Appendix 15

Appendix 15.2.1 Investment (Including Engineering Fee and Reinvestment)
Sensitivity Analysis: Investment 0% Up

Appendix 15.2.2 Investment (Including Engineering Fee and Reinvestment)
Sensitivity Analysis: Investment 5% Up

Appendix 15.2.3 Investment (Including Engineering Fee and Reinvestment)
Sensitivity Analysis: Investment 10% Up

Appendix 15.2.4 The Master Plan Study on the Development of Syrian Railway in the Syrian Arab Republic Financial Analysis
P/L Statement & Financial Program (Interest 2.20%)

Appendix 15.2.5 The Master Plan Study on the Development of Syrian Railway in the Syrian Arab Republic Fina Cash Flow & FIRR
Loan Condition 1

Appendix 15.2.6 The Master Plan Study on the Development of Syrian Railway in the Syrian Arab Republic Financial Analysis
P/L Statement & Financial Program (Interest 0.0075)

Appendix 15.2.7 The Master Plan Study on the Development of Syrian Railway in the Syrian Arab Republic Fina Cash Flow & FIRR
Loan Condition 2

Appendix 15.2.1.(1) Investment (Including Engineering Fee and Reinvestment)

Sensitivity Analysis: Investment 0% up (Unit: Million Syrian Pounds)

Item	Currency	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Land	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	530	744	638	444	252	318	239	145	37	0	62	54	40	37
	Total	530	744	638	444	252	318	239	145	37	0	62	54	40	37
Building	Foreign Currency	909	2,352	1,985	1,617	1,176	0	110	882	588	0	0	368	1,470	1,103
	Local Currency	347	1,008	851	693	504	0	47	378	252	0	0	158	630	473
	Total	1,155	3,360	2,835	2,310	1,680	0	158	1,260	840	0	0	525	2,100	1,575
Machine	Foreign Currency	29	595	406	463	255	0	0	142	47	0	0	0	378	189
	Local Currency	3	66	45	51	28	0	0	16	5	0	0	0	42	21
	Total	32	662	452	515	284	0	0	158	53	0	0	0	420	210
Electronics Equipment	Foreign Currency	215	215	215	215	217	222	222	222	222	225	117	117	332	332
	Local Currency	1	2	2	2	2	1	1	1	1	1	1	1	3	4
	Total	216	217	217	217	219	223	223	223	223	226	118	118	335	336
Electrical Equipment	Foreign Currency	407	407	407	407	412	445	445	445	445	449	129	128	128	128
	Local Currency	3	4	4	4	4	3	3	3	3	3	1	1	1	2
	Total	411	412	412	412	416	448	448	448	448	453	129	129	129	130
Cable	Foreign Currency	228	228	228	228	232	229	229	229	229	229	45	45	45	45
	Local Currency	3	4	4	4	4	3	3	3	3	4	1	1	1	1
	Total	231	232	232	232	236	232	232	232	232	233	46	46	46	46
Structure	Foreign Currency	65	88	92	80	67	90	101	96	63	4	4	7	4	3
	Local Currency	2,662	3,955	4,256	3,691	2,855	3,933	4,396	4,312	2,556	251	294	284	254	246
	Total	2,727	4,053	4,348	3,771	2,922	4,024	4,497	4,408	2,619	255	298	291	258	249
Track	Foreign Currency	788	1,796	2,228	2,338	2,074	1,479	2,342	2,673	2,597	2,665	485	657	665	574
	Local Currency	450	1,095	1,366	1,428	1,272	935	1,472	1,664	1,637	1,723	260	381	413	368
	Total	1,238	2,891	3,594	3,766	3,345	2,414	3,814	4,338	4,234	4,388	746	1,038	1,077	942
Locomootive & Diesel Car	Foreign Currency	964	965	965	964	964	794	794	795	794	794	2,367	2,367	2,367	2,367
	Local Currency	108	108	108	108	108	89	89	89	89	89	263	263	263	263
	Total	1,072	1,073	1,073	1,072	1,072	883	883	884	883	883	2,630	2,630	2,630	2,630
Passenger Car & Freight Car	Foreign Currency	65	67	66	66	66	619	621	621	621	619	1,373	1,375	1,374	1,374
	Local Currency	7	7	7	7	7	69	69	69	69	69	153	153	153	153
	Total	72	74	73	73	73	688	690	690	690	688	1,526	1,528	1,527	1,527
Grand Total	Foreign Currency	3,569	6,714	6,593	6,379	5,463	3,878	4,963	6,104	5,606	4,985	4,499	5,064	6,763	6,115
	Local Currency	4,114	7,004	7,281	6,433	5,036	5,351	6,320	6,681	4,652	2,140	1,055	1,295	1,800	1,567
	Grand Total	7,683	13,718	13,874	12,812	10,499	9,230	11,184	12,785	10,258	7,126	5,555	6,359	8,563	7,682

