

MINISTRY OF TRANSPORT VIETNAM

**SOUTH EAST ASIA COMMUNITY ACCESS
PROGRAMME**

SEACAP 27

Technical Report 2

**The Rural Road Surfacing Research (RRSR) Database
A Summary of Structure and Content**

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ABBREVIATIONS & ACRONYMS

| | |
|--------|---|
| ADT | Average Daily Traffic |
| CBR | California Bearing Ratio |
| DBM | Dry Bound Macadam |
| DCP | Dynamic Cone Penetrometer |
| DFID | Department for International Development |
| DST | Department of Science and Technology, Ministry of Transport |
| esa | equivalent standard axles |
| GoV | Government of Vietnam |
| IRI | International Roughness Index |
| ITST | Institute of Transport Science and Technology |
| Km | kilometre |
| LCS | Low Cost Surfacing |
| MERLIN | M achine for E valuating R oughness using L ow-cost I Nstrumentation |
| MoT | Ministry of Transport |
| PDOT | Provincial Department of Transport |
| QA | Quality Assurance |
| ITST | Research Institute of Transportation Science & Technology |
| RRGAP | Rural Road Gravel Assessment Programme |
| RRSR | Rural Road Surfacing Research |
| RRST | Rural Road Surfacing Trials |
| RT2 | Rural Transport 2 nd Project |
| SEACAP | South East Asia Community Access Programme |
| TBM | Temporary Bench Mark |
| TEDI | Transport Engineering Design Incorporated |
| TRL | Transport Research Laboratory |
| VOCs | Vehicle Operating Costs |
| VPD | Vehicles per day |
| WBM | Water Bound Macadam |
| WLC | Whole Life Costs |

The Rural Road Surfacing Research (RRSR) Database

1 Background

The RRSR database has developed out of a number of SEACAP projects as means of managing the information relating to DfID research into rural road surfaces and pavements in Vietnam. The principal sources of this information are as follows:

- SEACAP 1 (Modules 1-5): Construction and initial condition monitoring information of Rural Road Surfacing Trials (RRST) Phases I and II; 2003-06.
- SEACAP 1 (Module 6): One interim monitoring phase of representative RRST I and II trial sections; 2007-08.
- SEACAP 4: Information recovered from the Rural Road Gravel Assessment Programme (RRGAP) relating to the condition of a representative range of World Bank-funded Rural Transport 1 (RT1) and Rural Transport 2 (RT2) unsealed roads; 2004-05.
- SEACAP 27: Mid-term monitoring of representative RRST I and II trial sections; 2007-09.
- SEACAP 30: Preparation of proposed designs for RRST Phase III construction

2 Scope of Data

The RRGAP data comprises one round of data collected from 700 sites on 275 unsealed rural roads, together with associated laboratory testing.

The RRST data comprises initial construction information and subsequent monitoring information for the first two phases of the Rural Roads Surfacing Trials programme (RRST I and RRST II). Table 1 summarises the extent of the trials and Table 2 list the dates of the monitoring phases up January 2009.

Table 1 The RRST Trials

| Province | RRST | Constructed Roads (No.) | Monitored Roads (No.) | Monitoring Section (No.) |
|-------------|------|-------------------------|-----------------------|--------------------------|
| Hue | I | 1 | 1 | 7 |
| Tien Giang | I | 1 | 1 | 8 |
| Dong Thap | I | 1 | 1 | 9 |
| Da Nang | I | 1 | 1 | 5 |
| Tuyen Quang | II | 5 | 2 | 7 |
| Ha Tinh | II | 6 | 3 | 10 |
| Quang Binh | II | 3 | 2 | 8 |
| Ninh Binh | II | 10 | 4 | 13 |
| Hung Yen | II | 5 | 4 | 11 |
| Gai Lai | II | 5 | 2 | 9 |
| Dak Nong | II | 1 | 1 | 11 |
| Dak Lak | II | 3 | 3 | 9 |

