ROCK MASS QUALITY ASSESSMENT
OF THE
DRIFT SCALE HEATER TEST AREA

WBS 1.2.3.14.2

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Abstract

In order to assess the structural variability in the Drift Scale Heater Test two rock mass classification indices (Q and RMR) have been measured in 5 m interval along the drift. The Drift Scale Heater Test area (or Heated Drift) is located within the Thermal Testing Facility (Alcove 5) and situated stratigraphically in TSw2 Thermal Mechanical Unit. While some structural variations within the Heated Drift have been observed, the Q and RMR indices have been found to be relatively consistent with those found from the repository horizon TSw2 and do not display any significant systematic variation relative to location. Q and RMR indices for the Heated Drift fall within the range observed for the TSw2 Thermal Mechanical Unit in the Exploratory Studies Facility Main Drift and the Single Element Heater Test area. Therefore, with respect to Q and RMR indices the Drift Scale Test area is representative of the TSw2 Thermal Mechanical Unit.

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1. Introduction.

Rock Mass Quality indices, *RMR* (Bieniawski, 1979) and *Q* (Barton et al., 1974), have been developed as design aids for excavated tunnels and underground openings. RMR and Q indices are calculated from parameters related to degree of jointing, interaction of joint orientations to form blocks, joint frictional strength, rock strength versus active stress, and hydraulic conditions. Because of the parameters used in their derivation, RMR and Q indices are also useful as indicators of general structural conditions. Rock mass quality indices were collected following Sandia National Laboratories Technical Procedure-234 Revision 01, utilizing the data reduction program TBM.exe Version 4.5 and 4.51, under Work Agreement-0065 Revision 04. The data concerning the heated drift test has been submitted under TDIF 306063 (DTN SNF32020196001.015). Related data surrounding the single heater test has been submitted under TDIF 305579 (DTN SNF32020196001.010).

2. Rock Mass Quality Indices.

RMR and Q indices have been determined on 5 meter intervals, throughout the Main Drift of the Exploratory Studies Facility (ESF) and the Thermal Testing Facility (TTF). The TTF is located at station 28+27 m in the Main Drift and is entirely contained in the Tptpmn (Topopah Spring Middle Nonlithophysal Zone, Buesch et al., 1996) which forms the upper third of the Thermal/Mechanical Unit TSw2 (Figure 1). RMR and Q indices have been measured from station 00+60 to 01+35 m in the Access/Observation Drift, from station 00+03 to 00+45 m in the Connecting Drift, and station 00+03 to 00+60 m in the Heated Drift (Figure 2). Surrounding the Heated Drift test area Q indices ranged from 0.761 to 621.875, while RMR indices range from 51.1 to 97.0 [Figure 3 and 4; Table 1 and 2]. Both Q and RMR indices are relatively constant through the TTF, with relatively little scatter in values.

The range in Q and RMR indices from the TTF is relatively limited compared to that observed from the Main Drift (Figures 3 through 6). During data collection several observations of the existing geologic and structural conditions were made. These observations are summarized below:

- The rock faces exposed throughout the Cross Drift Alcove are massive with little jointing and no brecciation. This is reflected in the slightly elevated Q and RMR values from the Connecting Drift when compared to adjacent drifts (Figure 3 and 4).

Figure 1. Comparison of stratigraphic subdivisions of Thermal /Mechanical Unit Tsw2 volcanic rocks at Yucca Mountain. (no scale).

Zonation of Buesch et al., 1996	Thermal/Mechanical Unit Oritiz et al., 1985.
Tptpmn, Topopah Springs Middle Nonlithophysal	TSw2
Tptpll, Topopah Springs Lower Lithophysal	
Tptpln, Topopah Springs Lower Nonlithophysal	

Figure 2. Plan view figure identifying nomenclature in the Thermal Testing Facility (Alcove 5) (no scale).

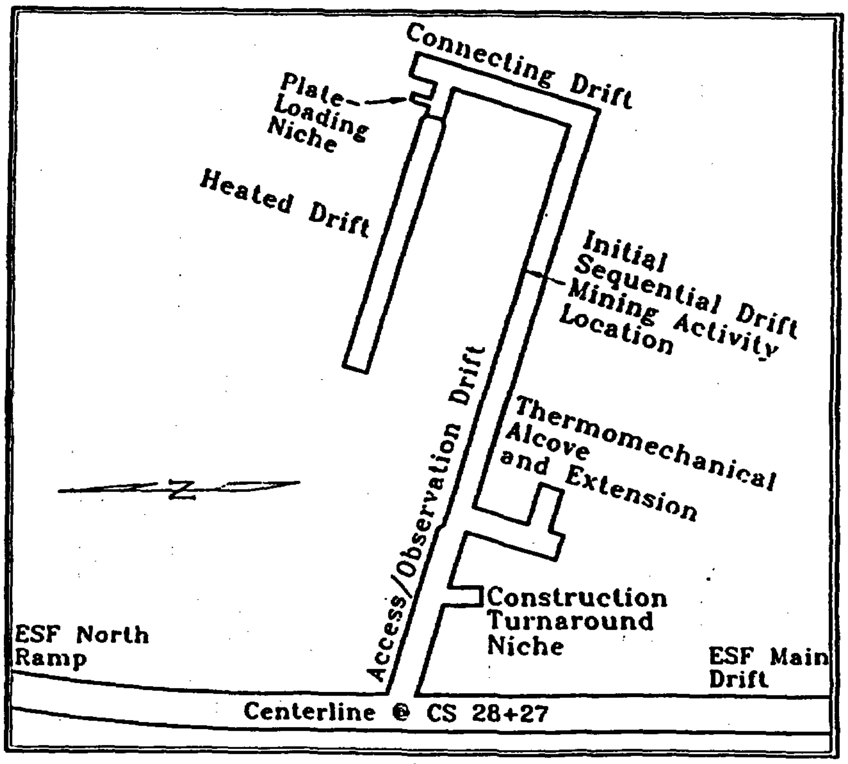

Figure 3. Q Values from Thermal Testing Facility (TTF) Surrounding the Heated Drift Test. Points with the "star" symbol next to them indicate that the interval is adjacent to the Heated Drift Test area.