Appendix 15.2.1 (2) Investment (Including Engineering Fee and Reinvestment)

Sensitivity Analysis: Investment 0% up (Unit: Million Syrian Pounds)

Item	Currency	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Land	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	46	84	4	4	0	0	0	0	0	0	0	0	0
	Total	0	46	84	4	4	0	0	0	0	0	0	0	0	0
Building	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machine	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electronics Equipment	Foreign Currency	334	314	316	320	320	320	222	225	117	117	332	332	334	314
	Local Currency	4	3	3	2	2	3	1	1	1	1	3	4	4	3
	Total	338	317	319	322	322	323	223	226	118	118	335	336	338	317
Electrical Equipment	Foreign Currency	129	102	102	102	102	103	407	407	407	407	412	445	445	445
	Local Currency	2	1	1	1	1	2	3	4	4	4	4	3	3	3
	Total	131	103	103	103	103	105	411	412	412	412	416	448	448	448
Cable	Foreign Currency	47	8	8	8	8	8	0	0	0	0	0	0	0	0
	Local Currency	2	1	1	1	1	1	0	0	0	0	0	0	0	0
	Total	49	9	9	9	9	9	0	0	0	0	0	0	0	0
Structure	Foreign Currency	1	2	5	9	6	0	0	0	0	0	0	0	0	0
	Local Currency	176	81	230	477	427	44	0	0	0	0	0	0	0	0
	Total	177	83	235	486	434	44	0	0	0	0	0	0	0	0
Track	Foreign Currency	660	203	231	360	445	519	0	0	0	0	0	0	0	0
	Local Currency	410	125	139	214	271	293	0	0	0	0	0	0	0	0
	Total	1,070	328	370	574	716	812	0	0	0	0	0	0	0	0
Locomootive & Diesel Car	Foreign Currency	2,367	2,502	2,502	2,502	2,502	2,502	0	0	0	0	0	0	0	0
	Local Currency	263	278	278	278	278	278	0	0	0	0	0	0	0	0
	Total	2,630	2,780	2,780	2,780	2,780	2,780	0	0	0	0	0	0	0	0
Passenger Car & Freight Car	Foreign Currency	1,374	1,743	1,743	1,743	1,743	1,743	0	0	0	0	0	0	0	0
	Local Currency	153	194	194	194	194	194	0	0	0	0	0	0	0	0
	Total	1,527	1,937	1,937	1,937	1,937	1,937	0	0	0	0	0	0	0	0
Grand Total	Foreign Currency	4,913	4,974	4,908	5,045	5,127	5,195	629	632	524	524	743	777	779	759
	Local Currency	1,010	729	930	1,171	1,179	815	4	5	5	5	7	7	7	6
	Grand Total	5,923	5,603	5,837	6,216	6,306	6,011	633	637	529	529	751	784	786	765

Appendix 15.2.1 (3) Investment (Including Engineering Fee and Reinvestment)