Table 2 RRST Monitoring Phases

| Province | Construction | Phases of Monitoring | | | | | | |
|-------------|--------------|----------------------|---------------|---------------|---------------|--------------|---------------|--------------|
| | | II (As Built) | II | III | IV | V | Vi | VII |
| Hue | May 2005 | June 2005 | February 2006 | July 2006 | March 2007 | January 2008 | May-June 2008 | Dec 08-Jan09 |
| Tien Giang | May 2005 | July 2005 | January 2006 | July 2006 | March 2007 | January 2008 | May-June 2008 | Dec 08-Jan09 |
| Dong Thap | July 2005 | July 2005 | January 2006 | July 2006 | March 2007 | January 2008 | May-June 2008 | Dec 08-Jan09 |
| Da Nang | June 2006 | July 2006 | March 2007 | January 2008 | May-June 2008 | Dec 08-Jan09 | | |
| Tuyen Quang | May 2006 | July 2006 | February 2007 | December 2007 | May-June 2008 | Dec 08-Jan09 | | |
| Ha Tinh | June 2006 | July 2006 | March 2007 | January 2008 | May-June 2008 | Dec 08-Jan09 | | |
| Quang Binh | June 2007 | July 2006 | March 2007 | January 2008 | May-June 2008 | Dec 08-Jan09 | | |
| Ninh Binh | May 2006 | July 2006 | March 2007 | December 2007 | May-June 2008 | Dec 08-Jan09 | | |
| Hung Yen | June 2006 | July 2006 | March 2007 | December 2007 | May-June 2008 | Dec 08-Jan09 | | |
| Gai Lai | June 2006 | July 2006 | March 2007 | January 2008 | May-June 2008 | Dec 08-Jan09 | | |
| Dak Lak | June 2006 | July 2006 | March 2007 | January 2008 | May-June 2008 | Dec 08-Jan09 | | |
| Dak Nong | June 2006 | July 2006 | March 2007 | January 2008 | May-June 2008 | Dec 08-Jan09 | | |

3 Database Structure

The RRSR database is made up of 3 principal components;

- The RRGAP unsealed rural road condition data
- The RRST condition monitoring data and additional RRSR support data
- Associated guides and specialist software.

Data is held within 4 principal folders

- 1. RRGAP:** Contains data files from the Rural Road Gravel Assessment Programme (SEACAP 4)
- 2. RRST-M:** Contains data files from the RRST-I and RRST-II trials construction and monitoring programme up to and including January 2009.
- 3. RRST-P3:** Contains data files from the preliminary design stages of the RRST-III programme up to June 2009.
- 4. RRST-Costs:** Contains information on the RRST construction costs and the draft RRSR Whole Life Cost Model from SEACAP 1

The relevant software and guidelines are contained in a separate folder.

4 The RRGAP Data

The RRGAP folder contains the following:

Folder **lab_data** holding tabulated laboratory data on recovered RRGAP surfacing materials in spreadsheet (xls) format

A Microsoft ACCESS database (**RRGAP-2005**) holding all the road location, condition and associated information from the gravel assessment programme. This information is held in 3 file-tables as shown in below in Figure 1

Figure 1 RRGAP Tables

The screenshot shows the Microsoft Access interface for the 'RRGAP-2005 : Database (Access 2000 file format)'. The 'Objects' pane on the left lists 'Tables', 'Queries', 'Forms', and 'Reports'. The main window displays a table with the following data:

| Name | Description | Modified | Created | Type |
|---------|--|---------------------|---------------------|-------|
| PDOT | Background materials data from PDOTs | 07/10/2009 05:27:08 | 15/10/2004 10:40:23 | Table |
| Road | Information on selected road links | 07/10/2009 07:15:44 | 19/01/2004 06:55:27 | Table |
| Profile | Condition information on selected sections | 07/10/2009 09:35:48 | 07/06/2004 05:23:56 | Table |

The fields within these tables are listed in Figures 2, 3 and 4. The look-up codes associated with these fields are listed in the RRGAP data collection guide.

Figure 2 List of Fields in Table “Road”

| Field Name | Data Type | Description |
|------------|-----------|--------------------------------|
| Rd-prop | Text | Province name |
| Rd-name | Text | Road name |
| Rd-refno | Text | Road reference no |
| Rd-co-ord1 | Text | Road start northings |
| Rd-co-ord2 | Text | Road start eastings |
| Rd-co-ord3 | Text | Road finish northings |
| Rd-co-ord4 | Text | Road finish eastings |
| Rd-type | Text | Road type - code |
| Rd-D-Thick | Number | Gravel design thickness (mm) |
| Rd-terr | Number | Terrain - code |
| Rd-month | Number | Age of road surface |
| Rd-date | Date/Time | Road construction date |
| Rd-condit | Number | Road condition - code |
| Rd-traff | Number | Traffic estimation - code |
| M-Cway | Number | Carriageway maintenance - code |
| M-Shold | Number | Shoulder maintenance - code |
| M-Ditch | Number | Ditch maintenance - code |
| Id-indate | Date/Time | Input date |
| Id-update | Date/Time | Update input |
| Id-inby | Text | input operator |
| Id-verify | Number | Verification - code |
| Id-mem1 | Memo | Additional info |

