

Appendices

A-1 GPS Reading at center line every 5 kilometer

POINT	NORTHING	EASTING	GPS HIGHT	LEVEL HIGHT	DIFF
cp1	1710824.177	462805.265	392.326	392.342	-0.016
cp2	1707136	466231.8	392.586	392.641	-0.055
cp3	1703225.896	469704.323	392.112	392.171	-0.059
cp3a	1703225.883	469704.335	391.166		
1	1703228.136	469697.764	391.289		
2	1703228.15	469698.147	391.475		
3	1703228.107	469694.779	391.436		
4	1703233.596	469700.342	391.411		
5	1703246.029	469704.485	391.461		
6	1703256.695	469712.453	391.448		
7	1703263.431	469720.998	391.566		
8	1703269.085	469727.869	391.714		
9	1703269.025	469727.813	391.7		
10	1703268.503	469727.374	391.641		
11	1703277.622	469730.797	392.067		
12	1703301.786	469709.448	391.999		
13	1703334.868	469673.807	391.902		
14	1703376.122	469629.058	391.852		
15	1703421.62	469581.128	391.767		
16	1703471.477	469530.087	391.713		
17	1703525.635	469477.167	391.706		
18	1703594.981	469411.015	391.681		
19	1703653.002	469357.48	391.711		
20	1703702.781	469312.544	391.72		
21	1703748.225	469275.278	391.695		
22	1703791.209	469239.885	391.712		
23	1703838.543	469200.849	391.683		
24	1703892.034	469157.45	391.696		
25	1703950.069	469110.295	391.694		
26	1704010.592	469061.265	391.711		
27	1704071.597	469011.313	391.68		

28	1704133.368	468961.716	391.658		
29	1704195.117	468912.262	391.633		
30	1704256.232	468862.198	391.685		
31	1704317.551	468811.683	391.678		
32	1704381.72	468760.431	391.766		
33	1704448.338	468706.302	391.932		
34	1704516.833	468652.078	392.14		
35	1704585.438	468596.829	392.287		
36	1704654.11	468540.724	392.426		
37	1704724.893	468483.488	392.283		
38	1704796.933	468424.967	392.082		
39	1704868.829	468366.261	391.887		
40	1704942.405	468306.986	391.777		
41	1705017.041	468247.279	391.873		
42	1705134.225	468149.759	392.156		
43	1705208.699	468084.303	392.324		
44	1705284.352	468014.651	392.542		
45	1705360.937	467943.559	392.779		
46	1705437.643	467871.981	393.016		
47	1705514.814	467800.141	393.119		
48	1705592.132	467727.423	393.098		
49	1705671.217	467653.273	393.007		
50	1705752.111	467578.589	392.98		
51	1705833.496	467503.031	392.984		
52	1705915.315	467426.921	392.923		
53	1705997.293	467350.379	392.852		
54	1706077.802	467274.967	392.792		
55	1706155.602	467202.563	392.738		
56	1706231.502	467132.092	392.735		
57	1706308.408	467060.476	392.682		
58	1706383.312	466990.957	392.587		
59	1706470.56	466909.475	392.621		
60	1706544.185	466840.388	392.63		
61	1706619.057	466770.752	392.63		
62	1706694.656	466700.565	392.586		
63	1706769.854	466630.624	392.515		
64	1706845.55	466560.425	392.533		
65	1706919.941	466490.935	392.467		
66	1706993.132	466422.822	392.474		
67	1707065.091	466356.384	392.506		
68	1707133.896	466292.021	392.567		
69	1707201.99	466228.842	392.755		