Sensitivity Analysis: Investment 0% up (Unit: Million Syrian Pounds)

Item	Currency	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Land	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	3,679
	Total	0	0	0	0	0	0	0	0	0	0	0	0	3,679
Building	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	12,468
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	5,339
	Total	0	0	0	0	0	0	0	0	0	0	0	0	17,798
Machine	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	2,504
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	278
	Total	0	0	0	0	0	0	0	0	0	0	0	0	2,783
Electronics Equipment	Foreign Currency	316	320	320	320	222	225	117	117	332	332	334	314	10,269
	Local Currency	3	2	2	3	1	1	1	1	3	4	4	3	90
	Total	319	322	322	323	223	226	118	118	335	336	338	317	10,359
Electrical Equipment	Foreign Currency	445	449	128	128	128	128	129	102	102	102	102	103	10,847
	Local Currency	3	3	1	1	1	2	2	1	1	1	1	2	99
	Total	448	453	129	129	129	130	131	103	103	103	103	105	10,945
Cable	Foreign Currency	0	0	228	228	228	228	232	229	229	229	229	229	4,846
	Local Currency	0	0	3	4	4	4	4	3	3	3	3	4	85
	Total	0	0	231	232	232	232	236	232	232	232	232	233	4,931
Structure	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	790
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	35,389
	Total	0	0	0	0	0	0	0	0	0	0	0	0	36,179
Track	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	25,759
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	15,935
	Total	0	0	0	0	0	0	0	0	0	0	0	0	41,693
Locomootive & Diesel Car	Foreign Currency	964	965	965	964	964	794	794	795	794	794	2,367	2,367	46,665
	Local Currency	108	108	108	108	108	89	89	89	89	89	263	263	5,201
	Total	1,072	1,073	1,073	1,072	1,072	883	883	884	883	883	2,630	2,630	51,866
Passenger Car & Freight Car	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	19,016
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	2,115
	Total	0	0	0	0	0	0	0	0	0	0	0	0	21,131
Grand Total	Foreign Currency	1,725	1,735	1,641	1,640	1,542	1,375	1,272	1,242	1,457	1,457	3,032	3,013	133,153
	Local Currency	114	113	114	116	114	96	95	94	96	97	271	272	68,211
	Grand Total	1,840	1,848	1,756	1,757	1,656	1,471	1,368	1,337	1,553	1,554	3,303	3,285	201,364

Appendix 15.2.2.(1) Investment (Including Engineering Fee and Reinvestment)

Sensitivity Analysis: Investment 5% up (Unit: Million Syrian Pounds)