Figure 3 List of Fields in Table “Profile”

| Field Name | Data Type | Description |
|------------|------------|-----------------------------------|
| ID | AutoNumber | |
| Rd-prov | Text | Province name |
| Rd-name | Text | Road name |
| Pr-chain | Number | Chainage of profile |
| Rd-refno | Text | Road reference no. |
| Pr-cway | Number | Carriageway width (m) |
| Pr-grad | Number | Road gradient - code |
| Pr-curv | Number | Horizontal curve - code |
| Pr-sect | Number | Pavement shape - code |
| Pr-thck | Number | Gravel thickness 1 (mm) |
| Pr-thick2 | Number | Gravel thickness 2 (mm) |
| Pr-Mat | Text | Overall surfacing material - code |
| Pr-grav1 | Number | Gravel type 1 - code |
| Pr-grav2 | Number | Gravel type 2 - code |
| Pr-eros | Number | Surface erosion - code |
| Pr-visap | Number | Visual appearance - code |
| Pr-sfrun | Number | Surface run-off - code |
| Pr-loos | Number | Loose material - code |
| Pr-osiz | Number | Oversize - code |
| Pr-rut | Number | Rutting - code |
| Pr-corrng | Number | Corrugations - code |
| Pr-pthol | Number | Potholes - code |
| Pr-swidl | Number | Shoulder width Left (m) |
| Pr-swidr | Number | Shoulder width right (m) |
| Pr-smatl | Number | Shoulder material left - code |
| Pr-smatr | Number | Shoulder material right- code |
| Pr-sconl | Number | Shoulder condition left - code |
| Pr-sconr | Number | Shoulder condition right - code |
| Pr-sdl | Number | Side drain left |
| Pr-sdr | Number | Side drain left |
| Pr-dconl | Number | Drain condition left |
| Pr-dconr | Number | Drain condition right |
| T-dcp-1 | Text | DCP reference |
| T-dcp-2 | Text | DCP reference |
| T-samp-1 | Text | Sample reference |
| T-samp-2 | Text | Sample reference |
| Pr-Align | Number | Alignment cross section - code |
| Pr-wtab-c | Number | Current water table (m) |
| Pr-wtab-m | Number | Maximum water table (m) |
| Pr-flood | Number | Flood condition - code |
| Id-Svydate | Date/Time | Date of survey |
| Id-Svyteam | Text | Survey team |
| Id-indate | Date/Time | Input date |
| Id-update | Date/Time | Update date |
| Id-verify | Number | Verification - code |
| Id-inby | Text | Operator |
| Id-mem1 | Memo | Additional data |

Figure 4 List of Fields in Table “PDOT”

| Field Name | Data Type | Description |
|------------|------------|-----------------------------------|
| ID | AutoNumber | |
| Rd-prop | Text | Province name |
| Rd-name | Text | Road link name |
| Mt-loc | Text | Materials location |
| Mt-type | Number | Type of materials - look-up table |
| Mt-haul | Text | Haulage distance (km) |
| Id-mem1 | Memo | Additional |

5 The RRSR Data

RRST I and RRSR II Data (RRST-M)

Basic information on the location and pavement design of the constructed trial sections and the selected monitoring sections is contained within the ACCESS file RRSR-2009, see Figure 5. This file also contains summary information on laboratory testing and quality assurance. Detail on the fields within the RRSR-2009 ACCESS tables is presented in Figures 6-9.