70	1707270.773	466164.689	392.881		
71	1707341.616	466098.945	392.922		
72	1707414.166	466031.1	392.816		
73	1707490.724	465959.454	392.675		
74	1707569.575	465886.553	392.571		
75	1707648.361	465812.977	392.584		
76	1707728.43	465738.386	392.621		
77	1707809.828	465662.783	392.685		
78	1707892.567	465586.005	392.682		
79	1707975.895	465508.048	392.724		
80	1708060.343	465429.472	392.696		
81	1708144.428	465350.722	392.711		
82	1708228.767	465272.327	392.723		
83	1708312.897	465194.189	392.766		
84	1708397.057	465115.72	392.743		
85	1708481.157	465036.929	392.709		
86	1708565.479	464959.613	392.732		
87	1708646.632	464884.185	392.715		
88	1708718.239	464817.515	392.72		
89	1708781.764	464758.459	392.72		
90	1708835.536	464708.029	392.702		
91	1708890.077	464657.876	392.668		
92	1708932.935	464618.924	392.634		
93	1708954.284	464604.811	392.183		
94	1708966.577	464609.282	391.858		
95	1708973.255	464617.092	391.889		
96	1708973.266	464617.086	391.881		
97	1708975.816	464619.403	392.312		
98	1708973.271	464617.068	392.425		
99	1708973.271	464617.062	392.415		
100	1708973.271	464617.062	391.86		
101	1708972.599	464616.082	391.831		
102	1708967.787	464611.742	391.842		
103	1708965.34	464611.04	391.81		
104	1708977.468	464597.056	391.827		
105	1708994.128	464573.296	392.046		
106	1709013.136	464549.862	392.201		
107	1709034.353	464529.024	392.186		
108	1709055.176	464508.949	392.267		
109	1709072.373	464489.874	392.424		
110	1709098.313	464463.428	392.623		
111	1709137.7	464425.889	392.627		

112	1709189.114	464377.283	392.614		
113	1709248.919	464323.054	392.575		
114	1709312.808	464263.157	392.567		
115	1709380.724	464199.722	392.523		
116	1709451.73	464134.123	392.512		
117	1709524.413	464066.887	392.495		
118	1709597.98	463998.513	392.439		
119	1709671.881	463929.369	392.478		
120	1709745.058	463861.109	392.465		
121	1709816.685	463794.08	392.486		
122	1709888.146	463729.034	392.433		
123	1709957.426	463664.863	392.406		
124	1710022.064	463604.68	392.387		
125	1710083.297	463547.599	392.388		
126	1710143.502	463491.413	392.365		
127	1710203.822	463434.802	392.373		
128	1710268.095	463374.389	392.408		
129	1710335.847	463311.766	392.458		
130	1710405.185	463247.513	392.614		
131	1710475.46	463182.422	392.529		
132	1710545.719	463117.201	392.431		
133	1710616.501	463051.384	392.28		
134	1710682.671	462990.538	392.278		
135	1710727.468	462943.216	392.297		
136	1710749.686	462917.587	392.219		
137	1710767.363	462899.802	392.223		
138	1710788.096	462877.25	391.85		
139	1710801.909	462861.324	391.769		
140	1710810.895	462844.261	391.624		
141	1710816.508	462833.1	391.629		
142	1710815.849	462819.239	391.569		
143	1710813.057	462808.959	391.769		

A-2 Leveling data by level Instrument for control points every 2.5 kilometer

B.S	F.S	HOF C	R.L	REMARKS
1.503		393.845	392.342	CP1
1.918	1.315	394.448	392.530	
1.531	1.581	394.398	392.867	
1.469	1.403	394.464	392.995	

1.571	1.594	394.441	392.870	
1.385	1.554	394.272	392.887	
1.644	1.150	394.766	393.122	
1.453	1.545	394.674	393.221	
1.338	1.823	394.189	392.851	BM2500
1.691	1.352	394.528	392.837	
1.461	1.669	394.320	392.859	
1.602	1.647	394.275	392.673	
1.580	1.729	394.126	392.546	
1.783	1.505	394.404	392.621	
1.650	1.496	394.558	392.908	
1.495	1.952	394.101	392.606	
1.574	1.499	394.176	392.602	
1.585	1.535	394.226	392.641	CP2
1.725	1.548	394.403	392.678	
1.626	1.820	394.209	392.583	
2.007	1.644	394.572	392.565	
1.626	1.503	394.695	393.069	
1.587	1.571	394.711	393.124	
1.582	1.415	394.878	393.296	
1.852	1.439	395.291	393.439	
0.567	1.698	394.160	393.593	
1.345	1.555	393.950	392.605	BM7500
1.644	1.798	393.796	392.152	
2.388	1.671	394.513	392.125	
0.903	1.449	393.967	393.064	
1.683	1.634	394.016	392.333	
1.766	1.695	394.087	392.321	
1.492	1.723	393.856	392.364	
1.355	1.390	393.821	392.466	
1.539	1.297	394.063	392.524	
	1.179	392.884	392.884	CP3