Item	Currency	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Land	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	557	782	670	466	265	334	251	152	39	0	65	56	42	39
	Total	557	782	670	466	265	334	251	152	39	0	65	56	42	39
Building	Foreign Currency	849	2,470	2,084	1,698	1,235	0	116	926	617	0	0	386	1,544	1,158
	Local Currency	364	1,058	893	728	529	0	50	397	265	0	0	165	662	496
	Total	1,213	3,528	2,977	2,426	1,764	0	165	1,323	882	0	0	551	2,205	1,654
Machine	Foreign Currency	30	625	427	486	268	0	0	149	50	0	0	0	397	198
	Local Currency	3	69	47	54	30	0	0	17	6	0	0	0	44	22
	Total	33	695	474	540	298	0	0	165	55	0	0	0	441	221
Electronics Equipment	Foreign Currency	226	226	226	226	228	233	233	233	233	236	122	122	348	348
	Local Currency	1	2	2	2	2	1	1	1	1	1	1	1	3	4
	Total	227	228	228	228	230	234	234	234	234	237	123	123	352	353
Electrical Equipment	Foreign Currency	428	428	428	428	432	467	467	467	467	472	135	135	135	135
	Local Currency	3	4	4	4	4	3	3	3	3	3	1	1	1	2
	Total	431	432	432	432	437	471	471	471	471	475	136	136	136	137
Cable	Foreign Currency	239	239	239	239	244	240	240	240	240	240	47	47	47	47
	Local Currency	3	4	4	4	4	3	3	3	3	4	1	1	1	1
	Total	243	244	244	244	248	244	244	244	244	245	49	49	49	49
Structure	Foreign Currency	68	93	97	84	71	95	106	100	66	4	4	8	4	3
	Local Currency	2,795	4,163	4,468	3,875	2,998	4,130	4,616	4,528	2,683	263	309	298	267	258
	Total	2,863	4,256	4,565	3,959	3,068	4,225	4,722	4,629	2,750	268	313	305	271	261
Track	Foreign Currency	827	1,885	2,340	2,455	2,177	1,553	2,459	2,807	2,726	2,796	488	690	696	603
	Local Currency	473	1,150	1,434	1,499	1,335	981	1,546	1,747	1,719	1,809	294	400	433	386
	Total	1,300	3,035	3,774	3,955	3,513	2,535	4,004	4,554	4,445	4,607	783	1,090	1,131	989
Locomootive & Diesel Car	Foreign Currency	1,012	1,013	1,013	1,012	1,012	834	834	835	834	834	2,485	2,485	2,485	2,485
	Local Currency	113	113	113	113	113	93	93	93	93	93	276	276	276	276
	Total	1,126	1,127	1,127	1,126	1,126	927	927	928	927	927	2,762	2,762	2,762	2,762
Passenger Car & Freight Car	Foreign Currency	69	70	69	69	69	650	652	652	652	650	1,442	1,444	1,443	1,443
	Local Currency	7	7	7	7	7	72	72	72	72	72	161	161	161	161
	Total	76	78	77	77	77	722	725	725	725	722	1,602	1,604	1,603	1,603
Grand Total	Foreign Currency	3,747	7,049	6,922	6,698	5,736	4,072	5,106	6,409	5,886	5,234	4,724	5,317	7,101	6,421
	Local Currency	4,320	7,354	7,645	6,754	5,288	5,619	6,636	7,015	4,885	2,247	1,109	1,360	1,890	1,645
	Grand Total	8,068	14,403	14,568	13,452	11,024	9,691	11,743	13,424	10,770	7,482	5,832	6,677	8,991	8,066

Appendix 15.2.2.(2) Investment (Including Engineering Fee and Reinvestment)

Sensitivity Analysis: Investment 5% up (Unit: Million Syrian Pounds)

Item	Currency	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Land	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	49	88	4	4	0	0	0	0	0	0	0	0	0
	Total	0	49	88	4	4	0	0	0	0	0	0	0	0	0
Building	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machine	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electronics Equipment	Foreign Currency	351	330	332	336	336	336	233	236	122	122	349	349	351	330
	Local Currency	4	3	3	2	2	3	1	1	1	1	3	4	4	3
	Total	355	333	335	338	338	340	234	237	123	123	352	353	355	333
Electrical Equipment	Foreign Currency	136	107	107	107	107	108	428	428	428	428	432	467	467	467
	Local Currency	2	1	1	1	1	2	3	4	4	4	4	3	3	3
	Total	138	108	108	108	108	110	431	432	432	432	437	471	471	471
Cable	Foreign Currency	50	9	9	9	9	9	0	0	0	0	0	0	0	0
	Local Currency	2	1	1	1	1	1	0	0	0	0	0	0	0	0
	Total	52	10	10	10	10	10	0	0	0	0	0	0	0	0
Structure	Foreign Currency	1	2	6	10	7	0	0	0	0	0	0	0	0	0
	Local Currency	185	85	241	501	449	46	0	0	0	0	0	0	0	0
	Total	186	87	247	510	455	46	0	0	0	0	0	0	0	0
Track	Foreign Currency	693	213	243	378	467	545	0	0	0	0	0	0	0	0
	Local Currency	430	131	146	225	284	308	0	0	0	0	0	0	0	0
	Total	1,123	344	388	603	752	852	0	0	0	0	0	0	0	0
Locomootive & Diesel Car	Foreign Currency	2,485	2,627	2,627	2,627	2,627	2,627	0	0	0	0	0	0	0	0
	Local Currency	276	292	292	292	292	292	0	0	0	0	0	0	0	0
	Total	2,762	2,919	2,919	2,919	2,919	2,919	0	0	0	0	0	0	0	0
Passenger Car & Freight Car	Foreign Currency	1,443	1,830	1,830	1,830	1,830	1,830	0	0	0	0	0	0	0	0
	Local Currency	161	204	204	204	204	204	0	0	0	0	0	0	0	0
	Total	1,603	2,034	2,034	2,034	2,034	2,034	0	0	0	0	0	0	0	0
Grand Total	Foreign Currency	5,158	5,118	5,153	5,297	5,383	5,455	660	664	550	550	781	816	818	797
	Local Currency	1,061	766	976	1,230	1,238	856	4	6	6	6	8	8	8	7
	Grand Total	6,219	5,883	6,129	6,527	6,621	6,311	665	669	556	556	788	824	826	804