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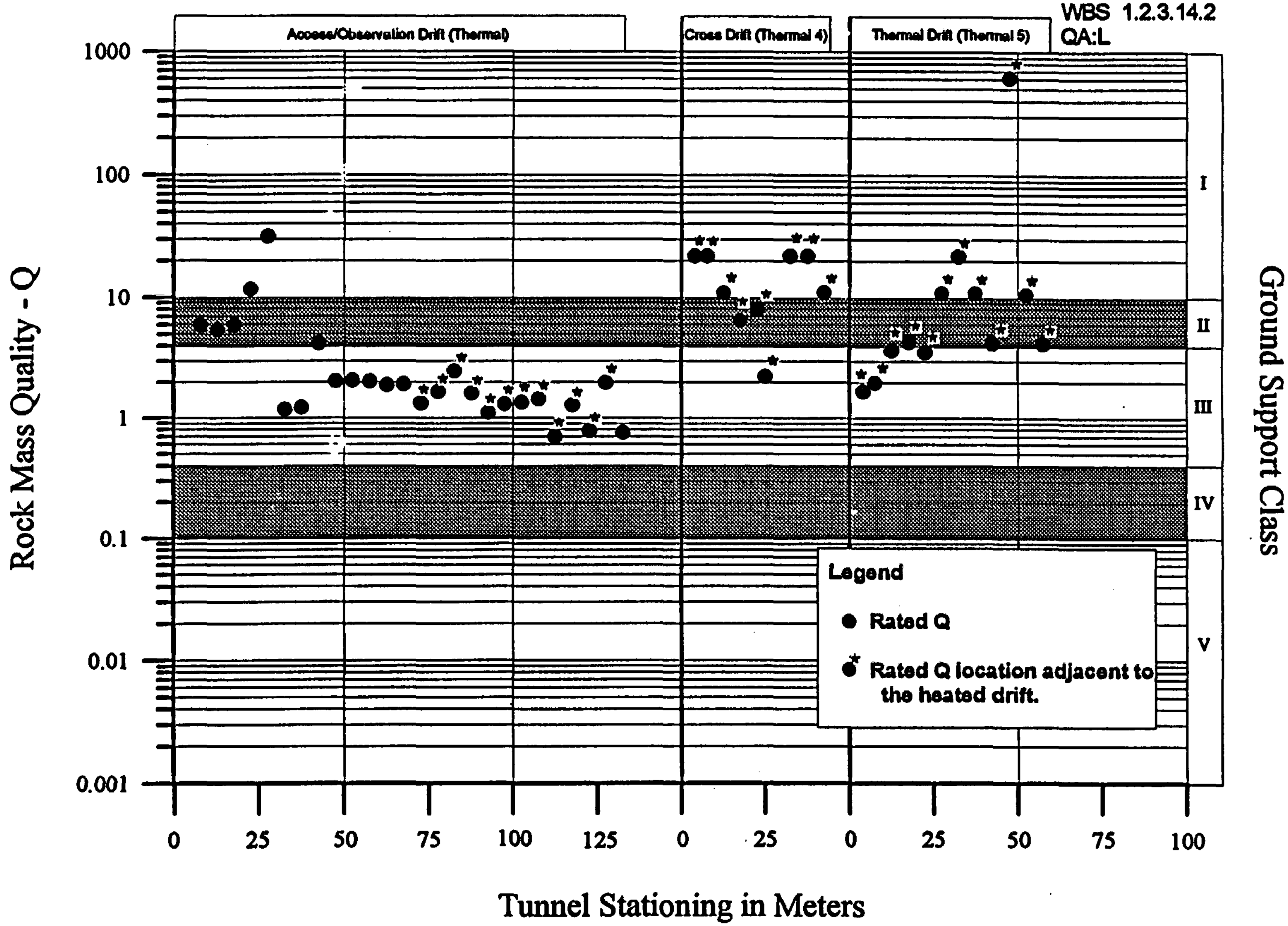

Figure 4. RMR Values from Thermal Testing Facility (TTF) Surrounding the Heated Drift Test. Points with the "star" symbol next to them indicate that the inteval is adjacent to the Heated Drift Test area.