A-3 Leveling data by level Instrument for centerline (Base every 2.5 kilometer)

NO	NORTHING	EASTING	GPS HIEGHT	LEVEL HIEGHT	DIFF	STATION
Base:cp2.5	1708975.920	464619.626	394.106			
cp2.5	1708975.920	464619.626	392.851			
cp1	1710824.145	462805.248	392.276			
cp1b	1710824.153	462805.230	392.283			

1	1710822.113	462822.894	392.218	392.269	-0.051	0
2	1710726.392	462921.477	392.355	392.393	-0.038	140
3	1710623.749	463019.856	392.319	392.367	-0.048	280
4	1710520.064	463119.613	392.401	392.436	-0.035	420
5	1710406.489	463226.885	392.309	392.369	-0.060	560
6no	1710308.983	463315.899	392.193	392.316	-0.123	700
7	1710236.454	463378.838	392.457	392.511	-0.054	840
8	1710140.299	463465.929	392.534	392.601	-0.067	980
9	1710029.376	463573.209	392.697	392.745	-0.048	1120
10 no	1709921.625	463670.884	392.455	392.580	-0.125	1260
11	1709814.015	463767.749	392.477	392.525	-0.048	1400
12	1709715.694	463868.549	392.606	392.671	-0.065	1540
13	1709612.399	463966.930	392.620	392.686	-0.066	1680
14	1709511.151	464059.911	392.541	392.623	-0.082	1820
15	1709401.444	464151.559	392.411	392.481	-0.070	1960
16	1709298.559	464249.318	393.193	393.268	-0.075	2100
17	1709193.652	464344.609	393.494	393.547	-0.053	2240
18no	1709095.265	464439.480	393.343	393.248	0.095	2380
19no	1708986.201	464535.338	392.430	392.513	-0.083	2520
20	1708880.830	464631.282	392.510	392.578	-0.068	2660
21	1708778.325	464729.869	393.070	393.125	-0.055	2800
22	1708675.594	464825.402	393.143	393.203	-0.060	2940
23	1708570.827	464920.673	392.763	392.808	-0.045	3080
24	1708468.318	465016.643	393.017	393.100	-0.083	3220
25	1708365.268	465110.913	393.532	393.587		3360
26	1708251.229	465217.010	392.620	392.723	-0.103	3500
27no	1708156.172	465318.750	392.882	393.009	-0.127	3640
28no	1708041.798	465409.732	393.096	393.199	-0.103	3780
29	1707934.268	465510.061	392.810	392.898	-0.088	3920
30	1707826.171	465608.178	392.746	392.862	-	4060
32	1707724.268	465704.399	392.688	392.804	-0.116	4200
33	1707618.521	465802.471	392.511	392.642	-0.131	4340
34	1707496.368	465913.811	392.515	392.616	-0.101	4480
35	1707388.408	466014.665	392.484	392.614	-0.130	4620
36	1707285.673	466117.050	392.968	393.099	-0.131	4760
37	1707172.763	466213.208	392.521	392.645	-0.124	4900
cp2	1707136.007	466231.765	392.590	392.628	-0.038	

A-4 Different reading between gps / level instrument every 1 kilometer

KILOMETER	N	E	GPS HIEGHT	LEVEL HIEGHT	DIFF
k1	1710055.707	463589.34	392.397	392.423	-0.026
k2	1709316.169	464285.38	392.506	392.529	-0.023
k3	1708630.024	464927.421	392.788	392.802	-0.014
k4	1707874.575	465628.727	392.911	392.932	-0.021
cp1	1710824.184	462805.242	392.321	392.342	-0.021
cp2.5	1708975.95	464619.65	392.873	392.851	0.022
cp2	1708975.944	464619.642	392.887	392.887	0
cp7.5	1705256.219	467975.377	392.509	392.499	0.01
cp3	1703225.921	469704.324	392.173	392.171	0.002

A-5 Leveling data by level Instrument for centerline (Base every 1 kilometer)

