

NORTH REGION OFFICE OF SURVEYS

QUALITY MANAGEMENT PLAN

FOR SURVEYS

INDEX:

- 1. MISSION STATEMENT FOR NROS-SURVEYS, QMP.**
- 2. QC/QA DESIGN BASED FLOWCHART FOR SURVEYS**
- 3. QC-QA FLOWCHART OUTLINE**
- 4. "COMBINED SURVEYS AND R/W ENGINEERING PROJECT
WORK FLOW DIAGRAM", (THIS IS A DETAILED FLOW CHART OF
THE INTERACTION OF SURVEYS AND R/W ENGINEERING WITH
THE PROJECT).**
- 5. GENERAL GUIDELINES FOR DESIGN FIELD SURVEYS**
- 6. FIELD BOOK PREPARATION**
- 7. REPORT OF FIELD SURVEY**
- 8. PROCESSING THE SURVEY REQUEST**
- 9. SURVEY FILE CHECKLIST**
- 9A. CONSTRUCTION/SURVEYS EXPECTATIONS**

NORTH REGION OFFICE OF SURVEYS: QUALITY MANAGEMENT PLAN

The **NORTH REGION OFFICE OF SURVEYS (NROS)** is a product and customer satisfaction driven division. In its efforts to attain a high level of quality assurance it finds its quality control elements bound to the integrity of its employees, who initiate and maintain the quality of the product, the **SURVEYS MANUAL¹**, the laws embodied in the **CALIFORNIA LAND SURVEYORS ACT** and **SUBDIVISION MAP ACT**, and its internal processes built with redundancies and checklists from field surveys through office processing.

GENERAL GUIDELINES FOR QUALITY CONTROL AND QUALITY ASSURANCE (QC/QA)

In broad scope, the NROS QC/QA program aims to ensure the following:

- That each task complies with the laws and regulations that govern the use of Federal, State, and local transportation funds;
- That each product meets the customer's needs and purposes, as defined in the **Task Order** and **Cost Estimate**;
- That a process for constructive feedback is implemented and contributes to satisfactory product delivery;
- And, that immunities established by law to protect the Department and its employees from liability are preserved.

These guidelines apply to all **Survey Tasks** including participation in the preparation of the Project Initiation Document (PID); engineering and environmental studies; plans, specifications and estimates; right of way, and construction to project closeout.

As with any general guidelines, which must apply to a wide range of activities, NROS staff members are expected to use professional judgment in their application.

In its conception, **QC/QA** is not intended to be an additional layer of effort required to deliver a successful project. It is, simply or not, intended to be the norm that governs all activities, projects, and processes within **NROS**.

The more specific steps towards Quality Assurance, through Quality Control, are described, listed and appended below.

¹ The **SURVEYS MANUAL** can be found at: <http://www.dot.ca.gov/hq/esc/geometronics/SurveysManual>. It is continually updated as processes and technology change.

IMPLEMENTING QUALITY ASSURANCE

The policies and processes of **NROS** are developed and continually refined to ensure high quality in its project deliverables through a series of **Quality Control** measures. These policies and processes are applied throughout the product delivery process from project initiation to post-construction. These measures include, but are not limited to, the following:

- A well trained and experienced work force, which is dedicated to producing a high quality product;
- The SURVEYS MANUAL, which specifies the precision, quality, and accuracy of the survey and its attendant documents throughout the range of NROS' many tasks;
- The office preparation, field surveys, and office processing practices with their many quality control checkpoints²;
- Feedback from the customers, including the other CALTRANS divisions and the public;
- Monthly field and office personnel meetings with Senior level participation to critique and improve current practices.

The more specific steps to Quality Assurance through Quality Control are contained in NROS and Departmental checklists and flowcharts, of which the pertinent ones are described and appended below.

APPENDED CHECKLISTS AND ASSOCIATED DOCUMENTS

The following documents are appended:

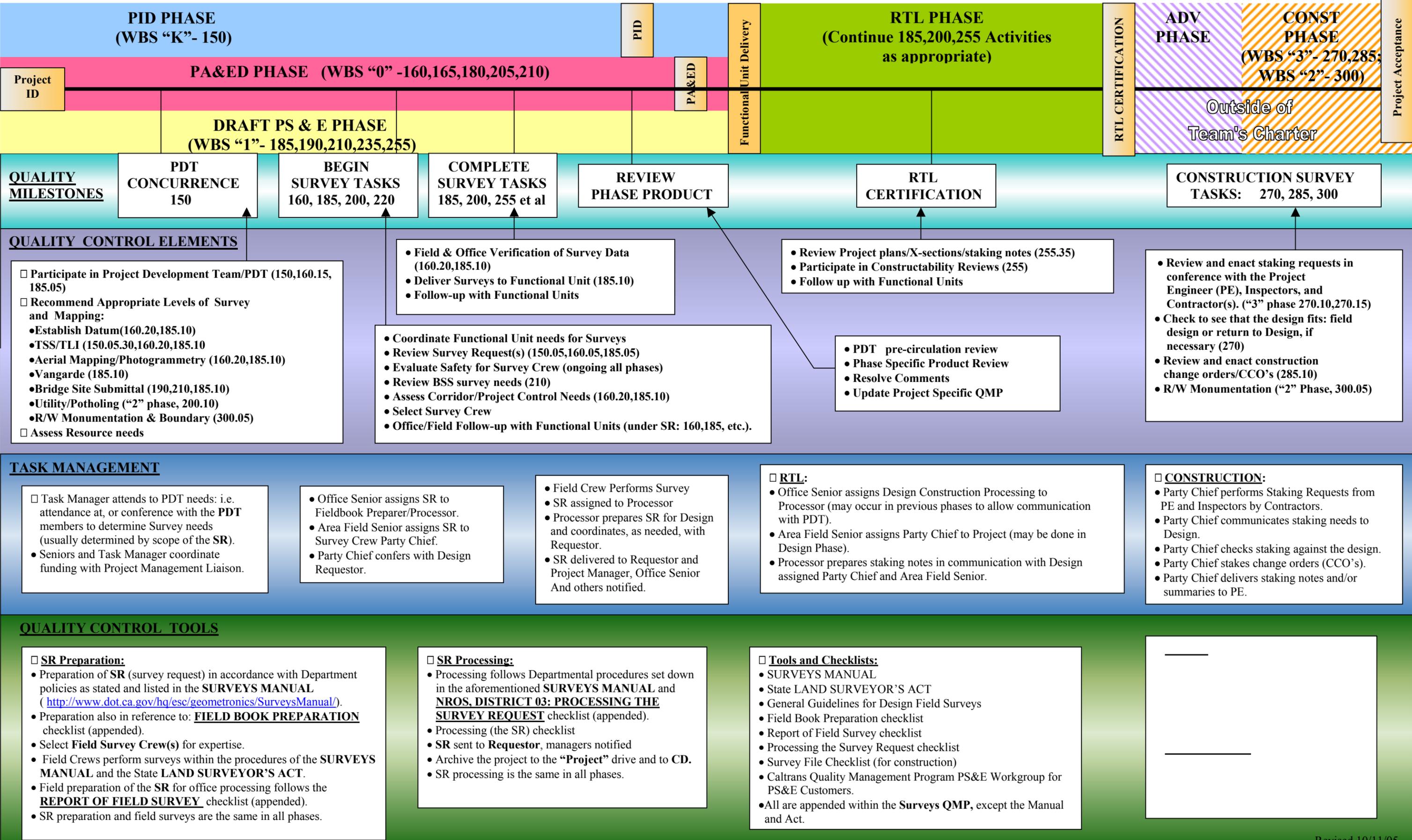
1. "QC/QA DESIGN BASED FLOWCHART FOR SURVEYS", which is the base flowchart document for the QMP
2. "QC-QA FLOWCHART OUTLINE", which is an outline of the materials within the QC/QA Flowchart ("1" above).
3. "COMBINED SURVEYS AND R/W ENGINEERING PROJECT WORK FLOW DIAGRAM", which is a complex flow chart diagramming the interactions of Surveys and R/W Engineering from project inception to completion (post construction and monument and control maintenance activities).
4. "GENERAL GUIDELINES FOR DESIGN FIELD SURVEYS", which is a descriptive document of field survey procedures.
5. "FIELD BOOK PREPARATION", which is a checklist of procedures for preparing the SR for the Survey Field Crew.
6. "OFFICE TO FIELD: REPORT OF FIELD SURVEY", which is a checklist for topographic surveys, or TLI, for field crews.

