**SANDIA NATIONAL LABORATORIES**
**CIVILIAN RADIOACTIVE WASTE MANAGEMENT**
**TECHNICAL PROCEDURE (TP)**

**TP-266**

# Development of Thermal-Mechanical Data from the Drift Scale Test

**Revision 00**

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## REVISION HISTORY

| Rev. | Summary of Changes |
|---|---|
| 00 | Initial Issue |

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## 1.0 SCOPE

This Sandia National Laboratories (SNL) Technical Procedure (TP) describes the methodology for the submittal of the acquired and developed mechanical data from the Drift Scale Test (DST) for the Yucca Mountain Project (YMP). The DST is located in Alcove 5 of the Exploratory Studies Facility (ESF). On a monthly basis, the Test Coordination Office (TCO) creates and distributes two duplicate Compact Disks (CD) that contain data from the Data Collection Systems (DCS) of the DST for a time interval of one month (30 calendar days). Two types of ***acquired*** mechanical data are written on the CD: 1) displacement data that are acquired from multi-point borehole extensometers (MPBX) collared within and outside the DST Heated Drift, and data from cross-drift extensometers (CDEX) installed inside the Heated Drift; and 2) strain data from strain gages mounted to the concrete liner in the back end of the Heated Drift. Additionally, temperature data from thermocouples (TC) are also included on the CD. Two types of ***developed*** mechanical data must be derived from the ***acquired*** mechanical data. The displacement data must be corrected for the thermal expansion of the Invar connecting rods that connect the borehole or drift wall anchors to the displacement-measuring device. The strain data must be corrected for the thermal expansion of the strain gage. Four sets of mechanical data (the two sets of ***acquired*** data, and the two sets of ***developed*** data) are then submitted to the Technical Data Management System (TDMS) semiannually.

This TP applies to all YMP personnel who will be trained to produce the ***developed*** DST mechanical data.

The two types of displacement gages, MPBXs and CDEXs, will usually be referred to as simply as MPBXs in the remainder of this procedure, as the methods for adding correction for thermal expansion to them are identical.

## 2.0 OBJECTIVE

This Technical Procedure defines the process to develop thermally-corrected mechanical data from the DST monthly data CDs, and to submit the acquired and developed data to the TDMS. The acquisition of the field data is performed by the TCO under its own set of scientific notebooks and procedures. The data must be corrected for thermal expansion effects to obtain the true deformation of the host rock or concrete.

## 3.0 RESPONSIBILITIES

The Principal Investigator (PI) has responsibility for ensuring that all information obtained in the ESF is in accordance with SNL’s Quality Assurance Implementing Procedures (QAIPs) and with the Office of Civilian Radioactive Waste Management (OCRWM) Quality Assurance (QA) Administrative Procedures (AP), and that all individuals collecting data are properly trained.

PIs of all activities who choose to work to this procedure shall ensure compliance. Each PI shall require that personnel working to this procedure have appropriate qualifications and experience to satisfactorily perform the work described. PIs are responsible for preparation and revisions of this TP, and for the maintenance and submittal of records that derive from its implementation. Documentation of work shall include receipt acknowledgement forms, data reports, and records road maps in YMP records associated with this work, and shall fulfill the QA requirements.

## 4.0 EQUIPMENT

The only equipment required to perform the work described herein is a IBM-compatible personal computer and operating system Windows NT 4.0 installed with Microsoft Excel and current qualified versions of twoYMP codes: READDATAFILES, Version 1.00 (Software Tracking Number 10566-1.00-00, Windows NT 4.0); and EDITOR, Version 1.00 (Software Tracking Number 10568-1.00-00, Windows NT 4.0).

## 5.0 METHOD

The sequence for the submittal of the developed DST mechanical data is the following:

1. Receive the acquired data CD from the TCO, and return the receipt acknowledgment form to the TCO.
2. Read the DST data from the acquired data CD using READDATAFILES, which sorts them by instrument type and borehole or surface location, and append them to existing comma separated value (.csv) files.
3. Check the acquired data for bad data or mistakes. The most important part of this step is the identification of failed thermocouples that might be used for the calculation of the corrected displacement of the MPBXs.
4. Correction of MPBX displacement data for the thermal expansion of the Invar connecting rods.
5. Correction of strain gage data for the thermal expansion of the strain gages.
6. Checking of the final thermally-corrected data.
7. Creation of the files to be submitted to the TDMS (data files, accompanying report).
8. Technical review of the data package.