Figure 5 Data Tables in RRSR-2009

| Name | Description | Modified | Created | Type |
|-------------------|---|---------------------|---------------------|-------|
| RRST-Monitoring | Selected monitoring sections and procedures | 08/10/2009 07:58:00 | 24/10/2006 05:13:25 | Table |
| RRST-Construction | Details of all constructed trial sections | 07/10/2009 11:21:21 | 11/04/2005 07:53:51 | Table |
| RRST-Labtest-1 | Laboratory test data RRST-I | 08/10/2009 08:18:42 | 14/02/2007 10:22:10 | Table |
| RRST-QA-II | As-built quality assessment data RRST-II | 08/10/2009 08:46:44 | 08/07/2008 12:00:30 | Table |

Figure 6 List of Fields within Table RRST-Monitoring

| Field Name | Data Type | Description |
|-------------|------------|----------------------------------|
| ID | AutoNumber | |
| ID-Province | Text | Province |
| ID-Rd | Text | Road name |
| Id-Ref | Text | Unique reference to road section |
| M-Chain1 | Number | Start chainage |
| M-Chain-2 | Number | End chainage |
| M-Length(m) | Number | Length of monitoring section |
| M-Refno | Text | Monitoring reference |
| M-Type | Text | Type of pavement |
| M-Vass | Yes/No | Visual assessment data ? |
| M-Level | Yes/No | Cross section level data ? |
| M-IRI | Yes/No | IRI roughness data ? |
| M-DCP | Yes/No | DCP data ? |

Figure 7 List of Fields within Table RRS-Construction

| Field Name | Data Type | Description |
|--------------|------------|---|
| ID | AutoNumber | |
| ID-Project | Text | Name of project |
| ID-Province | Text | Province |
| ID-Rd | Text | Road name |
| Id-Ref | Text | Unique reference to road section |
| Id-Chain-1 | Number | Start chainage |
| Id-Chain-2 | Number | End chainage |
| Id-Type | Text | Type of section, eg trial, control |
| D-Completion | Date/Time | Date of completion |
| Id-Monitor | Yes/No | Contains a monitoring section (yes/no) |
| D-Length(m) | Number | Length of section |
| D-Type | Text | Design reference |
| D-Design | Memo | Description of design |
| RRST101s | Yes/No | SBSD ? |
| RRST101d | Yes/No | DBSD ? |
| RRST102 | Yes/No | Sand seal ? |
| RRST201 | Yes/No | Gravel sub-base/base ? |
| RRST202 | Yes/No | Lime stabilised sub-base/base? |
| RRST203 | Yes/No | Cement stabilised sub-base/base? |
| RRST204 | Yes/No | Emulsion stabilised sub-base/base? |
| RRST205 | Yes/No | Armoured gravel roadbase? |
| RRST206 | Yes/No | Sand sub-base? |
| RRST207 | Yes/No | Quarry run sub-base? |
| RRST208 | Yes/No | Graded crushed stone sub-base |
| RRST209 | Yes/No | Sand bedding layer |
| RRST210 | Yes/No | Dry bound macadam sub-base/base |
| RRST301 | Yes/No | Fired clay brick surface - unmortared joints? |
| RRST302 | Yes/No | Fired clay brick surface - mortared joints? |
| RRST303 | Yes/No | Cement brick surface - unmortared joints? |
| RRST304 | Yes/No | Cobblestone paved surface? |
| RRST305 | Yes/No | Mortared dressed stone surface? |
| RRST401 | Yes/No | Bamboo reinforced concrete? |
| RRST402 | Yes/No | Steel reinforced concrete? |
| RRST403 | Yes/No | Non-reinforced concrete? |
| RRST501 | Yes/No | Gravel shoulders? |
| RRST502 | Yes/No | Quarry run shoulders |
| RRST503 | Yes/No | Lime stabilised shoulders |
| RRST504 | Yes/No | Cement stabilised shoulders |
| RRST505 | Yes/No | Sealed macadam shoulders |
| VN101 | Yes/No | Hot bitumen DBST |
| VN102 | Yes/No | Penetration macadam |
| VN103 | Yes/No | Semi-penetration (triple seal) |
| VN201 | Yes/No | Water bound macadam sub-base/base |
| VN401 | Yes/No | Gravel surfacing |
| VN402 | Yes/No | Unsealed waterbound macadam |
| VN501 | Yes/No | Local soil shoulder |
| VN502 | Yes/No | Unsealed macadam shoulder |
| SELECT | Yes/No | Research select button |