² The checkpoints are defined by the checklists and job flow charts appended to this document.

7. "PROCESSLING THE SURVEY REQUEST", which is a checklist for preparing the field survey for the Requestor.
8. "SURVEY FILE CHECKLIST", which is a checklist and guideline of needed elements of the "Survey File" from field to design to construction.
9. "CONSTRUCTION/SURVEYS EXPECTATIONS", which is a listing of the "Expectations and Performance Measures of PS&E Customers" and serves as a general guideline for construction project procedures and consultant project procedures.

NORTH REGION QUALITY MANAGEMENT PLAN

-SURVEYS PROJECT SPECIFIC QUALITY CONTROL PLAN-



NORTH REGION OFFICE OF SURVEYS
QUALITY MANAGEMENT PLAN (QMP)
RE: DESIGN QC/QA PLAN-SURVEYS-FLOWCHART
(An outline/elaboration of the flowchart)

Of note: The flowchart is designed to meet Design's needs, as the Project directing body. Surveys has found some plasticity in the row definitions or headings as they apply to the services we provide. Sometimes a "Quality Control Element" and a "Quality Control Tool" are interchangeable. In the process of surveying, as in the other divisions, there are constant checks built into the procedures employed by the surveyors, and they, the surveyors, are the most important "Quality Control Element", and their "tools" are the knowledge and understanding of the processes needed for good design. Too, our processes tend to be responses of a service division to a Survey Request and are much the same throughout the Project flow.

PROJECT INITIATION DOCUMENT (PID), PROJECT APPROVAL AND ENVIRONMENTAL DOCUMENTS (PA&ED), AND DESIGN PHASES:

1. Surveys involvement with a Design Project begins with the PDT meetings leading up to PDT Concurrence.
2. Seniors and Project Management Liaison review budgeting needs for Project.
3. Project specific work begins with the Survey Request, or **SR**, being received from another functional unit, usually Design.
4. The preparation of the SR for field survey is the same in all phases and occurs in "K" phase through construction, and, on occasion, post-construction with a monumentation request from Right of Way Engineering.
5. The project or SR is assessed on arrival for specific survey needs which can include: area control needs (the vertical and horizontal datum and monumentation), the type of survey that best fits the request (TSS/TLI, Photogrammetry, Vangarde), whether it is a Bridge Site Submittal (**BSS**), what utility location may be needed (potholing), and whether any R/W location and monumentation is needed
6. Processing the field survey for the Requestor is also the same in all phases. It begins with the return of the survey from the field. It is processed or edited on the current department software, and the product is delivered to the Requestor with any needed explanations and/or accompanying data. The current deliverables are the processed/edited

- survey file (Caice.zip, currently), a Microstation.dgn file, a Microsoft Access.kcm file (optional), and a description of the processing (zones and levels where various information is stored).
7. The survey project is then archived on CD and on the District Project drive. All the field notes are also scanned and archived.
 8. All the Surveying processes are governed by the Caltrans **SURVEYS MANUAL** (<http://www.dot.ca.gov/hq/esc/geometronics/SurveysManual/>), the California Land Surveyor's Act, and various district and departmental policies that are present in district checklists, and other descriptive documents (appended to the QMP).

READY TO LIST (RTL) PHASE:

1. The Ready to List, or **RTL PHASE**, sees surveys reviewing design plans received from Design, and preparing the needed notes to enable the Project to be surveyed for construction.
2. The products prepared for Construction include: cross section and staking notes, and the electronic files needed to survey, or stake, the Design on the ground.
3. In this phase, constructability reviews are completed with meetings with other functional units.
4. Storm water and drainage data reports are also assessed.
5. Safety Reviews are performed and project specific safety concerns addressed, to allow the survey work to proceed safely within the areas called for by interaction with the Project Engineer (PE) and contractor.
6. Construction staking concerns are addressed by:
 - A. Communication with the Project Engineer (PE), on project/survey related concerns.
 - B. Communication with the Inspectors who carry out the directions of the PE and needs of the Contractor on a day-to-day basis.
 - C. Checking the suitability of the slope stake notes for the field.
 - D. Checking the completeness of the plans for staking.
 - E. Communications between the survey office construction processors and Design, reviewing any concerns with the "final plans".
7. Construction processors, too, work closely with the field crews as the project moves into the Construction Phase.

CONSTRUCTION PHASE:

The Construction Phase consists of the following processes and practices:

1. Meetings with PE, Inspectors and contractors addressing the project staking needs, and the scheduling of staking requests (request flow: Contractor to PE/Inspector to Field Crew Party Chief).
2. Construction staking is performed within the standards defined in the SURVEYS MANUAL, and within agreements with the Project Engineer(s), Inspector(s), and contractors.
3. Field crew and office construction processors communicate and interact with the "final" design plans, design engineers, PE & Inspectors, and Contractor to fulfill staking requests.
4. In the process of staking, the Project Surveyor checks to see that the field staking fits the design requirements and fit with the existing ground and structures (a continuing process throughout staking), and noting if area re-designs are needed.
5. The field crew finalizes the staking, finishing staking requests, and any construction change orders (CCO's) approved by the PE/Inspector/Contractor interaction.