### <u>5.1 Receipt of the DST Data CD</u>

On a monthly basis, the TCO creates and distributes two duplicate Compact Disks (CD) that contain data from the Exploratory Studies Facility (ESF) Data Collection Systems (DCS) Drift Scale Test (DST) for a time interval of one calendar month. The CD is labeled with a unique identification number, CD*xx*DST, where *xx* is a two-digit number representing the sequence in which the CDs have been released. (For example, a recent CD labeled sent to SNL was labeled CD72DST, and included data dated from November 1, 2003 through November 30, 2003.) The data were collected in accordance with Field Work Package FWP-ESF-96-001 and Scientific Notebook SN-LANL-SCI-266-V1 (LA-EES-7-NBK-01-002) “Drift Scale Test Data Collection System Operations #3”. Data collected by the DCS are sorted by instrument name, date, and time of reading, in a comma separated value (.csv) formatted file named TCODST*yyyymm*.dds, where *yyyy* is the year and *mm* is the month (for the previous example, the file name is TCODST200311.dds ).

The acquired data on the compact disks include DCS raw data and the DCS converted engineering unit data from the DST. The DCS processes for calculating the engineering unit data have been reviewed and accepted by the PIs. All of the DCS-recorded data are included on the CD, including much that is not of interest for the purposes of the SNL DST data submittals (e.g., RTD temperature measurements, humidity measurements, etc.).

A receipt acknowledgment form for the transmitted information is included in the shipment, usually in hard copy and also as an electronic document on the CD. This form provides traceable chain-of-custody of DST data; it shall be signed and dated by the PI and returned to the TCO at the address specified on the form.

## 5.2 Procedure to Read the DST Data from the Distribution CD

This section describes the algorithm to read and process the Drift Scale Test (DST) data. The code READDATAFILES, Version 1.00 (Software Tracking Number 10566-1.00-00) is a simple utility code used to read and sort DST data. READDATAFILES reads the data from the CD distributed monthly by the TCO, and sorts the data into separate files based on type of data (temperature, displacement, etc.) and, where applicable, borehole number. The code READDATAFILES is a Pascal language code run on a PC. The primary quality-affecting implication of this software is to sort out the displacement data from extensometers from the DST so they may be corrected for thermal expansion by the code EDITOR, Version 1.00, and also sort the strain gage data for correction of thermal expansion in a Microsoft Excel worksheet. The data from the CD reflect the measured value on each instrument. These data are submitted as ***acquired*** data to the TDMS.

The code READDATAFILES is currently found on Steven Sobolik's personal computer, SNL property number S431942, under the file D:\YMP\dst\data\ReadDataFiles4\ReadDataFiles.exe. When the code is started, a pop-up window is created (shown in Figure 1). The CD filename should be typed in under "Input files". The code reads the files on the CD, sorts the data accordingly, and appends the data to existing .csv data files in the directory D:\YMP\dst\data\Processed data\. The pop-up window indicates CD file size, run time, and run errors (if any). It is recommended that before READDATAFILES is run, the existing .csv files in the Processed data directory be copied into a Winzip (".zip") file, in case a run error occurs and the code should be re-run.