B.S	I.S	F.S	HOF C	R.L	REMARKS
1.400			393.742	392.342	CP1
	1.473		393.742	392.269	0+000
	1.349		393.742	392.393	0+140
2.055		1.375	394.422	392.367	0+280
	1.986		394.422	392.436	0+420
1.620		2.053	393.989	392.369	0+560
	1.673		393.989	392.316	0+700
1.632		1.478	394.143	392.511	0+840
	1.542		394.143	392.601	0+980
1.678		1.398	394.423	392.745	1+120
	2.000		394.423	392.423	KM1+000
2.303		1.843	394.883	392.580	1+260
	2.358		394.883	392.525	1+400
1.740		2.212	394.411	392.671	1+540
	1.725		394.411	392.686	1+680
1.905		1.788	394.528	392.623	1+820
	2.047		394.528	392.481	1+960
1.560		1.260	394.828	393.268	2+100

	1.281		394.828	393.547	2+240
1.601		1.580	394.849	393.248	2+380
	2.300		394.849	392.549	km2+000
1.060		1.601	394.308	393.248	2+380
	1.795		394.308	392.513	2+520
1.810		1.730	394.388	392.578	2+660
	1.263		394.388	393.125	2+800
1.060		1.185	394.263	393.203	2+940
	1.461		394.263	392.802	KM3+000
	1.455		394.263	392.808	3+080
2.106		1.163	395.206	393.100	3+220
	1.619		395.206	393.587	3+360
1.683		2.483	394.406	392.723	3+500
	1.397		394.406	393.009	3+640
1.323		1.207	394.522	393.199	3+780
	1.624		394.522	392.898	3+920
1.145		1.537	394.130	392.985	KM4+000
	1.268		394.130	392.862	4+060
	1.326		394.130	392.804	4+200
1.457		1.488	394.099	392.642	4+340
	1.483		394.099	392.616	4+480
1.565		1.485	394.179	392.614	4+620
	1.080		394.179	393.099	4+760
1.390		1.534	394.035	392.645	4+900
		1.331	392.704	392.704	CP2

REFERENCES AND BIBLIOGRAPHY

- 1.Ahmad, T. Y., 1980, "Geophysical Investigation to the South and Southwest of AskiKalak", M.Sc.Thesis, Mosul University.
- 2.Al-Shaikh, Z. D. and Baker, H. A., 1973, "Gravity Survey of the Greater Mosul", Journal of the Geological Society of Iraq", vol.VI, pp.35-45.
- 3.Andersen O.B., Vest A.L. and Knudsen P., 2006. The KMS04 multi-mission mean sea surface. In: Knudsen P., Johannessen J., Gruber T., Stammer S. and van Dam T. (Eds.), GOCINA.
- 4.Christopher, B., J., 1999,"Geographical Information Systems and ComputerCartography", Addison Wesley Longman Limited, 318p.
- 5.Fotopoulos G., 2005. Calibration of geoid error models via a combined adjustment of ellipsoidal,
- 6.Improving Modelling of Ocean Transport and Climate Prediction in the North Atlantic Region.
- 7.Jiang Z. and Duquenne H., 1996. On the combined adjustment of a gravimetrically determined geoid and GPS levelling stations. J. Geodesy, 70, 505-514, European Center for Geodynamics and Seismology, ISBN: 2-9599804-2-5 Using GOCE Gravimetry. Cahiers du Centre European de Geodynamique et de Seismologie.
- 8.Kamal. A. A., 2006, "Unification of the Georeferencing Systems of GIS Spatial Data Infrastructure", Al-Ain Town Planning Department, available at: www.GISdevelopment.net, accessed at: 22/11/2006.
- 9.Kiamehr, R., 2006, "Potential of the Iranian Geoid for GPS/Leveling ", Department ".

10. orthometric and gravimetric geoid height data. *J. Geodesy*, 79, 111–123.
11. Surveying Engineering, University of Zanjan, available at: www.geomatics.kth.se/, accessed as: 22/12/2006, 10p.
12. Sadiq M., Ahmad Z. and Akhter G., 2009. A study on the evaluation of the geoid-quasigeoid separation term over Pakistan with solution of 1st and 2nd order height terms. *Earth Planet and Space*, (in print).