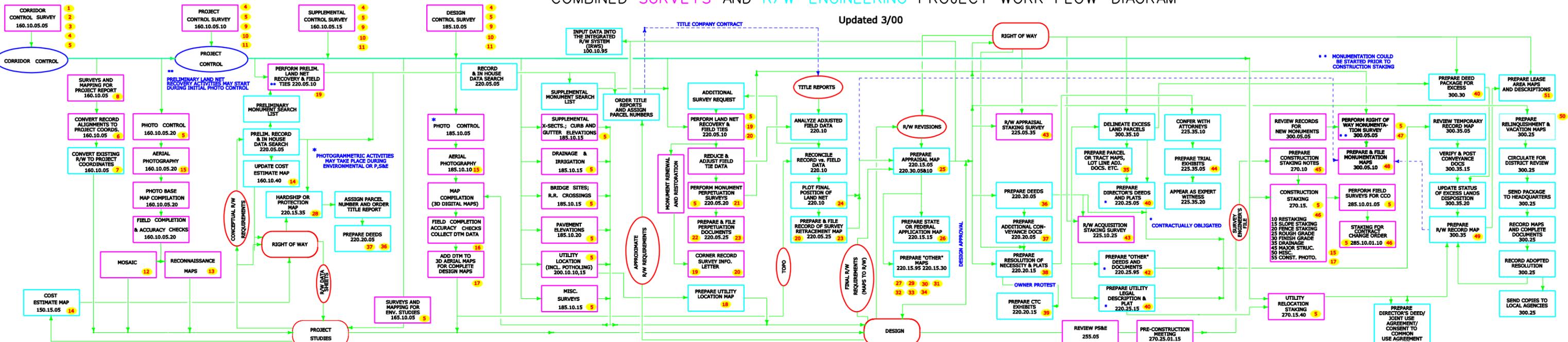
POST-CONSTRUCTION PHASE:

The Post-Construction Phase essentially involves Surveys in monumenting the "new" right of way and establishing any needed land net monuments required by the scope of the project. Such requests usually come from Right of Way Engineering, or Right of Way, and in some cases can be a decade or two from the end of construction or the abandonment of a project. Such work usually consists of:

1. Right of Way Engineering requests monumentation of the Right of Way (R/W).
2. Project Control is refurbished and construction losses are replaced in contemplation of future road maintenance and construction concerns.

COMBINED SURVEYS AND R/W ENGINEERING PROJECT WORK FLOW DIAGRAM

Updated 3/00



PRODUCTS

1	Corridor Control Diagram
2	Coordinate List (Published with NGS)
3	Corridor Control Report
4	Control Monuments
5	Field Notes
6	Converted and Adjusted Record Alignments
7	Converted Existing R/W Boundary Traverses
8	Surveyed Alignments of Existing Facilities
9	Project Control Diagram
10	Coordinate and Bench Mark List

11	Project Control Report
12	Photo Mosaic
13	Reconnaissance Maps
14	Cost Estimate Map
15	Aerial Photos
16	Design Maps
17	Digital Terrain Model
18	Utility Location Map
19	Corner Records
20	Survey Information Letter

21	Monuments
22	Monument Perpetuation Map (Record of Survey)
23	Retracement Map (Record of Survey)
24	Land Net Maps (Base Maps)
25	Right of Way Appraisal Maps
26	Government Application Maps
27	Comparable Sales Maps
28	Right of Way Hardship and Protection Maps
29	Appraisal Report Plats
30	PUC Application Maps

31	Transfer of Control and Possession Maps
32	Railroad Right of Way Agreement Exhibits
33	Federal Participation Area Maps
34	Material Site Maps
35	Parcel Maps, Tract Maps, Lot Line Adj. Plats
36	Deeds
37	Other Acquisition Documents
38	Resolution of Necessity and Plats
39	CTC Exhibits
40	Director's Deeds and Plats

41	Common/ Joint Use Agreement Exhibits
42	"Other" Documents
43	R/W Stakes (Flagging)
44	Court Exhibits
45	Construction Staking Notes
46	Construction Stakes
47	R/W Monuments
48	Monumentation Maps (Record of Survey and In-lieu)
49	Right of Way Record Map
50	Relinquishment and Vacation Maps and Requests
51	Lease Area Maps

KEY

- ACTIVITIES TRADITIONALLY DONE BY SURVEYS
- ACTIVITIES TRADITIONALLY DONE BY RIGHT OF WAY ENGINEERING
- PRODUCTS GENERATED BY SURVEYS/RWE
- PRODUCTS GENERATED BY OTHERS
- FUNCTIONAL GROUPS
- WORK FLOW
- INFORMATION FLOW

General Guidelines for Design Field Surveys

The purpose of this document is to standardize the way in which NROS field surveys for design are accomplished, and to provide for better coordination between the various elements of those surveys. In addition to the work accomplished by the field crews, design surveys may include support from vanguard, photogrammetry, and GPS. The manner in which each function is accomplished directly effects the various other functions and ultimately the project deliverables.

These guidelines are not cast in stone, but should be adhered to unless circumstances dictate otherwise. Any deviance from the suggested procedures must be coordinated in advance with the Field Chief so that he can insure that all parties are aware of the change.

Project Overview

Site Evaluation

The first function to arrive onsite will be the field crew. Initially, their job will be to uncover the existing control net and to determine the limits of the project. Additionally, they will need to search for and recover a number of right - of - way monuments sufficient to generally locate the bounds of the project area for design purposes. This doesn't mean that every monument needs to be located. Generally, if monuments can be uncovered at the ends of the project, with a few thrown in somewhere in the middle, a rough boundary analysis can be accomplished.

Once the existing control and right - of - way has been recovered, the party chief analyzes the site to determine if supplemental control is required. In cases where '83 control is not available, GPS static control will need to be brought in to control the site. (Note that for the purposes of this document, static and fast static GPS will be lumped together as "static.") It is also a good idea to tie any existing '27 control into the '83 net so as-built drawings and monument maps can be used in conjunction with the new design data. Party chiefs must beware of using any found GPS control until they have verified that it was brought in by static means. RTK is not suitable for precise control and will result in significant error propagation if improperly utilized.

When considering the project's control needs, the party chief should also look to future needs, remembering that some or all of his control may be useful during construction. He is also charged with densifying Caltran's existing primary control net. Ideally, primary control (brass disks in concrete, GPS statically controlled) should be spaced at about one mile intervals throughout the project. If practical, primary control should also be elevated to at least second order, class II specifications, by three - wire or digital leveling. The GPS Coordinator should be consulted with prior to the placement of any control requiring static GPS.

Photogrammetry

If the project is to be flown, premarks need to be laid out on the main line(s) at 450-foot intervals for high flight, or 250-foot intervals for PTL. These targets are in addition to the HV and V points shown on the photogrammetry control plan. Mainline HV and V points should be tied into a comprehensive control net, not just "hung" on some nearby GPS control or bench. Unless this procedure is followed, the next party onsite will have to run control before they can finish their job. Remember, the purpose of static GPS is to provide conventional control traverse endpoints.

Premark marks must be set out as soon as practical so that the project can be flown at the earliest possible date. Photogrammetry is the longest process in the design deliverables package so we need to expedite our portion of it. Once the project has been flown it is ready to be controlled.