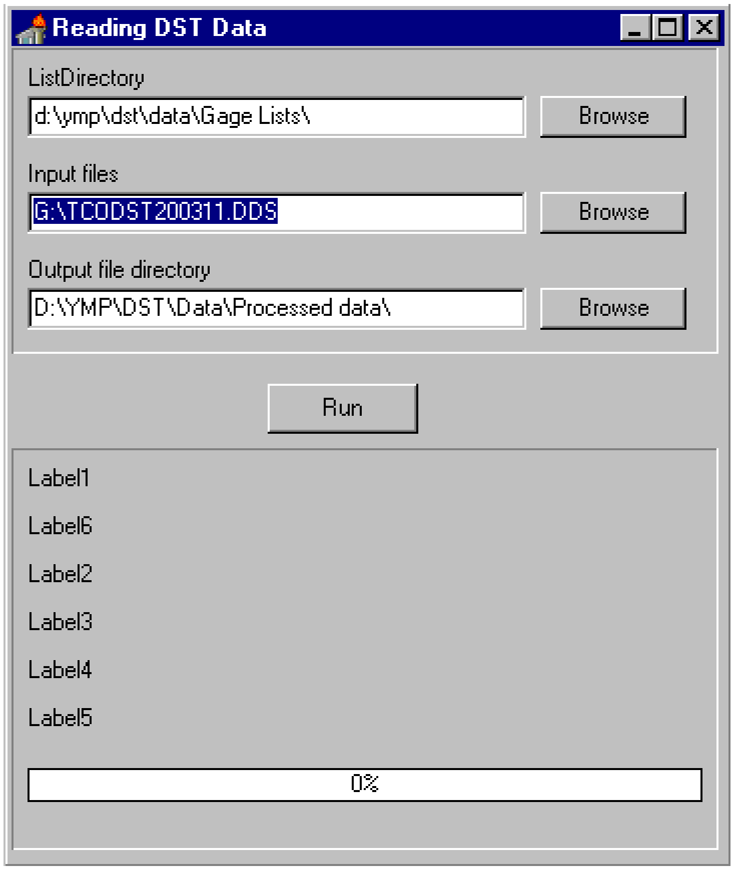


Figure 1. READDATAFILES Pop-Up Window

The code READDATAFILES is in the YMP software configuration management system per the controlling procedure *Software Management* AP-SI.1Q. There is only one equation used in READDATAFILES. This equation reads the date/time stamp of each data entry, and subtracts from it the data/time value of the initiation of the test (12/3/1997, 18:35 GMT) to produce a time value based on days (in decimal form) since test initiation. All of the DST data are sampled hourly, and the data on the CD represent four of each day's data samplings (i.e, the data on the CD are at six-hour intervals, in a pattern established prior to the initiation of the test). Each individual data sample reads data from over 2000 gages, and this process can take up to 10 minutes, so each data point on the CD has a different date/time stamp. For the sake of simplicity in analyzing the data, the code READDATAFILES gives a single time value for all the data gathered from the same sample.

## 5.3 Checking the Acquired Data

The third step is to check the acquired data for bad data or mistakes. This step is done in a series of substeps:

1. Import the acquired temperature, displacement, and strain data from the updated .csv files into corresponding Excel files. The files are listed in Table 1. This process is done in Microsoft Excel, where the new data is copied from the .csv files and added to the bottom of the Excel (".xls") files.
2. Examine the MPBX temperature files and note any locations and times of failed thermocouples that might be used for the calculation of the corrected displacement of the MPBXs. This information will be used in Step 4 described in Section 5.4. Failed thermocouples are identified

either by the word "BAD", which means they have definitely failed; a null or empty value, which means there is no reading from it at that time; or an impossible value, such as anything over 300°C or below 15°C.

3. Note locations where either MPBX or strain gages data have gone bad, which will be noted definitively by either the word "BAD" or by a null or empty value. Also note other areas of possible bad data, which may be indicated by a lot of noise. Sometimes this noise represents true data; noisy thermocouples in the same borehole indicate water recirculation within a borehole, which also causes oscillation of the displacement gage readings. At other times, the oscillations in data are due to a malfunctioning gage or other signal problems. These observations will be used in Step 7, described in Section 5.7.

Table 1. File Locations of Acquired DST Data

| Data Type | .xls File (Located in Directory D:\Excel\dstdata\) | .csv File (Located in Directory D:\YMP\dst\data\Processed data\) |
|---|---|---|
| Displacement | mpbx-anc.xls | mpbx-anc.csv; cdex.csv |
| Temperature | mpbx-tc-hd.xls (MPBXs collared in Heated Drift)<br>mpbx-tc-aod.xls (MPBXs collared outside Heated Drift) | mpbx-tc.csv; cdex.csv<br>mpbx-tc.csv |
| Strain (also temperatures from related TCs) | rsg.xls | rsg.csv; surf.csv |

## 5.4 Correction of MPBX Displacement Data for Thermal Expansion of the Invar Rods

This section describes the algorithm used for correcting the multi-point borehole extensometers (MPBX) displacement data from the Drift Scale Test for the thermal expansion of the Invar connecting rods. This algorithm is incorporated in the code EDITOR, Version 1.00 (Software Tracking Number 10568-1.00-00), which is a Pascal-language code compiled into an executable by the programming language software Borland Delphi Professional Version 5.0 (Update 6.18).