Appendix 15.2.2.(3) Investment (Including Engineering Fee and Reinvestment)

Sensitivity Analysis: Investment 5% up (Unit: Million Syrian Pounds)

Item	Currency	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Land	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	3,963
	Total	0	0	0	0	0	0	0	0	0	0	0	0	3,963
Building	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	13,081
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	5,606
	Total	0	0	0	0	0	0	0	0	0	0	0	0	18,687
Machine	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	2,629
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	292
	Total	0	0	0	0	0	0	0	0	0	0	0	0	2,922
Electronics Equipment	Foreign Currency	332	336	336	336	233	236	122	122	348	348	351	330	10,782
	Local Currency	3	2	2	3	1	1	1	1	3	4	4	3	95
	Total	335	338	338	340	234	237	123	123	352	353	355	333	10,877
Electrical Equipment	Foreign Currency	467	472	135	135	135	135	136	107	107	107	107	108	11,389
	Local Currency	3	3	1	1	1	2	2	1	1	1	1	2	104
	Total	471	475	136	136	136	137	138	108	108	108	108	110	11,492
Cable	Foreign Currency	0	0	239	239	239	239	244	240	240	240	240	240	5,088
	Local Currency	0	0	3	4	4	4	4	3	3	3	3	4	89
	Total	0	0	243	244	244	244	248	244	244	244	244	245	5,177
Structure	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	829
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	37,159
	Total	0	0	0	0	0	0	0	0	0	0	0	0	37,988
Track	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	27,047
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	16,732
	Total	0	0	0	0	0	0	0	0	0	0	0	0	43,778
Locomootive & Diesel Car	Foreign Currency	1,012	1,013	1,013	1,012	1,012	834	834	835	834	834	2,485	2,485	48,998
	Local Currency	113	113	113	113	113	93	93	93	93	93	276	276	5,461
	Total	1,126	1,127	1,127	1,126	1,126	927	927	928	927	927	2,762	2,762	54,459
Passenger Car & Freight Car	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	19,967
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	2,221
	Total	0	0	0	0	0	0	0	0	0	0	0	0	22,188
Grand Total	Foreign Currency	1,812	1,821	1,723	1,722	1,619	1,443	1,335	1,304	1,529	1,529	3,183	3,163	139,811
	Local Currency	120	119	120	122	120	101	101	99	101	102	285	286	71,621
	Grand Total	1,932	1,940	1,843	1,844	1,739	1,545	1,437	1,403	1,631	1,632	3,468	3,449	211,432

Appendix 15.2.3(1) Investment (Including Engineering Fee and Reinvestment)

Sensitivity Analysis: Investment 10% up (Unit: Million Syrian Pounds)