Conventional supplemental control needs to be run from one end of the project to the other, in such a manner as to support TLI collection and if possible, future construction needs. All of the HV, V, and intermediate premarks (450's) on the mainline need to be elevated, preferably by differential levels, to second order, class II standards. Second order, class II specifications can be met with trig leveling procedures (see attachment). For projects utilizing PTL, all HV, V, and mainline intermediate premarks (250's) must be elevated by digital level to apparent first order, second class specifications. High flight wing points can be trig leveled, but should be double tied to prevent blunders.

On projects where RTK is utilized to locate premarks, it should only be used on the wing points for elevation. The mainline must be elevated conventionally to minimize error in the pavement planes. RTK can also be used to tie found right - of - way monuments. All RTK

coordinates sheets must be clearly marked to indicate RTK positioning was used in order to prevent confusing future surveyors regarding the precision of the data.

Vangarde

In cases where vangarde is not following photogrammetry on the project, they will need to have horizontal and vertical project control spaced at no less than 1000-foot intervals. In cases where vangarde follows photogrammetry, the existing control scheme will be sufficient for their needs.

Vangarde will be responsible for the collection of pavement planes and any topographic information lying in harm's way. Additionally, they may be called upon to collect drainage structures, etc. on smaller projects or projects where the scope of work doesn't warrant conventional TLI methods.

TLI

In addition to controlling the project and providing support for photogrammetry and vangarde, field crews will be responsible for all TLI collection not accomplished by other means. All topographic features not clearly discernible from aerial photos (power poles, pull boxes, etc.) and all drainage (submersed flowlines, inverts, etc.) are the responsibility of the field crews. In areas where safety is not a problem, field crews may also be responsible for topographic and DTM features normally captured by vangarde or PTL.

□ NROS: <u>FIELD BOOK PREPARATION</u>
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Notes on preparing a Survey Request for the Field Surveyor.

- I. The Survey Request.
 - Receive a Survey Request (SR) and label a "field notebook" for this request.
 - Sign and date the SR as the Preparer.
 - Read the SR to assess its scope and needs.
 - Communicate with the Requestor for needed clarifications.
 - Assess the Field Crew's needs.

- II. Inclusions for the Survey Request (as applicable):
 - Control for the survey area (research and acquisition).
 - Evaluate the found control for accuracy (is it up to date, is there superceding control).
 - Note Datum of the Horizontal Control:
 - NAD 83: __ Metric, __ Feet
 - Epoch of the Control (1991.35 or other)_____.
 - NAD 27: __ Feet, __ Metric
 - Assumed: __ Feet, __ Metric
 - Vertical Control:
 - NGVD29: __ Feet, __ Metric
 - NAVD88: __ Feet, __ Metric
 - NGS control as available, and if needed.
 - GPS Control
 - GPS Control Particulars (HPGN et al): _____
 - "To Reaches" for the control.
 - Corridor Maps of the Control relative to the Project.
 - Previous Work in the Area
 - .DGN maps provided by Requestor (required with the SR).
 - Any DHIPPS (photos) of the area needed for explanation, if available.
 - Topo Maps of Previous Work (if it applies).
 - Needed Elements for the Request (e.g. Land Net to be tied, scope of the survey, H/V control ties to adjacent control, etc.).

III. Electronic Files to be supplied (on floppy and/or **CD**):

- Control Files:
- .CTP
- CGF (combined grid factor), if needed (needed with HP200), available through Corpscon.
- .CTL
- .DC
- .ALN or .ALI if alignments are needed or helpful.
- Caice.zip (if needed or explanatory, usually optional as these large files are unwieldy on laptops).
- .DGN maps if useful or provided by Requestor (usually provided as hard copies).

IV. Assemble the Fieldbook:

- SR
- Maps
- Control
- "To reaches for control"
- Control files on disk or CD
- Notes and communications
- "Sign" and date the SR as the Preparer.

V. Deliver the Field Book:

- Deliver to Office Senior
- Office Senior routes to Field Senior
- Field Senior routes to appropriate Field Crew Party Chief.

VI. Archive/store the Data you send to the field:

- "Project" drive under SR, within "Final Content", or as appropriate.
- Optional: On CD under the SR/Project.

Report of Field Survey
Checklist

NAME:

TITLE:

Report

- Cover Sheet / Statement of Responsible Charge
- Scope of Work(SR, EA, COUNTY, ROUTE, PM)
- Survey Party Members
- Date(s) of Survey
- Equipment Used
- Work Summary - Control
 - Control Datum / Pedigree / Problems Encountered w/ Historical Positions
 - Problem Solving – Assumptions & Methodology
 - Floated Historical Positions – Reasons / Justification for Floating Points
 - Suspected Problems / Unresolved Issues
- Work Summary – TLI
 - Logical “Zones” or “Locations” Subdividing Project for Collection
 - Unusual Situations Encountered / Solutions
 - 900 Codes Utilized
 - Statement of Resolution of Crossing Breaklines (CAiCE), with any unusual solutions or resolutions noted, if they were needed.
- Work Summary – Boundary / ROW
 - Problems / Solutions / Unresolved Issues
 - Disturbed / Suspect Monuments
 - Evidence of Encumbered Title (encroachments / occupations, etc.)

Supporting Documents

- TRIMBLE/TGO/TDS Files, or, CTDC / CTDAP Files
 - .DC FILES, Raw .dmp files (electronic copies)
 - Electronic copies of data collector associated files, primarily .tss and .dc files, or CTDC/CTDAP equivalents (.apr, .sdb, .sts, .fob, .tss, .ucr and .obs).
 - Edited TGO files, or .dmp files, if needed (electronic copies w/ cross references on field notes).
- STARNET Files
 - Files produced from STARNET adjustment of control/traverse points.
 - .lst (electronic copy and printout)
- DIGILEV / STARLEV Files
 - Files produced from level adjustments (re: .raw, .dat, and .lev, et al)
 - .dat, .err, .lst, and .prj (electronic copies), if applicable.
 - .pts (electronic copy and printout)
- CAiCE Files
 - .zip (electronic copy)
 - Printout of .txt file tracking all edits (optional). An unedited file (.dmp or TGO version) would suffice.
- Field Notes (as applicable)
 - Traverse, TLI and Trig level note sheets (original copies)
 - Control Schematic (if not included on traverse notes)
 - ROW / Property Point Schematic (tied points)
 - ROW / Property Point Search Schematic (points not found / obliterated)
 - Corner Records (filed IAW PLS Act)
 - To Reach Notes (set points and recovered points)
 - Peg Book Notes (copies of original notes)
 - Monument Rubbings / Photos
- Job Book Remnants
- Report of Field Survey Checklist

NROS: PROCESSING THE SURVEY REQUEST (SR) FROM THE FIELD SURVEY FOR THE REQUESTOR

- I. Receive the Field Survey
 - Field Survey routed from Field Senior to Office Senior.
 - Field Survey routed from Office Senior to Processor.
 - If the field survey is routed directly to the Processor, communicate this to the Office Senior and Field Senior.