MPBXs were installed in 17 boreholes both within and outside the Heated Drift to monitor rock mass movement during the DST. Five of the boreholes collared outside the Heated Drift were instrumented with six-anchor MPBXs.  Each of the C-ring anchors was connected to an MPBX head (located at the borehole collar) via Invar connecting rods. A vibrating wire displacement transducer is attached to each connecting rod to measure the relative displacement between the anchors and MPBX head, which is fixed and sealed into the borehole collar. In a similar fashion, twelve boreholes were drilled into the surrounding rock mass from within the Heated Drift itself. Each of these boreholes was instrumented with an MPBX that included four anchors with Invar connecting rods. The displacements are measured relative to the MPBX heads, which are sealed into the borehole collar. Displacements are measured using linear variable displacement transformers (LVDTs) fixed in each head. In addition, two CDEXs were installed with LVDTs in the drift, to measure vertical and horizontal closure of the drift. For all of these sensors, the displacement data given by the instrument (i.e., the acquired data) represents the actual displacement between the gage and the anchor to which the gage is connected by an Invar connecting rod. The MPBXs are all equipped with thermocouples to provide temperature measurements along the lengths of the Invar rods.

The purpose of these sensors is to measure the displacement of the rock mass due to the added heat in the Heated Drift. The thermal expansion of the Invar rods that connect MPBX anchors to the displacement sensors located in the MPBX head (collar) and the CDEXs must be added to the measured displacements to obtain the actual rock mass displacements. Because the rods expand due to heating, the displacements measured by the gages appear to be smaller. The actual rock mass displacements are therefore the measured displacements plus the rod expansion. The rod thermal expansion is calculated from temperatures measured on the rods, measured rod lengths, and known Invar thermal expansion coefficients (SNL laboratory determined, DTN: SNL22100196001.003). The calculated rod thermal expansion is:

$$\delta = \alpha \Delta T \ell, \text{ where} \qquad (1)$$

$\delta$ = MPBX connecting rod thermal expansion (m)
$\alpha$ = Thermal expansion coefficient for Invar ($10^{-6}$/°C)
$\Delta T$ = Change in temperature from initial (approximately 25°C)
$\ell$ = Invar rod segment length (m)

The cumulative thermal expansion for each successive anchor for the MPBXs is the sum of the previous anchors' thermal expansions. This cumulative calculation is used because a temperature gradient is expected along the length of the MPBXs. For this calculation, the "average" temperature change over each rod segment length is used. The Invar thermal expansion coefficient has been measured in the laboratory by SNL and been found to be somewhat temperature dependent. A fourth-order polynomial was fit to the Invar expansion data to calculate the thermal expansion coefficient at a given temperature:

$$\alpha = 1.3363 + 9.5806e\text{-}3{*}T - 8.9220e\text{-}5{*}T^2 + 1.2210e\text{-}6{*}T^3 - 1.9152e\text{-}9{*}T^4, \qquad (2)$$

where T is temperature in degress Celsius in the range of 20°C to 230 °C. These equations are used in the code EDITOR to calculate the corrected MPBX displacement data. The calculations performed by the code EDITOR with the DST data have been checked by doing the following: 1) checking the anchor and thermocouple (TC) locations to make sure they correspond to the as-built data; 2) checking the algorithm for computing thermal expansion coefficient for each section of Invar or carbon fiber rod; 3) checking the algorithm for temperature averaging along each rod, including those times when a TC is non-operative. The code performs the algorithms as intended.

The substeps for performing this procedure are as follows:

1. If an MPBX thermocouple has failed, there are three options (to be chosen from at the discretion of the PI). Option A or C should be done at this point; option B should be performed later in Substep 5.

   A) If the TC failure is denoted with the word "BAD" in the temperature file, the code will automatically not attempt to use it in calculating the average temperature for the corresponding section of Invar rod. The equation for calculating the average temperature over a section of Invar rod is adjusted to use only temperature from operating TCs for that interval. If all the values for a TC are BAD (that is, there are no occasional numerical values), the first option is to do nothing, and allow the code to operate automatically. This is usually the best option.