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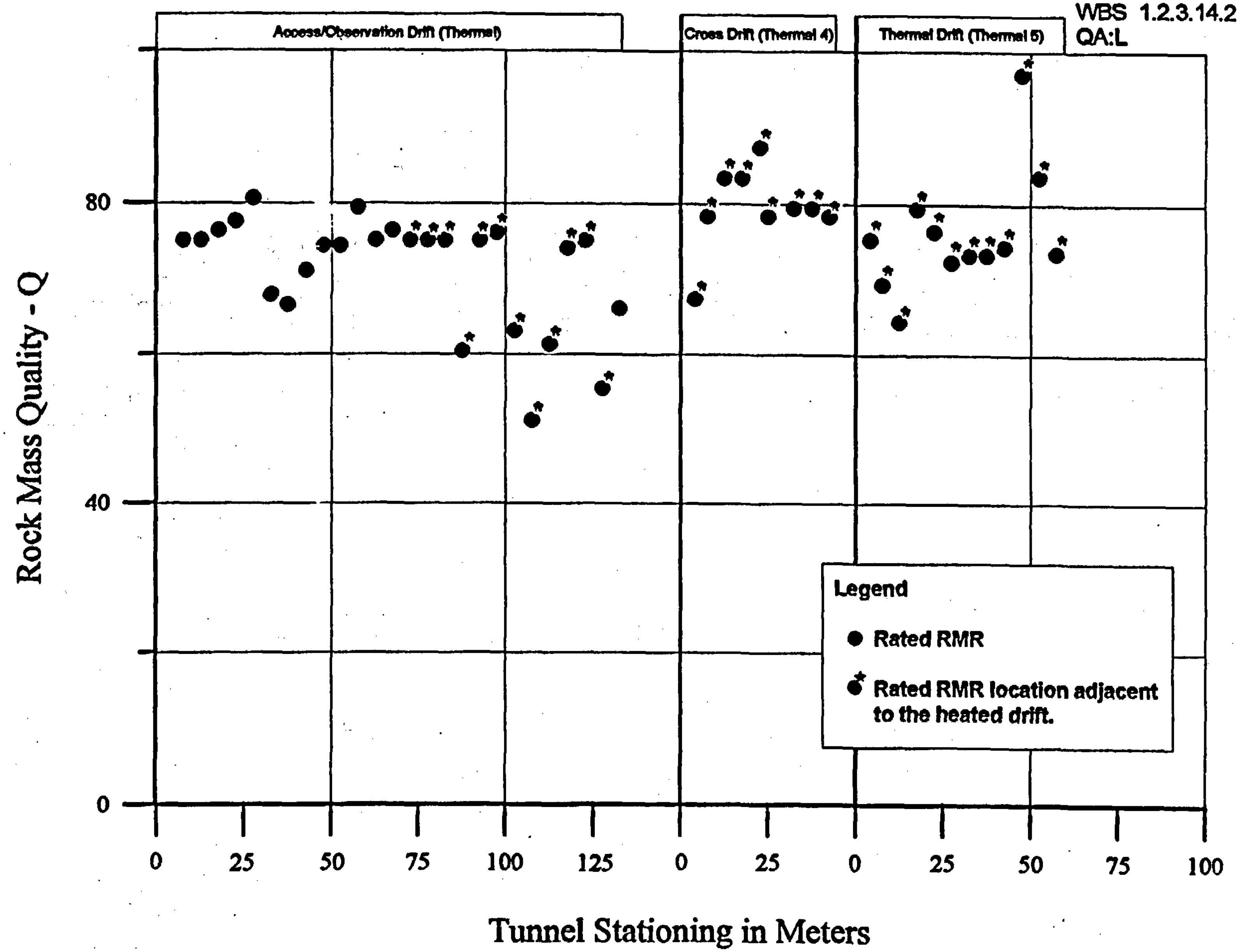

Table 1. Rock Mass Rating Q for the Thermal Testing Facility (Alcove 5) and Alcove Extensions.