- II. Check the Field Survey for the appropriate files:
 - .TSS file
 - Caice.zip file
 - New control "to reaches".
 - .DC file in lieu of .TSS or Caice.zip.
 - .TSS or Caice segment files, if segmented.

- III. Process the Field Survey
 - Create a Project file under the "SR" number in your "jobs" or "projects" file (usually on the **project server** or local drive).
 - Open the job in Caice (note: Caice naming conventions must be attended to, and the file(s) may need to be renamed).
 - Zone the files by segment (A=1) or by a personal process and keep notes on the zoning and segmentation. It is often useful to put the control and DTM boundary in 99 or 100 (Caice has 10,000 zones.).
 - If this project is attached to a previous file import the "new" field project into the "old" or master project.
 - Attach or detach the Caltrans Feature Table (Caltrans.ftb).
 - Attach or detach the appropriate cell file (mtcellib.ccl for caice).
 - Edit crossing lines and attend to other edits: large projects edit more easily with the feature and cell files detached (i.e. attach the Null files).
 - Create the DTM, after editing lines et al.
 - Edit the DTM triangles to the survey area (i.e. obscure triangles outside of the survey), and create a DTM boundary (zone boundary and associated points in a separate zone from the project: e.g. Zone 99,100,..., but not with control).
 - View (drive through) the DTM for anomalies such as holes and spikes that indicate HI/elevation or editing problems.

IV. Prepare the deliverables for the Requestor

- Create the following electronic files:
- .kcm file, optional (Microsoft Access file). This file is sometimes created earlier as it makes edits and importation into Caice easier in some cases.
- .dgn file (Microstation file). First remove the DTM from the screen. The .dgn exporter exports what is on the screen.
- For the .dgn, usually attach a Zone 2 metric seed file (or the appropriate seed file), and attach the mtcclib.cel cell file (note the difference from the Caice cell: mtcclib.ccl).
- Prepare a statement for the Requestor explaining your editing and zoning of these files, and any project concerns.

V. Deliver the Project to the Requestor

- E-mail the requestor and cc the appropriate parties, including the Office and Field Seniors, telling him/her where to find the project, and other particulars.
- Store the project on a drive or server where it can be accessed by the Requestor.
- <http://10.24.22.201> with delivery/Marysville, a delivery site
- <ftp://sv03surveys02/archives/d1/delivery/Marysville>, the same site by another address.
- Or an associated Project drive/server (the Gateway project drive is sv03s03).
- Give the requestor the name of the project and where it is stored (a double check bullet).
- Include the following files/documents:
 - Caice.zip, project file
 - .dgn
 - .kcm (optional, and may be more useful to the processor).
 - A Read-Me file with project particulars
 - Processor's office phone number.

VI. Archive the Project.

- Archive the project on the project drive (e.g.: on the project server: sv03/s01://suv1/03/EAfile#/SR# for District 3. As filing conventions vary slightly within the district and among the districts, the address is slightly variable (the EA may be "older" and have an "s" before the EA number).
- Archive the various files within the appropriate folder.
- Book: store a .pdf file of the appropriate field survey notes.
- Caice: store the processed Caice.zip file (usually SR.zip as 04108.zip).
- Control: control file for a .ctp, .ctl, or .dc file.
- MS: store the .dgn or microstation file here.
- .kcm: store the .kcm with the Caice file.
- Photo: store any photogrammetry files here (usually not the purview of the processor, but a good place to possibly find a photogrammetry file related to the project).
- Optional: Archive on a CD with all the above burned on it.
- Notify the Office Senior, or appropriate responsible party, that you have archived the project.

Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002

Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)

Construction / Surveys Expectations

Biddable and Buildable

Accuracy and consistency between plans, specifications and estimates

Complete and accurate plans (including existing field verified conditions and as-builts information)

Clear set of plans

Accurate quantities (with checked back up; drainage, electrical etc.)

Enough construction detail (especially if non – standard)

Accurate estimate (enough money to build job)

Project draws accurate bids that are near the engineer's estimate and at completion of construction, has only nominal contract change orders or claims, and has been built as designed

All items have a measurement and payment clause

No significant change in quantities due to design error or omissions

Appropriate number of working days

Construction work plans (CPM) clearly identifies permit windows including construction windows (environmental, weather, utility, traffic handling, etc.) and sufficient work days

Storm water Pollution Prevention Plan (SWPPP) provided

Survey information is correct and complete

Survey engineer's file agree with plan sheets

Staging plans and lane closure charts do not conflict

Contract documents clearly identify constraints (construction windows, environmental, cooperative agreements, permits, materials, utilities, right of way, etc.)

Permits, pre-construction permits obtained, construction phase permits identified and related information identified (especially environmental)

All right of way elements have been identified

Right type

Complete and final right of way certification

Enough room to do project

**Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002**

**Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)**

Utilities relocated prior to construction and identified clearly
Property owners have access during construction
Special features (driveways, fences, etc)

Safety

Safe work environment

Construction staging is realistic, minimizes delays and enhances workers safety
Compatible with adjacent projects and/or existing conditions*

Communication

Continuous communication through PS&E * (include a field review with construction) (Measures TBD)

Design support through completion of construction
All products delivered to RE at or before pre-construction meeting
Timely Construction support from all areas
Standardized meeting schedule and point of contact for design team during construction
Commitments are accurately and fully communicated in a timely fashion
RE file, permits, agreements, and mitigation list points of contact (from all functions)
RE file is complete
RE gets timely (24 hours) and valuable support during construction from design team

Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002

Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)

Policy and Procedures

All design exceptions have been approved before construction

Need and Purpose

Minimize change in scope (**Measures TBD**)

Construction / Surveys Performance Measures

- Number of CCO's due to design errors or omissions
- Number of CCOs for unidentified contract items
- Number of CCOs caused by missing or conflicting measurement and pay clauses
- Number of RFI's due to design errors or omissions
- Number of bidder inquiries
- Number of contract addendum due to design error or omissions
- Contractors bid within __% of engineers estimate
- Number of potential claims
- Collision rates (type of incidents) during construction
- Number of design exceptions during construction
- Number of Cost Reduction Incentive Proposal
- Number of survey RFI's

Operations Expectations

Need and Purpose

Improve traffic operations Scope issue**

Improve level of service Scope issue**

Safety

Meet drivers expectations for traffic delays and safety during construction and provide appropriate detours to minimize travel time

- Staging to minimize disruption and delays to drivers
- Staging to minimize safety issues
- Adequate access controls to minimize risk of collisions and traffic delays

**Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002**

**Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)**

Incident response is rapid, interval time to clean up is minimized
As appropriate maximize use of K Rail during construction
Minimize construction duration
Traffic management plan (maintain access) is fully implemented
COZEEP is fully implemented and in accordance with guidelines

Standards and Manuals

Design documents in accordance with Caltrans standards, policies and procedures

Traffic features installed according to specification and inspected for compliance
Implement contract streamlining measures with objective standards to reduce construction duration
Adequate signage and striping to meet drivers expectations and in accordance with standards
Meet operations standards

Efficient

Project features compatible with total system operations (ramp metering enforcement, signal phasing, etc)

Compatible with adjacent facilities

Operations Performance Measures

Measured traffic delays during construction do not exceed specifications
Number of public complaints due to unclear design features during construction
Number of public complaints due to unclear design features after construction
Traffic operations and level of service have been improved after construction
Traffic operations and level of service have not been exceeded prior to design life
Collision rates (type of incidents) reduced after completion of construction

Maintenance Expectations

Safety

Safe to operate and maintain

Safe to operate
Safe to maintain (enough work space, group roadside fixtures away from traffic or in shielded locations, minimize handwork)

**Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002**

**Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)**

Designed to allow easy and safe access for routine maintenance considering equipment constraints.