B) If the TC has gone "BAD", but has occasional numerical values, or if the TC is producing numbers but they are all bad ones (e.g., wildly oscillating, over 250C, below 20C, etc.), one option is to designate the TC as bad in the file D:\YMP\dst\data\Gage Lists\BadGages.lst. An example of such a designation in this file is:

```
ESF-HD-179-MPBX12-TC-8,1985.   ,
```

where the number referes to the date when the TC goes bad. This will prevent the wild fluctuation of the temperature reading from being expressed in the corrected displacement. If this option is chosen, **do not exercise it until substep 5 below**.

C) Another way of overriding the problem in option B is to assign a substitute TC in the file D:\YMP\dst\data\Gage Lists\MPBX-TC substitution.lst, and designating the time in days from heater initiation when this change should take place. An example of such a designation in this file is:

```
ESF-HD-178-MPBX11-TC-6,ESF-HD-180-MPBX13-TC-6,1953.25 ,
```

where the first TC listed is the bad one, the second is the TC from which to obtain the substitute temperature value, and the number is the time in days after heater initiation to implement the change. The code will use the original TC until the expressed time, then switch to the new temperature. This option is most important for failed TCs at the collar of a borehole (TC-1) or at the deep end of the borehole (TC-8).

2. Run the program file D:\YMP\dst\data\mpbx2\editor.exe. When the pop-up window comes up, click on the "Run" button.
3. Open up the Excel spreadsheet D:\Excel\dstdata\corrmpbx.xls in Microsoft Excel.
4. Open up the .csv file D:\YMP\dst\data\Processed data\Corrected MPBX data.csv. Copy the new times and displacements for the MPBXs to the bottom of the worksheet "CORRMPBX".
5. At this point, examine the data in corrmpbx.xls, and using the notes from the prior examination of failed TCs, note if the corrected displacements are adversely affected by TCs with sporadic or incorrect values. If option B is necessary, edit the file BadGages.lst, and re-run EDITOR. The code EDITOR re-writes the entire file "Corrected MPBX data.csv" every time it is run, and it re-calculates the entire history of corrected displacement for a particular anchor if one of its TCs has been declared bad. Repeat substep 4, but copy over to corrmpbx.xls only the data for the specific anchors, and after their corresponding designated times of TC failure.
6. The corrected data have been updated. Save the file corrmpbx.xls.

## 5.5 Thermal Correction of Strain Gage Data

This section documents the procedure used for computing a thermal correction to the Drift Scale Test (DST) strain gage measurements in the cast-in-place (CIP) concrete sections located at the west end of the Heated Drift. This algorithm is incorporated in a Microsoft Excel spreadsheet format. The spreadsheet, rsg.xls (see Table 1), documents the computational procedure used to convert the raw strain readings to the corrected values. The correlation of strain gages to the corresponding temperature measurements is documented in this file as well.

The strain gages were manufactured by BLH Electronics and installed by SNL. As-built locations and technical specifications for strain gage measurements made for the DST are presented in detail in DTN: SNF38040197001.001. Measured strains were corrected for thermal effects on the strain gage itself using a temperature-correction equation and constants supplied by the manufacturer. An additional thermal correction due to the thermal expansion of the temperature-compensated strain gages was also required. These strain gages have thermal expansion characteristics designed to provide a measure of mechanically-induced strain on 304 stainless steel. In this case, the thermally corrected output from the strain gage is matched with the thermal expansion characteristics of the stainless steel, and should result in little or no change in strain as the unconstrained coupon is heated. However, to measure the total strain of the specimen, one must include the thermal expansion of the strain gage itself. The equation used to obtain the total strain measured by the strain gages is

$$\varepsilon_{actual} = \varepsilon_{meas} - \varepsilon_T + \varepsilon_{sg} + \varepsilon_?, \quad (3),$$

where

$\varepsilon_{actual}$ = actual, or total, measured strain deformation of the concrete

$\varepsilon_{meas}$ = strain calculated from the measured voltage for ¼-bridge strain gage

$\varepsilon_T$ = temperature-induced apparent strain, corrected by manufacturer-supplied equation based on temperature

$\varepsilon_{sg}$ = strain correction calculated by $\alpha_{sg} \times \Delta T$, where $\alpha_{sg}$ is the thermal expansion coefficient of the temperature compensated strain gage (for these gages, $\alpha_{sg}$ = 8.5 µstrain/°F = 15.3 µstrain/°C, from BLH Electronics)

$\varepsilon_?$ = unknown strain correction due to other phenomena (difference between concrete and strain gage temperature-compensated for stainless steel, bonding effectiveness, etc.)

