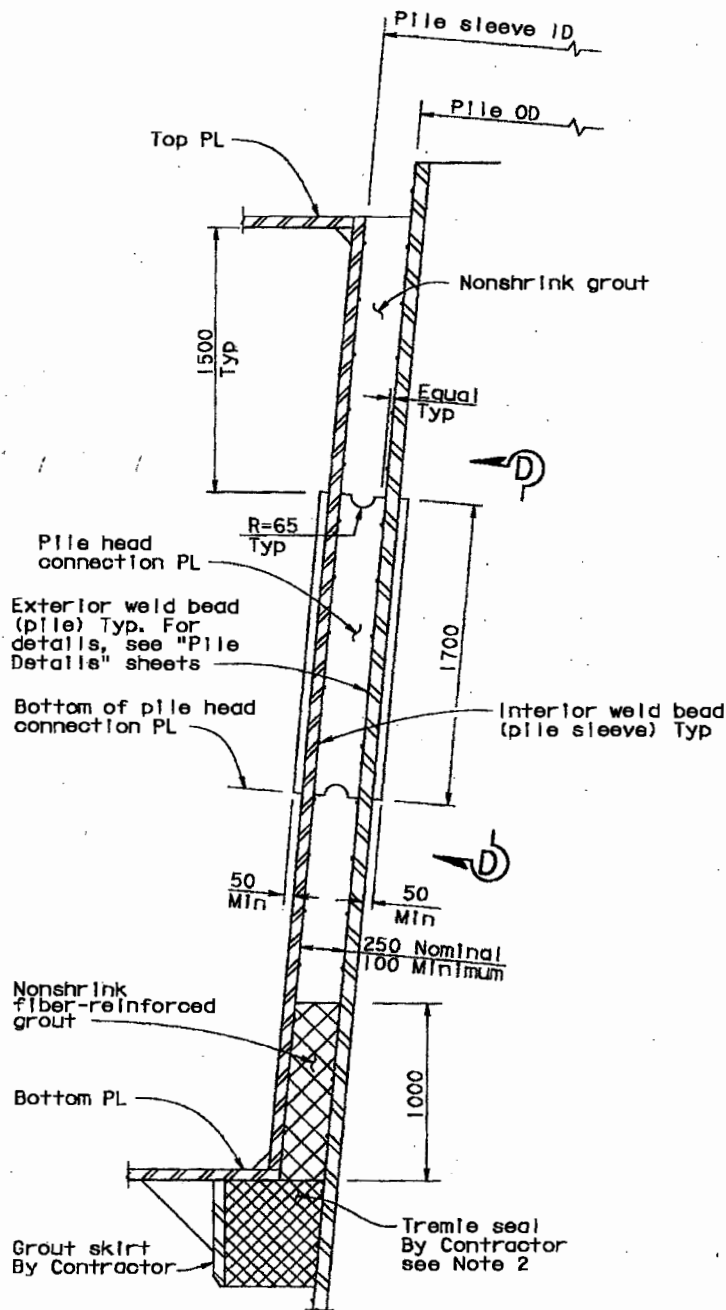


Fit-up crew
 moved in: 3-17-05
 1st Roots: 4-5-05: 2E1, 5A1 & 2
 & GC1
 Work stopped: 4-7-05 @
 4:30 PM

F.U. Crew Back: 5-9-05
 F.U. Crew WELD: 5-10-05
 F.U. Crew Left: 6-06-05
 Production Crew moved in: 6-11-05
 LAST WELD: 3D3A: 7-08-05
E5W

Re MT 3A3A
 on 6-29-05 (HI)