Easy and safe access for routine maintenance

Design for constraints of maintenance equipment to be used on the facility

Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002

Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)

Communication

Continuous communication through PS&E:

Field review with maintenance

Maintenance needs incorporated into PS&E

Long term commitments communicated to maintenance

Maintainable

Designed to provide long life features that are easy and inexpensive to maintain.

Designed to use readily available stock and minimize specialty items.

Post PS&E

Timely delivery of as – builds

Electronic version of physical inventory of maintainable items delivered at project completion

Maintenance Performance Measures

Safety

Minimize the number of maintainable items

Routine maintenance items are safely accessible

Communication

Commitments are accurately and fully communicated in a timely fashion

Routine maintenance has been incorporated into construction reducing the need for immediate maintenance in the construction zone

Maintainable

**Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002**

**Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)**

Minimize Life cycle cost & Maximize Life of facility as compared with similar facilities.
No net increase in maintenance inventory or operations
New design features do not require maintenance for 5 years (slopes, culverts, vegetation etc.)

Pre-PS&E

Flexibility in Funding

Post-PS&E

Maintainability review checklist is complete

Environmental Expectations

Low Impact

Project impacts are minimized and limited to the foot print for which environmental compliance has been effected.

Mitigation measures incorporated in PS&E

Avoid/minimize construction impacts

Construction impacts are limited to the foot print for which environmental compliance has been effected

Safe for the environment

Complete & Accurate

Mitigation measures and ESA are documented and incorporated into the PS&E.

Mitigation measures incorporated in PS&E

Show ESA's on plan

Biddable & Buildable

Environmental permits obtained or identified, and related information incorporated into the PS&E

Statutory requirements incorporated into the PS&E

Mitigation measures incorporated in PS&E

Work plan incorporates mitigation procedures (construction schedule window)

Meets statutory requirements

Complete permit request package

Permits obtained as appropriate in a timely manner

Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002

Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)

Has permits, environmental permits obtained, environmental phase permits identified and related information identified
No enforcement action

Communication

Environmental staff included in PS&E development.

Communication during process*

Invitation to pre-construction meeting

Global

Adequate time and resources to do environmental assessment

Post-PS&E

Include environmental on change order construction

Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002

Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)

Environmental Performance Measures

Low Impact

Mitigation measures incorporated in PS&E
Community consensus is maintained through construction

Biddable & Buildable

No increase in construction days or cost (CCOs and claims) due to environmental errors or omissions

No redesign (CCO) due to unidentified permits or impacts beyond previously defined footprint

No re-evaluation of environmental document or additional permits required to build the project as planned

No Enforcement Actions

All Requirements and commitments to regulatory agencies, permit requirements and mitigation measures incorporated in PS&E

Number of (preferably none) unanticipated permits required during construction

Number of (preferably none) environmental reevaluation based on change of footprint during construction or design

Number of (preferably none) increase in construction days and cost (CCOs and claims) due to environmental errors or omissions

No enforcement actions

Safety Expectations

Policies and Procedures

Meets design standards, GAD, and design exception fact sheets as appropriate **(TBD)**

Recoverable slopes (1:4 or flatter)

A forgiving roadside - fixed objects in the clear zone removed, relocated, made breakaway, or shielded

Design elements shall meet or exceed standards wherever practicable

All drainage take into account all reasonably predictable weather condition

Traffic management plan or traffic handling plans for all construction projects and account for disabled / emergency vehicles during construction

**Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002**

**Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)**

Safety

Safe for: construction, maintenance, traveling public, emergency vehicles, environment, pedestrians, and bicyclists

Safety that balances maintenance with traveling public

Meets drivers expectations during and after construction

Provide for disabled vehicles

Coordination with local law enforcement agencies

Safety Measures

Collision rate related to construction activities

Number of public complaints due to unclear design features during construction

Number of public complaints due to unclear design features after construction

Collision rates (type of incidents) reduced after completion of construction

Need for a safety project five years after completion of construction

Number of changes during construction (eliminate)

Design Expectations

Standards & Manuals

Appropriate design speed and standards for driver expectations and adjacent roadway sections

Meets Caltran's design standards

Appropriate design speed for driver expectation and adjacent roadway sections

Efficient

Balance customer expectations with cost effective design to achieve the best possible result

Makes users benefits available as early as possible

Cost effective design

Balance customer expectations as best possible

Makes users benefits available as early as possible

Low Impact

Balance socio-economic and environmental with project needs.

Consider economic, social, and environmental balance

**Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002**

**Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)**

Communication

Coordinate timely input between technical functions
Communicate and secure management concurrence on critical decisions and risk management
 Timely and appropriate technical input from other functions
 Management concurrence on risk design

Global

Technical functions provide deliverables on the agreed upon schedule that fits into the overall design for PS&E submittal
Each design shall be independently checked by a qualified engineer
Each plan sheet shall be signed by a professional engineer who is in responsible charge of the work.
 Meets reasonable schedule
 Separate or independent check of PS&E done

Pre- PS&E

 Fixed scope/scheduled and cost early in the project

Design Performance Measures

Standards & Manuals

Balance the need for the project with design standards using engineering judgement
Engineering Decisions Documented (Permanent History File)

- **Risk Design**
- **Independent Checks (Backup)**
- **Environmental Commitments**
- **Technical reports completed**

 In accordance with all Caltrans standards and policies
 Independent design check has been completed and documented
 Engineering Decisions Documented

Global

Maintenance, traffic and hydraulics are satisfied with the project
 Quantities calculations and backups are included in a complete RE file

**Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002**

**Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)**

Efficient

Design effort is proportionate to product completeness

Construction costs is balanced with project need

Minimal redesign effort

 Earned value

 Value analysis has been performed

 Minimal redesign effort

Communication

No unresolved conflicts between functional components of overall design

Overall design meets management expectations

Pre-PS&E

 Project Change Request (scope, cost, schedule) is not needed

Right of Way Expectations

Biddable and Buildable

Right of way requirements include all state facilities and cover all constructed work