Figure 8 List of Fields within Table RRSR-Labtest-1

| Field Name | Data Type | Description |
|----------------|------------|---------------------------------|
| ID | AutoNumber | |
| Id-Section_Ref | Text | Unique section reference |
| Id-Layer_Ref | Text | Unique road layer reference |
| Id-Layer | Text | Description of layer |
| Id-Material | Text | Description of material |
| Id-Spec | Text | Relevant RRSR specification |
| Id-Sample Date | Date/Time | Sampling date |
| Id-Rep-Date | Date/Time | Testing date |
| T-W | Number | Moisture content |
| T-WL | Number | Liquid limit |
| T-Wp | Number | Plastic limit |
| T-Ip | Number | Plasticity index |
| T-MDD | Number | MDD -Modified |
| T-OMC | Number | OMC |
| T-CBR Comp | Number | CBR compaction condition |
| T-CBR (4) | Number | CBR soaked |
| T-Cube UCS-MPa | Number | Concrete cube strength |
| T-UCS-MPa | Number | Unconfined Compressive Strength |
| T-strip-Class | Number | Bitumen stripping |
| T-W Abs | Number | Water absorption |
| T-LAA | Number | LAA |
| P5-Clay | Number | Clay content |
| P5-Silt | Number | Silt content |
| P5-Sand | Number | Sand content |
| P5-Gravel | Number | Gravel content |
| T-Flake | Number | Flakiness |
| T-F Mod | Number | Fines modulus |
| SP-75 | Number | Passing sieve size |
| SP-63,5 | Number | Passing sieve size |
| SP-50 | Number | Passing sieve size |
| SP37,5 | Number | Passing sieve size |
| SP-28 | Number | Passing sieve size |
| SP-25 | Number | Passing sieve size |
| SP-20 | Number | Passing sieve size |
| SP-14 | Number | Passing sieve size |
| SP-10 | Number | Passing sieve size |
| SP-6,3 | Number | Passing sieve size |
| SP-4,75 | Number | Passing sieve size |
| SP-3,35 | Number | Passing sieve size |
| SP-2,36 | Number | Passing sieve size |
| SP-1,18 | Number | Passing sieve size |
| SP-0,6 | Number | Passing sieve size |
| SP-0,425 | Number | Passing sieve size |
| SP-0,3 | Number | Passing sieve size |
| SP-0,15 | Number | Passing sieve size |
| SP-0,074 | Number | Passing sieve size |
| SP<0,074 | Number | Passing sieve size |

Figure 9 List of Fields within Table RRSR-QA-II

| Field Name | Data Type | Description |
|-------------------------|-----------|---------------------------------|
| M-Refno | Text | Section Reference no. |
| C-Date | Date/Time | Construction date |
| Q-C/w | Text | Quality of surfacing |
| Q-Sh | Text | Quality of shoulders |
| Q-XS | Text | Cross sectional shape |
| Q-Pit | Text | Observation from inspection pit |
| Q-Layer | Text | Layer thickness/material |
| Q-Mat'l | Text | Material test compliance |
| Q-Construction comments | Text | Comments |

The monitoring data from 2005 to January 2009 is held within folders and sub-folders as shown in Figure 10. Detail on the content of the main data-folders is summaries in Table 3