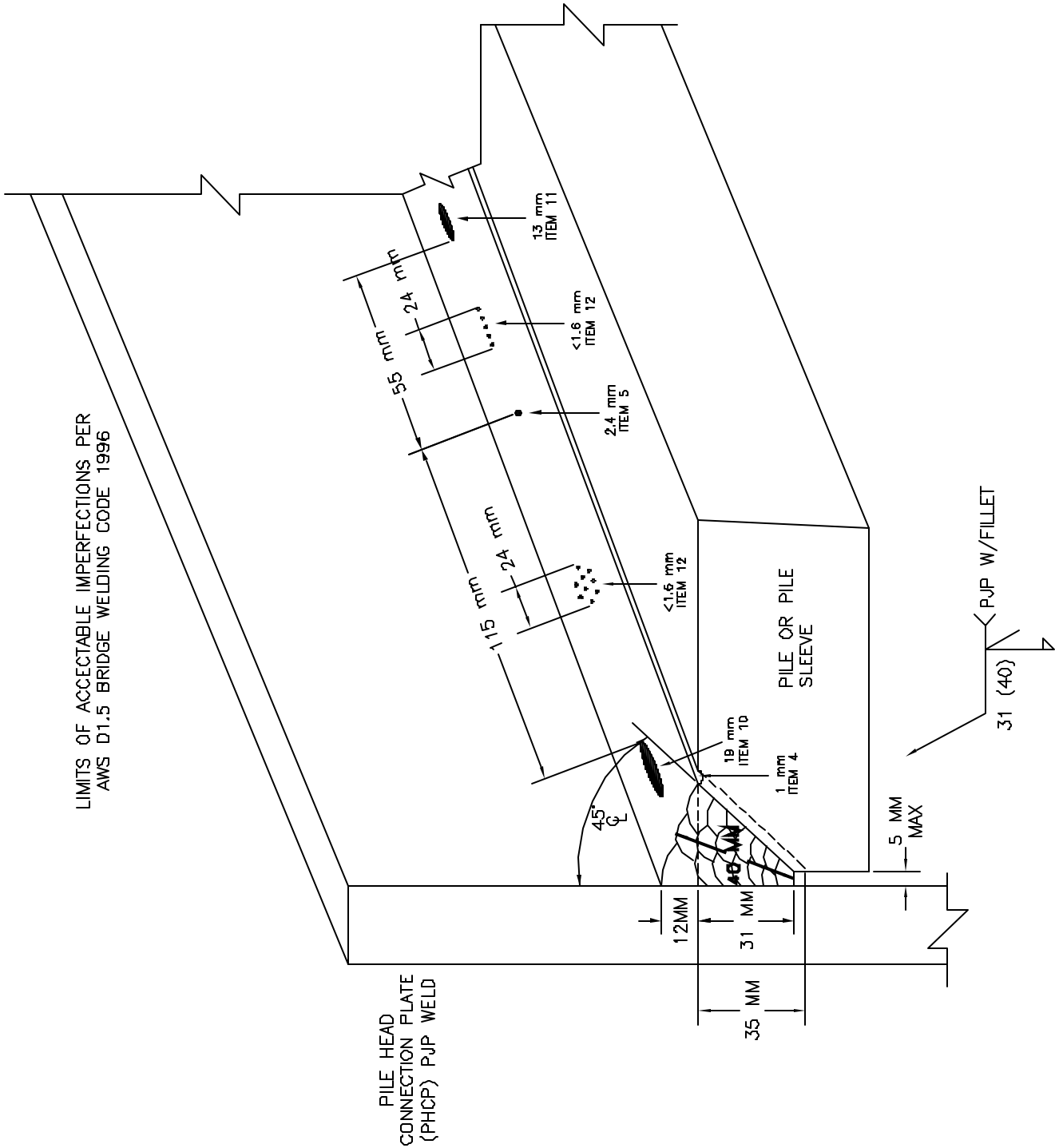




PILE HEAD CONNECTION DETAIL

1:20

LIMITS OF ACCEPTABLE IMPERFECTIONS PER
AWS D1.5 BRIDGE WELDING CODE 1996



PER DESIGN: DEPTH OF PREP IS 31 MM
PER QC050: DEPTH OF PREP IS 35 MM