 All easements are identified

 Right of way obligations shown on plans and specifications

Policies and Procedures

Railroad agreements are complete and comprehensive (Measures 1,2,3)

State's liability on utilities is minimized

 Utility agreements are complete and comprehensive

 All utilities relocation are complete prior to construction as applicable

 All utilities are in conformance with state policies and procedures

Caltrans Quality Management Program
PS&E Workgroup
15 – 16 October, 2002

Expectations and Performance Measures of PS&E Customers
(Draft Updated 15 –16 Oct)

Timely and complete right of way transmittals

Right of Way Performance Measures

Right of way delay cost

Right of way certification delays

Number of revisions by design after certificate of sufficiency

Number of revisions by design after right of way certification

No unidentified utilities encountered on project

*Global Expectations

Need and purpose should be stated in clear, measurable, and should relate to better service, greater safety, or preserving the structural integrity of a facility

Meets standards and manuals

Communication plans with appropriate functions

Safety

Consistent with regional plans, customer expectations and other projects in area

Periodic PDT meetings take place throughout PS&E and include all stakeholders

Global Performance Measures

Keep orderly and complete project files

Check design against need and purpose at appropriate milestones

Accurate meeting minutes and decisions documented

SURVEY FILE CHECKLIST

Co. Rte. KP (PM): _____ EA: _____
Project Limits: _____
Project Manager: _____ Phone: _____
Design Senior: _____ Phone: _____
Project Engineer: _____ Phone: _____
Design Team Contacts: _____ Phone: _____
_____ Phone: _____
_____ Phone: _____

1) **Horizontal Datum and Existing Alignment History**

- Metric coordinates, bearings and grid distances are based on:** (see options below)

California Coordinate System - Zone (1 – 6): _____

- CCS83 (1991.35)
 CCS83 (pre-HPGN)
 CCS27 (USC&GS 1965)
 Other: _____

- Method alignments were generated:**

- Existing CCS83 alignments from as-builts
 "Best-fit" to CCS83 photogrammetric topographic data
 "Best-fit" to CCS83 survey topographic data
 Generated by Surveys Office
 Other: _____

If metric stationing is based on English as-builts identify a major tie point:

Metric station _____ **is equivalent to English station** _____.

- Identify or deliver all as-built documentation referenced for existing alignment.

2) **Vertical Datum**

- Elevations are based on** (see options below)

- NGVD29
 NAVD88
 Other: _____

3) **Design Documentation and Electronic Format Design Files**

The electronic formatted deliverables requested in the following table are recommended files known to be compatible with Caltrans current Design software, Microstation and CAICE.

Discuss alternate electronic formats with the District Surveys Office during the Constructability Review Process.

SURVEY FILE CHECKLIST

Required Deliverables – Hardcopy (Electronic Files as noted)	Date Required	Date Provided	Remarks
1. Preliminary Plans (See Section 5 1a & 2a)	Prior to PS&E		
2. Final Contract Plans (See Section 5 2b) (Do we want/need electronic?) <input type="checkbox"/> Reduced (11" x 17") <input type="checkbox"/> Full size (on request)	RTL		
3. Base Map – Electronic Format Only (See Section 5 2a) <input type="checkbox"/> Roadway, structural, and drainage layouts, and contours	RTL		
4. Roadway Alignments (See Section 5 1a or 1b) <input type="checkbox"/> Main lines, Ramps, & Branch Connections <input type="checkbox"/> Frontage Roads <input type="checkbox"/> Detours <input type="checkbox"/> Other _____	Preliminary 30% Updates 60% & 95% Final PS&E		
5. Structural Layout Lines (See Section 5 1a or 1b) <input type="checkbox"/> Retaining and sound wall LOL's <input type="checkbox"/> Bridge abutment and wing wall LOL's <input type="checkbox"/> Curb returns and pullouts not parallel with roadway alignments <input type="checkbox"/> Pipes and culverts over 60 m long or those containing curves and angle points	Preliminary 30% Updates 60% & 95% Final PS&E		
6. Profiles for items requiring vertical control for construction (See Section 5 1a or 1b) <input type="checkbox"/> Roadways <input type="checkbox"/> Median Barriers <input type="checkbox"/> Retaining Walls <input type="checkbox"/> Curb Return gutters <input type="checkbox"/> Ditch <input type="checkbox"/> Other _____	Preliminary 30% Updates 60% & 95% Final PS&E		
7. Rights of Way (See Section 5 1a or 1b) Final traverse and R/W Maps approved by R/W Engineering.	PS&E		

SURVEY FILE CHECKLIST

Required Deliverables – Hardcopy (Electronic Files as noted)	Date Required	Date Provided	Remarks
<p>8. Roadway Cross-Sections (See Section 5 1a & 1c)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Hardcopy on request <input type="checkbox"/> Minimum of 20 m station intervals <input type="checkbox"/> Minimum of 10 m station intervals <ul style="list-style-type: none"> ▪ On curves with a radius equal to or less than 300 m ▪ When the profile grade is less than 0.3%, the minimum profile grade allowed without an exception <input type="checkbox"/> Include a cross-section for all begin/end of curves, roadway tapers, roadway pullouts, angle point locations, begin/end high side super, etc. <input type="checkbox"/> Include all planes necessary for staking finish roadbeds, including slopes, benches, and ditches <input type="checkbox"/> Slope rounding when applicable <input type="checkbox"/> Include all cross slopes, including areas of “Pavement Plane Projection” or “Match Existing Cross Slope” <input type="checkbox"/> Include offsets to R/W if the slope catch point is within 3 m of the R/W <input type="checkbox"/> Tapered sections at on/off ramp connections shall be included in the main line listings up to and including the nose (or end) of the gore paving area. The remaining portion of each ramp is to be listed separately. <input type="checkbox"/> When two alignments are converging or diverging, provide a match line between both slope stake listing segments until the alignments become completely separated. 	<p>Preliminary 60%</p> <p>Updates 95%</p> <p>Final PS&E</p>		
<p>9. Roadway Slope Stake Listings (1 or 2 per page) (See Section 5 1d)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Millimeter accuracy for both horizontal and vertical labels <input type="checkbox"/> Finish Grade only <input type="checkbox"/> Minimum of 20 m station intervals <input type="checkbox"/> Minimum of 10 m station intervals <ul style="list-style-type: none"> ▪ On curves with a radius equal to or less than 300 m 	<p>Preliminary 60%</p> <p>Updates 95%</p> <p>Final PS&E</p>		

SURVEY FILE CHECKLIST

Required Deliverables – Hardcopy (Electronic Files as noted)	Date Required	Date Provided	Remarks
<ul style="list-style-type: none"> ▪ When the profile grade is less than 0.3%, the minimum profile grade allowed without an exception <input type="checkbox"/> Include a station listing for all begin/end of curves, roadway tapers, roadway pullouts, angle point locations, begin/end high side super, etc. <input type="checkbox"/> Include all planes necessary for staking finish roadbeds, including slopes, benches, and ditches <input type="checkbox"/> Slope rounding when applicable <input type="checkbox"/> Include all cross slopes, including areas of “Pavement Plane Projection” or “Match Existing Cross Slope” <input type="checkbox"/> Include offsets to R/W if the slope catch point is within 3 m of the R/W <input type="checkbox"/> Tapered sections at on/off ramp connections shall be included in the main line listings up to and including the nose (or end) of the gore paving area. The remaining portion of each ramp is to be listed separately. <input type="checkbox"/> When two alignments are converging or diverging, provide a match line between both slope stake listing segments until the alignments become completely separated. 			
10. Documentation identifying the horizontal alignments, profiles, and cross section files delivered in electronic format. <i>(See Section 7 - Electronic File Reference Listing)</i>	PS&E		

4) Required Items on Contract Plans

THESE ITEMS MAY BE MOVED TO THE PS&E CHECKLIST SINCE THEY ARE REQUIRED WELL BEFORE PS&E

The following items are important in the construction phase of a project and should be shown on the Contract Plans.