Start Station	End Station	Record #	Revision #	Stratigraphic Unit	RQD	Jn	Jr	Ja	Jw	SRF	Q	
Access/Observation Drift (FN: Thermal)												
5	10	1	0	Tptpmn	88.6	12	4.0	1.0	1	5.0	5.907	
10	15	11	0	Tptpmn	81.8	12	4.0	1.0	1	5.0	5.453	
15	20	2	0	Tptpmn	89.1	12	4.0	1.0	1	5.0	5.940	
20	25	3	0	Tptpmn	87.7	6	4.0	1.0	1	5.0	11.693	
25	30	4	0	Tptpmn	95.7	12	4.0	1.0	1	1.0	31.900	
30	35	5	0	Tptpmn	71.2	12	4.0	4.0	1	5.0	1.187	
35	40	6	0	Tptpmn	73.9	12	4.0	4.0	1	5.0	1.232	
40	45	7	0	Tptpmn	63.8	12	4.0	1.0	1	5.0	4.253	*
45	50	8	0	Tptpmn	92.6	12	4.0	3.0	1	5.0	2.058	*
50	55	9	0	Tptpmn	94.3	12	4.0	3.0	1	5.0	2.096	*
55	60	10	0	Tptpmn	92.7	12	4.0	3.0	1	5.0	2.060	*
60	65	12	0	Tptpmn	85.6	12	4.0	3.0	1	5.0	1.902	
65	70	13	0	Tptpmn	87.6	12	4.0	3.0	1	5.0	1.947	
70	75	14	0	Tptpmn	91.7	15	3.3	3.0	1	5.0	1.345	**
75	80	15	0	Tptpmn	75.7	12	4.0	3.0	1	5.0	1.682	**
80	85	16	0	Tptpmn	97.6	6	2.3	3.0	1	5.0	2.494	**
85	90	17	0	Tptpmn	73.0	12	4.0	3.0	1	5.0	1.622	**
90	95	18	0	Tptpmn	83.7	20	4.0	3.0	1	5.0	1.116	**
95	100	19	0	Tptpmn	99.0	20	4.0	3.0	1	5.0	1.320	**
100	105	20	0	Tptpmn	92.7	12	4.0	3.0	1	7.5	1.373	**
105	110	21	0	Tptpmn	49.5	6	4.0	3.0	1	7.5	1.467	**
110	115	22	0	Tptpmn	79.5	12	2.4	3.0	1	7.5	0.707	**
115	120	23	0	Tptpmn	87.2	12	4.0	3.0	1	7.5	1.292	**
120	125	24	0	Tptpmn	88.7	20	4.0	3.0	1	7.5	0.788	**
125	130	25	0	Tptpmn	67.7	6	4.0	3.0	1	7.5	2.006	**
130	135	26	0	Tptpmn	51.4	12	4.0	3.0	1	7.5	0.761	
Thermomechanical Alcove/Single Element Heater Test (FN: Thermal2)												
3	5	1	0	Tptpmn	86.2	12	4.0	3.0	1	5.0	1.916	*
5	10	2	0	Tptpmn	94.6	12	4.0	4.0	1	5.0	1.577	*
10	15	3	0	Tptpmn	98.5	12	2.1	3.0	1	1.0	5.746	*
15	20	4	0	Tptpmn	78.9	12	4.0	3.0	1	7.5	1.169	*
20	25	5	0	Tptpmn	74.8	12	4.0	3.0	1	7.5	1.108	*
Thermomechanical Alcove Extension (FN: Thermal3)												
3	5	1	0	Tptpmn	96.6	6	4.0	3.0	1	5.0	4.293	*
5	10	2	0	Tptpmn	97.8	6	4.0	3.0	1	1.0	21.733	*
10	12	3	0	Tptpmn	93.4	12	4.0	3.0	1	5.0	2.076	*
Connecting Drift (FN: Thermal4)												
3	5	1	0	Tptpmn	99.5	6	4.0	3.0	1	1.0	22.111	**
5	10	2	0	Tptpmn	99.5	6	4.0	3.0	1	1.0	22.111	**
10	15	3	0	Tptpmn	99.2	12	4.0	3.0	1	1.0	11.022	**
15	20	4	0	Tptpmn	97.6	12	2.4	3.0	1	1.0	6.507	**
20	25	5	0	Tptpmn	96.9	12	4.0	4.0	1	1.0	8.075	**
25	30	6	0	Tptpmn	84.3	6	2.4	3.0	1	5.0	2.248	**
30	35	7	0	Tptpmn	99.2	6	4.0	3.0	1	1.0	22.044	**
35	40	8	0	Tptpmn	99.8	6	4.0	3.0	1	1.0	22.178	**
40	45	9	0	Tptpmn	99.7	12	4.0	3.0	1	1.0	11.078	**

Table 1. Rock Mass Rating Q for the Thermal Testing Facility (Alcove 5) and Alcove Extensions.

Start Station	End Station	Record #	Revision #	Stratigraphic Unit	RQD	Jn	Jr	Ja	Jw	SRF	Q	
Heated Drift (FN: Thermal5)												
3	5	1	0	Tptpmn	75.9	12	4.0	3.0	1	5.0	1.687	**
5	10	2	0	Tptpmn	89.7	12	4.0	3.0	1	5.0	1.993	**
10	15	3	0	Tptpmn	84.4	6	4.0	3.0	1	5.0	3.751	**
15	20	4	0	Tptpmn	98.4	6	4.0	3.0	1	5.0	4.373	**
20	25	5	0	Tptpmn	80.8	6	4.0	3.0	1	5.0	3.591	**
25	30	6	0	Tptpmn	99.0	12	4.0	3.0	1	1.0	11.000	**
30	35	7	0	Tptpmn	99.5	6	4.0	3.0	1	1.0	22.111	**
35	40	8	0	Tptpmn	99.1	12	4.0	3.0	1	1.0	11.011	**
40	45	9	0	Tptpmn	96.9	6	4.0	3.0	1	5.0	4.307	**
45	50	10	0	Tptpmn	99.5	1	5.0	0.8	1	1.0	621.875	**
50	55	11	0	Tptpmn	96.0	12	4.0	3.0	1	1.0	10.667	**
55	60	12	0	Tptpmn	95.5	6	4.0	3.0	1	5.0	4.244	**
	*	Interval adjacent to the single element heater block.										
	**	Interval adjacent to the heated drift.										
	RQD	Rock Quality Designation										
	Jn	Joint Set Number										
	Jr	Joint Roughness Number										
	Ja	Joint Alteration Number										
	Jw	Joint Water Reduction Factor										
	SRF	Stress Reduction Factor										
	Q	Rock Mass Quality Indices										

Table 2. Rock Mass Rating RMR for the Thermal Testing Facility (Alcove 5) and Alcove Extensions.