The raw strain data reported by the TCO on the distributed CD is determined by using the first two right-hand terms in Equation 3 (i.e., $\varepsilon_{actual} = \varepsilon_{meas} - \varepsilon_T$ ). This shortened equation is valid for measuring mechanical strain on a sample with the same thermal expansion characteristics as the strain gage, but is incorrect for determining the total strain on a heated sample with a different thermal expansion (e.g., concrete). To obtain the total strain (thermal + mechanical), the thermal expansion coefficient of the strain gage multiplied by the change in temperature should be included in the equation. Therefore, the thermally-corrected value of strain is obtained by adding the strain value determined by the TCO to the thermal expansion of the strain gage. Both the acquired and corrected values of strain are submitted to the YMP Technical Data Management System. (Note: The error term given in Equation 3 ($\varepsilon_?$) is included to indicate that such additional corrections were evaluated and, at this time, were found to have no or negligible effect.)

The substeps for performing this procedure are as follows:

1. Open up the Excel spreadsheet D:\Excel\dstdata\rsg.xls in Microsoft Excel.
2. Open up the .csv file D:\YMP\dst\data\Processed data\surf.csv. Copy the new times and temperatures for thermocouples SURF-TC-31 through SURF-TC-45, inclusive, to the bottom of the worksheet "temps" in rsg.xls.
3. Open up the .csv file D:\YMP\dst\data\Processed data\rsg.csv. Copy the new times and strains for the strain gages to the bottom of the worksheet "Uncorrected Strain (CD)" in rsg.xls. Note that the Excel Worksheet does not have columns for strain gages RSG-5-DIA, RSG-6-DIA, RSG-10-DIA, and RSG-12-CIR, whereas the .csv file does. Do not copy these columns to the spreadsheet file; these gages were inoperable from the time the test was initiated. Close the .csv files so they may not be accidentally edited.
4. Go to the sheet "Strain" in rsg.xls, and copy the new times to the bottom of the first column. Copy the cells B6 through AT6, which contain the thermal correction formula for each individual strain gages, to the new rows at the bottom of the sheet. Once the corrected strains are

in place, perform a "Copy/Paste Special/Values only" on the new cells to replace the formulas with the calculated values. (Keep the formulas in row 6 unchanged!) This saves disk space and makes the values easy to transfer to the final submittal file.

5. Save the file rsg.xls.
6. Open the Excel spreadsheet D:\Excel\dstdata\rsgplots.xls and copy the new times and corrected strains to the bottom of the sheet "Strain", so that plots of the data may be seen in the sheet "Charts".

## 5.6 Checking of the Final Thermally-Corrected Data

Use the plots in the Excel spreadsheet files corrmpbx.xls and rsgplots.xls to check the validity of the final data. Signs that the data in the spreadsheet files are not correct include:

- A shift in the data for a specific gage at the time step when the new data set starts - most likely due to a copying mistake.
- A sudden onset of unusual behavior. This is probably correct, due to either changes in thermal-mechanical behavior or to problems with one of the gages. If this happens, visually inspect the earlier Excel and .csv files, and if necessary, the original file on the CD, to determine that the data are indeed correct from one step to another.
- If there are any unexplained problems, check the CD for any documents detailing errors or bad data discovered during that month.

## 5.7 Creation of the Files to be Submitted to the TDMS (data files, accompanying report)

Steps 1-6 are typically performed on a monthly basis when the DST data CD has been delivered. However, DST data submittals to the TDMS are usually scheduled every six months. Step 7, the creation of the data files and packages for submittal, is performed on the six-month period (or whatever period deemed by YMP). The following substeps are required for submittal of acquired and developed DST thermal-mechanical data to the TDMS. For purposes of illustration, the data submittal of DST data for the time period 1/1/2003-6/30/2003 will be used as an example.