CONTRACT PLAN REQUIREMENTS
1. Roadway alignment data for all stationed lines (main lines, ramps, frontage roads, detours, branch connections, etc.) to include: <ul style="list-style-type: none"> <input type="checkbox"/> Stationing at all angle points and at the beginning and endings of curves <input type="checkbox"/> Station Equations

SURVEY FILE CHECKLIST

CONTRACT PLAN REQUIREMENTS
<input type="checkbox"/> Line & Curve data
<p>2. Drainage Facilities – including Ditches & Channels</p> <p>a. Alignment References (Station/offset for horizontal and vertical angle points, end points, and curve data of the drainage facility.)</p> <input type="checkbox"/> Cross-sections <input type="checkbox"/> Structure Locations (Provide station/offset to the centerline point at the flow line of all structures.) <input type="checkbox"/> Skews (if not 90°) <input type="checkbox"/> Crosscheck Drainage Plan, Profile, Details, and Quantity Sheets for consistency.
<p>3. Bridge Structures</p> <input type="checkbox"/> Abutment and wing wall lay-out lines and references to footings <input type="checkbox"/> Abutment fills Needs more explanation <input type="checkbox"/> Pier/Bent alignments
<p>4. Structural Lay-out Lines (Provide station/offsets for angle points, begin/end curves, and end points, curve data, bearings, and distances)</p> <input type="checkbox"/> Retaining Walls and Noise Barriers (Berms) <input type="checkbox"/> Benches <input type="checkbox"/> Curb Returns <input type="checkbox"/> Other
<p>5. Minor Structures Locations</p> <input type="checkbox"/> Signs <input type="checkbox"/> Signals <input type="checkbox"/> Lighting Foundations <input type="checkbox"/> Other _____
<p>6. Utilities</p> <input type="checkbox"/> Any specifics?
<p>7. Taper, Transition Curves, and Flare Locations (Sufficient data to precisely define and differentiate tapers and flares: begin & end roadway tapers and super transitions, radius point, offset, and parabolic curve base line distances, offsets, and direction.)</p> <input type="checkbox"/> Guard Rails <input type="checkbox"/> Pavement Edges <input type="checkbox"/> Pull outs <input type="checkbox"/> Other _____
<p>8. Profiles</p> <input type="checkbox"/> Roadways <input type="checkbox"/> Curb & Gutter <input type="checkbox"/> Median barriers <input type="checkbox"/> Ditches or Channels <input type="checkbox"/> Other _____

SURVEY FILE CHECKLIST

CONTRACT PLAN REQUIREMENTS
9. Super Elevations (Sufficient data to precisely define begin & end of transitions and grade.)
10. Construction Details - Staking Plans shown in detail when slope stake listings do not adequately depict the area to be constructed.

5) Recommended Digital File Formats

1: Recommended CAiCE files:

All of the Geometry Chains, Profiles, and Cross-sections that are required in the construction of the project should be delivered to the District Surveys Office with a completed Electronic File Reference Listing, found in Section 7 below.

- a. CAiCE Project Archive (*.ARC or *.ZIP)
A CAiCE Project Archive should include the Existing Survey data and **only** those objects required in the construction of the project. Extraneous data should be removed from the project before archiving.

Included objects:

- Geometry Chains and associated Points and Curves
- Profiles
- Cross-sections
- Design Digital Terrain Models.

Please specify if WinZip is used to package the project files instead of the CAiCE Archive Utility.

- b. CAiCE Database Explorer File (*.KCM)
A CAiCE Database Explorer File should include only those objects required in the construction of the project. Extraneous data should not be included in the delivered KCM file.

Included objects:

- Geometry Chains and associated Points and Curves
- Profiles

- c. CAiCE End Area File (*.EAR)
Only the final Cross-section files required in the construction of the project should be delivered.

- d. Microsoft Word document (*.DOC) and/or Slope Stake Note Generator 3.1 Report File (*.SSR)
Slope Stake Listings must be generated from the final Cross-section files required in the construction of the project.

2: Recommended Microstation Design files (*.DGN):

- a. Basemap and associated design files with the coordinate design plane still intact, prior to submittal for PS&E. At a minimum the file(s) should contain roadway, structural and drainage layouts, and any contours created for the construction of the project.
- b. Contract Plans as submitted to PS&E (*Coordinates may or may not contain the values based on the California Coordinate System*). **Do we really need this????????????????????**

6) Typical Grade Break Headers

We still need to work with CADD about standardizing these

SURVEY FILE CHECKLIST

BSW - Back of Sidewalk
CONT or **CON** - Contour-grading point
CP - Catch Point (Cut or Fill)
DIKT – Top of Dike
EB – Edge of Barrier
EOD – Edge of Deck
DEP - Designed Edge of Pavement
DES - Designed Edge of Shoulder
DETW – Designed Edge of Travel Way
DFL - may designate any Designed flow line of a ditch, curb, or dike
DTOP – Designed Top of Ditch
GTR - Gutter
HP or **HNG** - Hinge Point
LIP - Lip of curb & gutter
LOL - Layout Line for walls
(Use Mainline, Gore area or Ramp alignment name for layout line)
PG - Profile Grade
R/W – Right of Way
S/C– Sawcut
TC - Top of Curb
TOE - Toe of Sound Berm/Ditch
TOP - Top of Sound Berm/Ditch

(If there is more than one plane of the same callout then number the planes if possible. For example, DETW1, DETW2, or HP1, HP2 etc.)

SURVEY FILE CHECKLIST

7) *Electronic File Reference Listing*

Co. Rte. KP (PM): _____ EA: _____

Full un-restricted path to the electronic format project data files:

Alignment/Layout Line		Profile		CAiCE Deliverable	Cross Section & Slope Stake Notes	
Alignment Name	CAiCE Name	Profile Name	CAiCE Name	KCM file name	EAR file name	DOC &/or SSR file name
Additional Comments: _____						
Additional Comments: _____						
Additional Comments: _____						
Additional Comments: _____						
Additional Comments: _____						