Start Station	End Station	Record #	Revision #	Stratigraphic Unit	RQD-I	C	JS	JC	JW	JOA	RMR	
Access/Observation Drift (FN: Thermal)												
5	10	1	0	Tptpmn	17	12	15	21.1	15	-5	75.1	
10	15	11	0	Tptpmn	17	12	15	21.1	15	-5	75.1	
15	20	2	0	Tptpmn	17	12	15	22.4	15	-5	76.4	
20	25	3	0	Tptpmn	17	12	15	23.6	15	-5	77.6	
25	30	4	0	Tptpmn	20	12	15	23.6	15	-5	80.6	
30	35	5	0	Tptpmn	13	12	8	24.9	15	-5	67.9	
35	40	6	0	Tptpmn	13	12	8	23.6	15	-5	66.6	
40	45	7	0	Tptpmn	13	12	15	21.1	15	-5	71.1	*
45	50	8	0	Tptpmn	20	12	10	22.4	15	-5	74.4	*
50	55	9	0	Tptpmn	20	12	10	22.4	15	-5	74.4	*
55	60	10	0	Tptpmn	20	12	15	22.4	15	-5	79.4	*
60	65	12	0	Tptpmn	17	12	15	21.1	15	-5	75.1	
65	70	13	0	Tptpmn	17	12	15	22.4	15	-5	76.4	
70	75	14	0	Tptpmn	20	12	20	20.1	15	-12	75.1	**
75	80	15	0	Tptpmn	17	12	15	21.1	15	-5	75.1	**
80	85	16	0	Tptpmn	20	12	20	20.1	15	-12	75.1	**
85	90	17	0	Tptpmn	13	12	10	22.4	15	-12	60.4	**
90	95	18	0	Tptpmn	17	12	15	21.1	15	-5	75.1	**
95	100	19	0	Tptpmn	20	12	20	21.1	15	-12	76.1	**
100	105	20	0	Tptpmn	20	12	8	20.1	15	-12	63.1	**
105	110	21	0	Tptpmn	8	12	8	20.1	15	-12	51.1	**
110	115	22	0	Tptpmn	17	12	8	21.3	15	-12	61.3	**
115	120	23	0	Tptpmn	17	12	15	20.1	15	-5	74.1	**
120	125	24	0	Tptpmn	17	12	15	21.1	15	-5	75.1	**
125	130	25	0	Tptpmn	13	12	5	22.4	15	-12	55.4	**
130	135	26	0	Tptpmn	13	12	10	21.1	15	-5	66.1	
Thermomechanical Alcove/Single Element Heater Test (FN: Thermal2)												
3	5	1	0	Tptpmn	17	12	8	17.1	15	-10	59.1	*
5	10	2	0	Tptpmn	20	12	10	27.4	15	-5	79.4	*
10	15	3	0	Tptpmn	20	12	15	18.9	15	-10	70.9	*
15	20	4	0	Tptpmn	17	12	15	23.6	15	-5	77.6	*
20	25	5	0	Tptpmn	13	12	15	23.6	15	-5	73.6	*
Thermo+A4mechnical Alcove Extension (FN: Thermal3)												
3	5	1	0	Tptpmn	20	12	10	21.3	15	-5	73.3	*
5	10	2	0	Tptpmn	20	12	15	21.3	15	-5	78.3	*
10	12	3	0	Tptpmn	20	12	10	18.5	15	-10	65.5	*
Connecting+A25 Drift (FN: Thermal4)												
3	5	1	0	Tptpmn	20	12	10	22.4	15	-12	67.4	**
5	10	2	0	Tptpmn	20	12	15	21.3	15	-5	78.3	**
10	15	3	0	Tptpmn	20	12	20	21.3	15	-5	83.3	**
15	20	4	0	Tptpmn	20	12	20	21.3	15	-5	83.3	**
20	25	5	0	Tptpmn	20	12	15	27.4	15	-2	87.4	**
25	25	6	0	Tptpmn	17	12	15	21.3	15	-2	78.3	**
30	35	7	0	Tptpmn	20	12	15	22.4	15	-5	79.4	**
35	40	8	0	Tptpmn	20	12	15	22.4	15	-5	79.4	**
40	45	9	0	Tptpmn	20	12	15	21.3	15	-5	78.3	**

Table 2. Rock Mass Rating RMR for the Thermal Testing Facility (Alcove 5) and Alcove Extensions.

Start Station	End Station	Record #	Revision #	Stratigraphic Unit	RQD-I	C	JS	JC	JW	JOA	RMR	
Access/Observation Drift (FN: Thermal)												
5	10	1	0	Tptpmn	17	12	15	21.1	15	-5	75.1	
10	15	11	0	Tptpmn	17	12	15	21.1	15	-5	75.1	
15	20	2	0	Tptpmn	17	12	15	22.4	15	-5	76.4	
20	25	3	0	Tptpmn	17	12	15	23.6	15	-5	77.6	
25	30	4	0	Tptpmn	20	12	15	23.6	15	-5	80.6	
30	35	5	0	Tptpmn	13	12	8	24.9	15	-5	67.9	
35	40	6	0	Tptpmn	13	12	8	23.6	15	-5	66.6	
40	45	7	0	Tptpmn	13	12	15	21.1	15	-5	71.1	*
45	50	8	0	Tptpmn	20	12	10	22.4	15	-5	74.4	*
50	55	9	0	Tptpmn	20	12	10	22.4	15	-5	74.4	*
55	60	10	0	Tptpmn	20	12	15	22.4	15	-5	79.4	*
60	65	12	0	Tptpmn	17	12	15	21.1	15	-5	75.1	
65	70	13	0	Tptpmn	17	12	15	22.4	15	-5	76.4	
70	75	14	0	Tptpmn	20	12	20	20.1	15	-12	75.1	**
75	80	15	0	Tptpmn	17	12	15	21.1	15	-5	75.1	**
80	85	16	0	Tptpmn	20	12	20	20.1	15	-12	75.1	**
85	90	17	0	Tptpmn	13	12	10	22.4	15	-12	60.4	**
90	95	18	0	Tptpmn	17	12	15	21.1	15	-5	75.1	**
95	100	19	0	Tptpmn	20	12	20	21.1	15	-12	76.1	**
100	105	20	0	Tptpmn	20	12	8	20.1	15	-12	63.1	**
105	110	21	0	Tptpmn	8	12	8	20.1	15	-12	51.1	**
110	115	22	0	Tptpmn	17	12	8	21.3	15	-12	61.3	**
115	120	23	0	Tptpmn	17	12	15	20.1	15	-5	74.1	**
120	125	24	0	Tptpmn	17	12	15	21.1	15	-5	75.1	**
125	130	25	0	Tptpmn	13	12	5	22.4	15	-12	55.4	**
130	135	26	0	Tptpmn	13	12	10	21.1	15	-5	66.1	
Thermomechanical Alcove/Single Element Heater Test (FN: Thermal2)												
3	5	1	0	Tptpmn	17	12	8	17.1	15	-10	59.1	*
5	10	2	0	Tptpmn	20	12	10	27.4	15	-5	79.4	*
10	15	3	0	Tptpmn	20	12	15	18.9	15	-10	70.9	*
15	20	4	0	Tptpmn	17	12	15	23.6	15	-5	77.6	*
20	25	5	0	Tptpmn	13	12	15	23.6	15	-5	73.6	*
Thermo+A4mechnical Alcove Extension (FN: Thermal3)												
3	5	1	0	Tptpmn	20	12	10	21.3	15	-5	73.3	*
5	10	2	0	Tptpmn	20	12	15	21.3	15	-5	78.3	*
10	12	3	0	Tptpmn	20	12	10	18.5	15	-10	65.5	*
Connecting+A25 Drift (FN: Thermal4)												
3	5	1	0	Tptpmn	20	12	10	22.4	15	-12	67.4	**
5	10	2	0	Tptpmn	20	12	15	21.3	15	-5	78.3	**
10	15	3	0	Tptpmn	20	12	20	21.3	15	-5	83.3	**
15	20	4	0	Tptpmn	20	12	20	21.3	15	-5	83.3	**
20	25	5	0	Tptpmn	20	12	15	27.4	15	-2	87.4	**
25	25	6	0	Tptpmn	17	12	15	21.3	15	-2	78.3	**
30	35	7	0	Tptpmn	20	12	15	22.4	15	-5	79.4	**
35	40	8	0	Tptpmn	20	12	15	22.4	15	-5	79.4	**
40	45	9	0	Tptpmn	20	12	15	21.3	15	-5	78.3	**