1. Create a directory under D:\Excel\dstdata\ in which to save the necessary files for this data submittal. Figure 2 shows a directory called "21st-22nd quarter", which represent the dates Jan. 1, 2003 through June 30, 2003. Several of the files necessary for submittal are here, albeit in the form required for the data from that time period.
2. Copy the acquired and developed DST displacement and strain data (e.g., for the period 1/1/2003-6/30/2003) into a single Excel spreadsheet file, (e.g., DSTMechData_010103-063003.xls). This file will contain the data in four sheets. Table 2 describes the data type, its source file/worksheet, and its destination file/worksheet.
3. Work with SNL QA support staff to open four individual DTN/TDIF numbers under which to submit the data, per AP-SIII.3Q, Rev 2, ICN 1. Because the DST mechanical data submitted by SNL rely on the temperatures measured in the Heated Drift and in the vicinity of the mechanical instruments, the DST temperature data are required input to SNL's data. The TCO is responsible for submitting all temperature data from the CDs to the TDMS. Obtain the appropriate DTN for the temperature data from the TCO, and use this as a Source Data entry on the TDIF form.

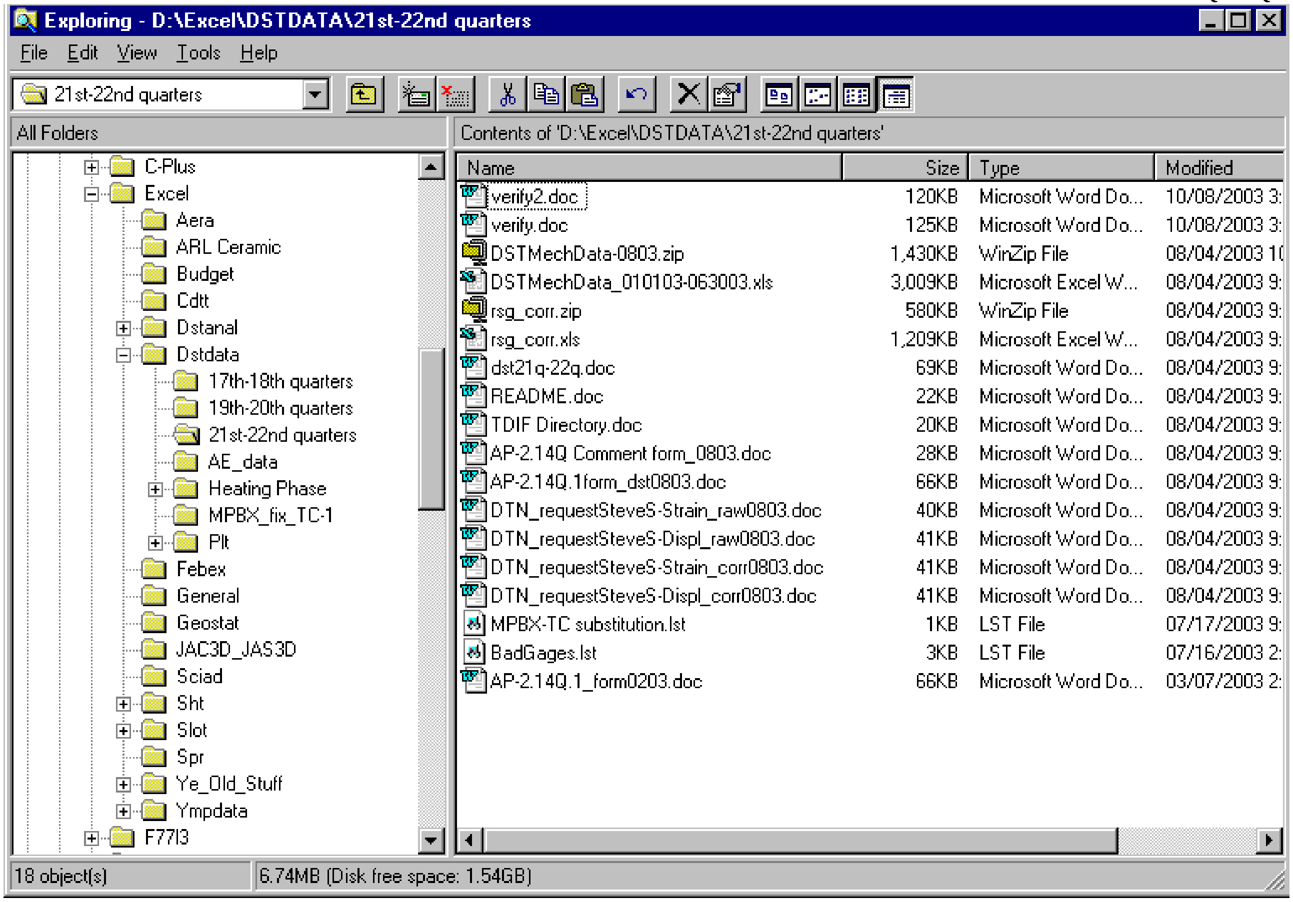


Figure 2. Directory containing necessary files for data submittal

Table 2. Source and destination files for DST acquired and developed data

| Description (example period 1/1/2003-6/30/2003) | Source sheet name | Destination sheet name |
|---|---|---|
| ***Acquired*** MPBX and CDEX displacement data (represents the true measured displacement value obtained at the sensor) | D:\Excel\dstdata\mpbx-anc.xls, sheet "MPBX-ANC" | DSTMechData_010103-063003.xls, sheet "Displ_raw" |
| MPBX and CDEX displacement data corrected for thermal expansion of the Invar rods (represents the displacement due to the deformation of the in situ rock) | D:\Excel\dstdata\corrmpbx.xls, sheet "CORRMPBX" | DSTMechData_010103-063003.xls, sheet "Displ_corr" |
| ***Acquired*** strain gage data from the DST (represents the true measured strain at the strain gage) | D:\Excel\dstdata\rsg.xls, sheet "Uncorrected Strain (CD)" | DSTMechData_010103-063003.xls, sheet "Strain_raw" |
| Strain data corrected for thermal expansion of the strain gages (represents the strain actually incurred by the concrete) | D:\Excel\dstdata\rsg.xls, sheet "Strain" | DSTMechData_010103-063003.xls, sheet "Strain_corr" |