Figure 10 List of RRST-II Monitoring Data Folders

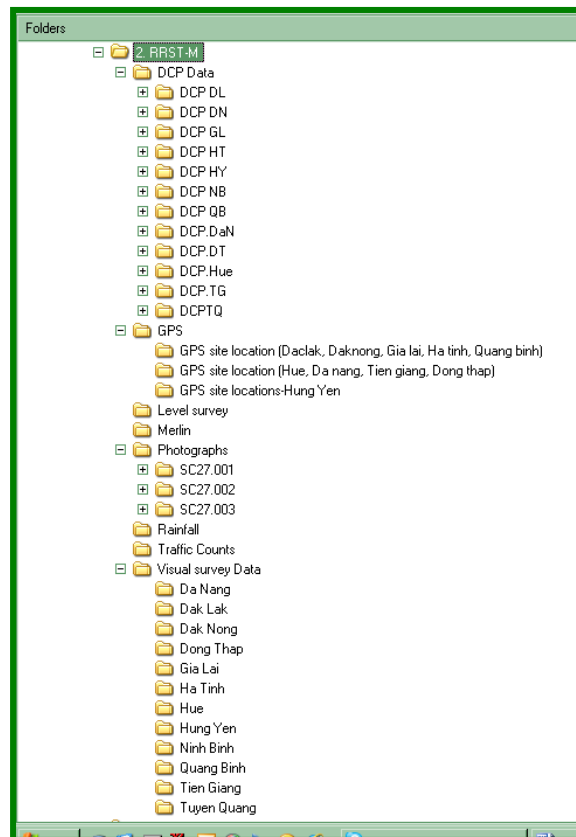


Table 3 Detail of Data Sets in RRST-M Folders

| Main Data Folder | Content Description | Data File Types |
|--------------------|---|-------------------------------------|
| DCP Data | Results of individual monitoring DCP tests. Filed under Province, Road | XLS spreadsheets and UK-DCP reports |
| GPS | Easting and Northing coordinates for the start and finish of all trial monitoring sections | Garmin reports |
| Level Survey | Summaries of cross-section levelling data and associated plots for all un-sealed control sections | XLS spreadsheets |
| Merlin | Data and summaries of all roughness (IRI) calculations from MERLIN surveys. | XLS spreadsheets |
| Photograph | Selected photographs from SC27 monitoring phases, filed under Phases, Province, Road | jpg files |
| Rainfall | Summaries of rainfall 2005-2008 | XLS spreadsheets |
| Traffic counts | Summaries of trial road traffic counts | XLS spreadsheet |
| Visual Survey Data | Details of individual visual surveys for all monitoring sections, filed under Province, Road | XLS spreadsheets |

RRST-III Data

Information recovered as part of the Rural Road Surfacing Trials Phase 3 (RRST-III) is contained within a series of data folders as shown on Figure 11. Details of the data sets within these folders is described in Table 4

Figure 10 List of RRST-III Data Folders

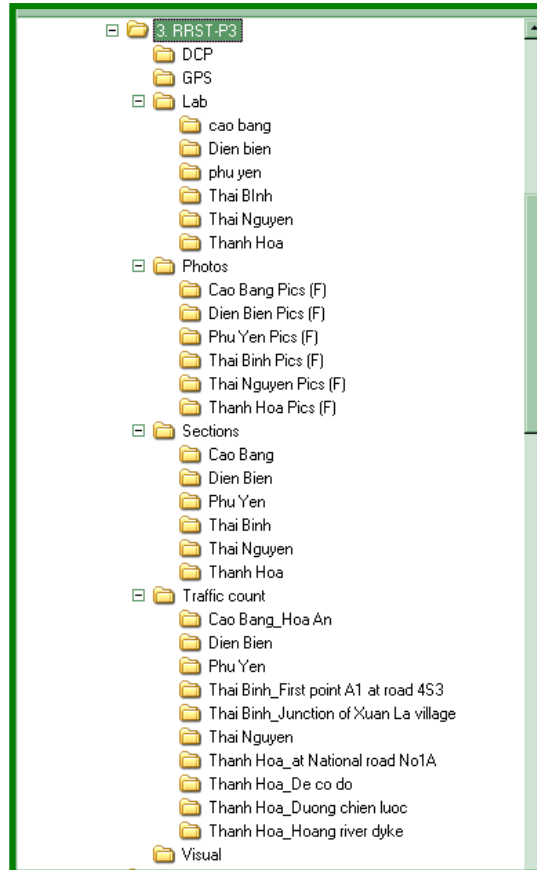


Table 4 Detail of Data Sets in RRST-III Folders

| Main Data Folder | Content Description | Data File Types |
|------------------|---|-------------------------------------|
| DCP | Results of individual DCP tests. Filed under Province, Road | XLS spreadsheets and UK-DCP reports |
| GPS | Easting and Northing coordinates for the start and finish of proposed trial roads | Garmin reports |
| Lab | Laboratory test results and summaries from trial investigation surveys | XLS spreadsheets |
| Photos | Selected photos of the existing condition of proposed trial roads | jpg files |
| Sections | Cross-sections showing proposed trial pavement designs | Autocad and pdf files |
| Traffic count | Summaries of trial road traffic counts on existing roads | XLS spreadsheet |
| Visual | Walk-over survey summary sheets of proposed trial roads | XLS spreadsheets |

RRST Cost Data

Information held regarding RRST costs is under two headings as detailed in Table 5

Table 5 RRST Cost Information

| Main Data Folder | Content Description | Data File Types |
|-------------------------|---|------------------------|
| Construction costs | Construction costs for RRST-I and RRST-II trial and control sections. | XLS spreadsheets |
| Cost Model V2 | Draft Whole Life Cost Model based on results from SEACAP 1 | XLS spreadsheets |