Table 2. Rock Mass Rating RMR for the Thermal Testing Facility (Alcove 5) and Alcove Extensions.

Start Station	End Station	Record #	Revision #	Stratigraphic Unit	RQD-I	C	JS	JC	JW	JOA	RMR	
Heated Drift (FN: Thermal5)												
3	5	1	0	Tptpmn	17	12	15	21.3	15	-5	75.3	**
5	10	2	0	Tptpmn	17	12	15	22.4	15	-12	69.4	**
10	15	3	0	Tptpmn	17	12	10	22.4	15	-12	64.4	**
15	20	4	0	Tptpmn	20	12	15	22.4	15	-5	79.4	**
20	25	5	0	Tptpmn	17	12	15	22.4	15	-5	76.4	**
25	30	6	0	Tptpmn	20	12	15	22.4	15	-12	72.4	**
30	35	7	0	Tptpmn	20	12	15	21.3	15	-10	73.3	**
35	40	8	0	Tptpmn	20	12	15	21.3	15	-10	73.3	**
40	45	9	0	Tptpmn	20	12	15	22.4	15	-10	74.4	**
45	50	10	0	Tptpmn	20	12	20	30	15	0	97	**
50	55	11	0	Tptpmn	20	12	15	23.6	15	-2	83.6	**
55	60	12	0	Tptpmn	20	12	8	23.6	15	-5	73.6	**
	*	Interval adjacent to the single element heater block.										
	**	Interval adjacent to the heated drift.										
	RQD	Rock Quality Designation Rating										
	C	Intact Rock Strength Rating										
	JS	Joint Spacing Rating										
	JC	Joint Condition Rating										
	JW	Ground Water Rating										
	JOA	Joint Orientation Adjustment										
	RMR	Rock Mass Rating										

- Within the Heated Drift Alcove there was a change in excavation technique from drill and blast to the alpine miner at approximately 12.5 m. Compared to drill and blast the alpine miner tends to produce a much smoother excavated surface, homogenizes the texture of the exposed face, and minimizes the exposed joint faces. Because alpine mining tends to minimize the joint face exposure, areas excavated by this method will have elevated Q and RMR values when compared to areas excavated by drill and blast. However, in the interval of the Heated Drift excavated by alpine miner (12.5 to 60 m) the invert section was excavated by drill and blast and this exposure was included in the rock mass quality assessment evaluation.
- From approximately station 40 to 60 m in the Heated Drift the matrix has been moderately affected by vapor phase alteration and low angle vapor phase partings are present.
- Schmidt hammer values have been collected throughout the TTF as a ***non-Q activity***. Despite the massive texture observed in the Cross Drift and the vapor phase alteration observed at the terminus of the Heated Drift, Schmidt hammer values throughout the Heated Drift test area are relatively constant and range from 58.8 to 61.8 with an average value of 59.9 $\pm$1.1, n = 6 (Memo from Moo Lee to Dick Kovack, Subject Schmidt Hammer Test Results, March 14, 1996.)

While these observations do not appear to have dramatically affected the rock mass quality indices, they may influence the results of mechanical, thermal, and hydrologic test conducted in the heated drift.

There are three prominent joint sets observed in the TTF. These joint sets are also observed in the Topopah Springs Middle Non-Lithophysal Zone (Tptpmn) in the Main Drift. Joint Set 1 (JS1) and Joint Set 2 (JS2) are both near vertical, moderately long joints (1 - 3 m), have relatively smooth surfaces (Joint Roughness Coefficient {JRC} 8 - 10, Brown, 1981), and have relatively small variations in amplitudes normal to the joint surfaces (0.1 to 0.2 m). Joint apertures are typically 1 to 2 mm, open, with little or no infilling. JS1 has a dip direction of approximately 30 degrees and a dip angle from 70 to 85 while JS2 has a dip direction of approximately 110 degrees and a dip angle of 70 to 85.