4. Create a report document (e.g., "dst21q-22q.doc") that details the information regarding the DST mechanical data being submitted, including instances of bad or suspect data, identification of failed thermocouples, important observations about data behavior, and summaries of the methods used to develop the data.
5. Using the utility WinZip, create a .zip file (e.g., DSTMechData-0803.zip) which contains the Excel spreadsheet containing all the data for this submittal (e.g., DSTMechData_010103-063003.xls).
6. Copy the updated versions of BadGages.lst and MPBX-TC substitution.lst to the new directory. A copy of these files will be included in the records package that accompanies the data submittal.

### 5.8 Technical Review of the Data Package

Data are now reviewed in accordance with this procedure, and AP-SIII.3Q, "Submittal and Incorporation of Data to the Technical Data Management System." The technical review shall be performed in accordance with AP-2.14Q, "Document Review" (including the review form and the process itself), utilizing Attachment 11, "Criteria for the Technical Review of Data/Product Output" in AP-SIII.3Q. The review and any comments are submitted in hard copy as part of the record package. The entire data package, including data file, report, and other necessary files, are applicable for review. The technical reviewer must insure that the acquired data were correctly transferred from DST CD to final submittal form (by spot-checking records from the .dds file on the CD and comparing them to the Excel files), that the developed data were computed correctly, and that the report correctly identifies bad or suspect data and at least attempts to offer explanations for these events.

## 6.0 QA RECORDS

QA records (as designatd in Section 6.1 of AP-SIII.3Q), and any corrections or changes generated as a result of implementing this procedure shall be prepared and submitted as inclusionary QA records (QA:QA) by the PI or designee in accordance with AP-17.1Q, *Records Management*.

## 7.0 REFERENCES

### 7.1 Implementing Documents

QAIP 20-1, Technical Procedures

AP-SIII.3Q, "Submittal and Incorporation of Data to the Technical Data Management System."

AP-2.14Q, "Document Review"

AP-17.1Q, Records Management