Joint Set 3 (JS3) is a relatively low angle (20 to 40 degrees dip) joint set with a dip direction of 30 degrees. In the Heated Drift Alcove from station 40 to 60 m this joint set appears to have been altered to a vapor phase parting surface with infillings of calcite and quartz. Compared to JS1 and JS2, the joint surfaces of JS3 are generally shorter (1- 2 m), have a slightly more irregular surfaces (JRC 10 to 12, Brown, 1981), and have larger variations in amplitudes normal to the joint surfaces (0.2 to 0.3 m). The apertures for JS3 are generally small (1 - 2 mm) and are typically open and unfilled.

3. Comparing Rock Mass Indices from the Main Drift.

Rock Mass Indices Q and RMR for the thermal mechanical unit TSw2 (Ortiz et al., 1985) from the Main Drift are plotted in Figures 5 and 6. The thermal mechanical unit TSw2 is composed of Topopah Springs Middle Nonlithophysal, Topopah Springs Lower Lithophysal, and Topopah Springs Lower Nonlithophysal (Figure 1) following Buesch et al., (1996) stratigraphic nomenclature. Examining the Q and RMR values from the Heated Drift test area clearly shows that the observed variation falls within the range observed for TSw2 in the Main Drift (Figure 3 through 6). Comparing average and standard deviation for RMR between the Heated Drift test area and Main Drift it is appar..nt that the indices from the Heated Drift test area fall within the observed norm for the Main Drift:

RMR Indices for Topopah Spring Middle Non-Lithophysal Zone (TSw2)

	X_{RMR}	σ_{RMR}	N
Thermal Testing Facility	74.1	9.1	33
Main Drift	63.7	7.0	718

X_{RMR} = Average
σ_{RMR} = Standard Deviation
N = Number of Samples

The average RMR and standard deviations from the Heated Drift test area is 74.1 $\pm$ 9.1, TSw2 Main Drift is 63.7 $\pm$ 7.0. This indicates that no significant difference exists in RMR values determined from the Heated Drift test area and TSw2 Main Drift. Similarly, Q and RMR (avg = 74.1 + 9.1) indicies calculated for the Single Heater Test area fall within the range observed for TSw2 Main Drift (TDIF 305579/DTN SNF32020196001.010 and TDIF 305970/DTN SNF32070996001.005).

Figure 5. Q Values for TSw2 (Tptpmn and Tptpll), Main Drift Station 27+15 to 63+05 m.

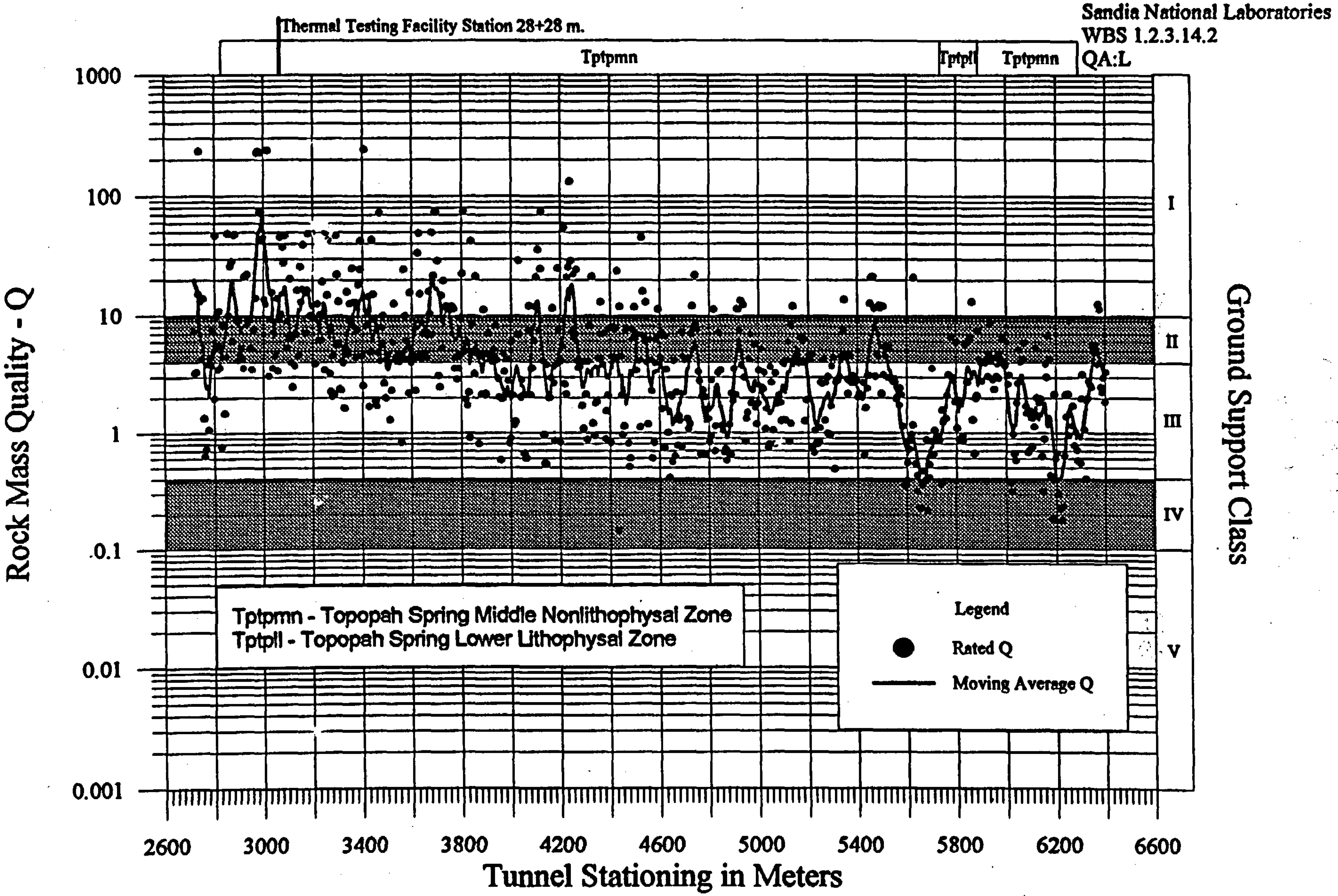

Figure 6. RMR Values for TSw2 (Tptpmn and Tptpll), Main Drift Station 27+15 to 63+05 m.

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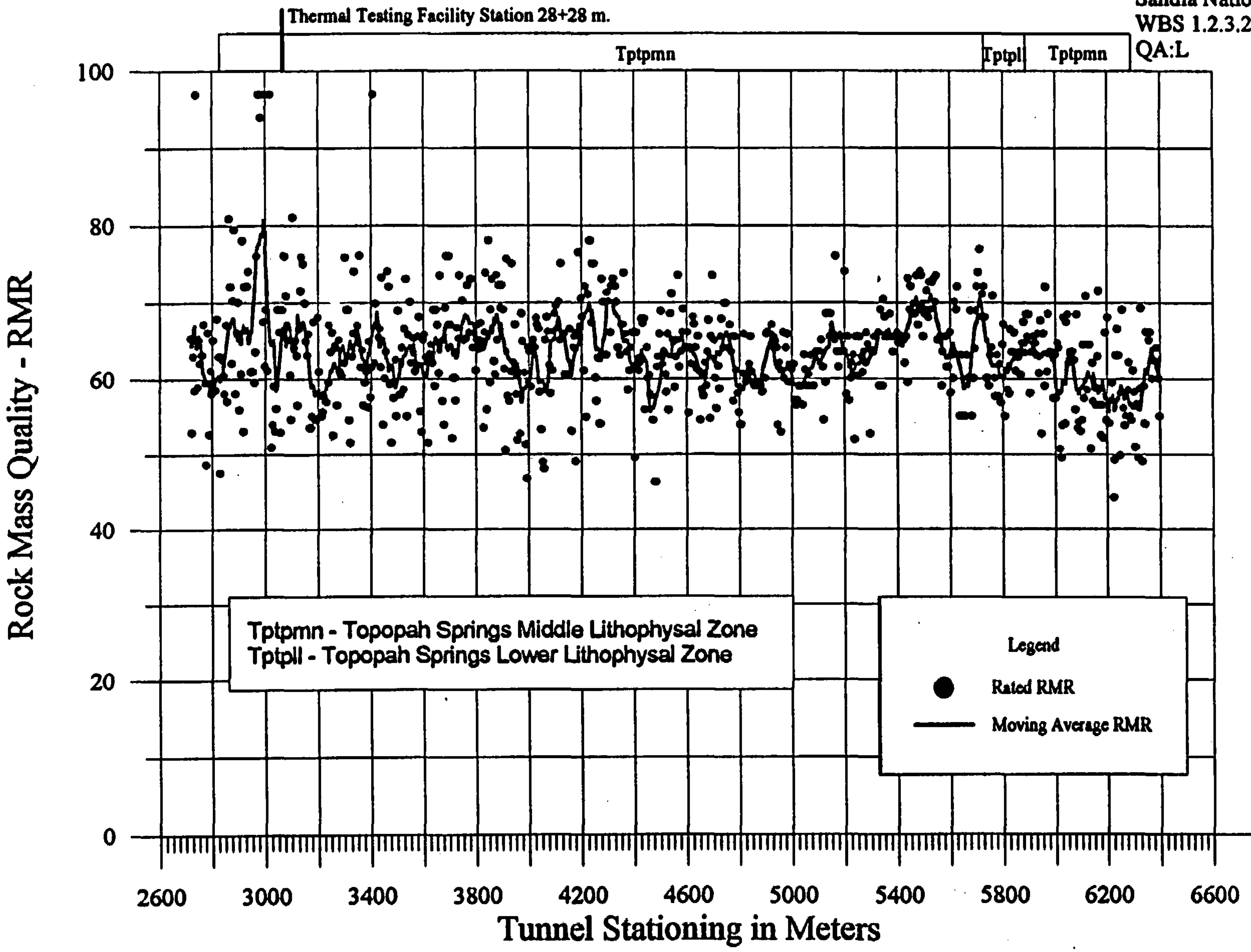

4. Conclusions

Rock mass quality indices Q and RMR are relatively consistent in the Heated Drift test area. Despite some structural variations observed in the test area there is no strong systematic variation between Q and RMR values and location. Comparison of rock mass quality indices from the Thermal Testing Facility with indices from the same thermal mechanical zone (TSw2) in the Main Drift indicate that no significant differences exists. Therefore with regards to rock mass quality indicies the Heated Drift Test area is representative of the TSw2 of the Main Drift.

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