Item	Currency	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Land	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	583	819	702	489	277	350	263	159	40	0	68	59	44	40
	Total	583	819	702	489	277	350	263	159	40	0	68	59	44	40
Building	Foreign Currency	889	2,587	2,183	1,779	1,294	0	121	970	647	0	0	404	1,617	1,213
	Local Currency	381	1,109	936	762	554	0	52	416	277	0	0	173	693	520
	Total	1,271	3,696	3,119	2,541	1,848	0	173	1,386	924	0	0	578	2,310	1,733
Machine	Foreign Currency	31	655	447	509	281	0	0	156	52	0	0	0	416	208
	Local Currency	3	73	50	57	31	0	0	17	6	0	0	0	46	23
	Total	35	728	497	566	312	0	0	173	58	0	0	0	462	231
Electronics Equipment	Foreign Currency	237	237	237	237	239	244	244	244	244	247	128	128	365	365
	Local Currency	1	2	2	2	2	1	1	1	1	1	1	1	3	5
	Total	238	239	239	239	241	245	245	245	245	248	129	129	368	370
Electrical Equipment	Foreign Currency	448	448	448	448	453	490	490	490	490	494	141	141	141	141
	Local Currency	3	5	5	5	5	3	3	3	3	3	1	1	1	2
	Total	452	453	453	453	457	493	493	493	493	498	142	142	142	143
Cable	Foreign Currency	251	251	251	251	255	252	252	252	252	252	50	50	50	50
	Local Currency	3	5	5	5	5	3	3	3	3	5	1	1	1	1
	Total	254	255	255	255	260	255	255	255	255	256	51	51	51	51
Structure	Foreign Currency	72	97	102	88	74	99	111	105	69	5	5	8	5	3
	Local Currency	2,928	4,361	4,681	4,060	3,140	4,327	4,836	4,744	2,811	276	323	312	280	270
	Total	3,000	4,458	4,783	4,148	3,214	4,426	4,947	4,849	2,881	281	328	320	284	274
Track	Foreign Currency	866	1,975	2,461	2,572	2,281	1,627	2,576	2,941	2,856	2,931	512	723	731	632
	Local Currency	495	1,205	1,503	1,571	1,399	1,028	1,619	1,831	1,801	1,895	308	419	454	404
	Total	1,362	3,180	3,964	4,143	3,680	2,655	4,195	4,771	4,657	4,827	820	1,142	1,185	1,036
Locomootive & Diesel Car	Foreign Currency	1,060	1,062	1,062	1,060	1,060	873	873	875	873	873	2,604	2,604	2,604	2,604
	Local Currency	119	119	119	119	119	99	98	98	99	98	289	289	299	289
	Total	1,179	1,180	1,180	1,179	1,179	971	971	972	971	971	2,893	2,893	2,893	2,893
Passenger Car & Freight Car	Foreign Currency	72	74	73	73	73	691	683	683	693	691	1,510	1,513	1,511	1,511
	Local Currency	8	8	8	8	8	76	76	76	76	76	168	168	168	168
	Total	79	81	80	80	80	757	759	759	759	757	1,679	1,681	1,680	1,680
Grand Total	Foreign Currency	3,926	7,385	7,252	7,017	6,009	4,266	5,350	6,715	6,166	5,484	4,949	5,570	7,439	6,727
	Local Currency	4,526	7,704	8,009	7,076	5,540	5,896	6,952	7,349	5,117	2,354	1,161	1,424	1,990	1,723
	Grand Total	8,452	15,089	15,262	14,093	11,549	10,153	12,302	14,063	11,283	7,838	6,110	6,995	9,419	8,450

Appendix 15.2.3 (2) Investment (Including Engineering Fee and Reinvestment)

Sensitivity Analysis: Investment 10% up (Unit: Million Syrian Pounds)

Item	Currency	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Land	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	51	92	5	5	0	0	0	0	0	0	0	0	0
	Total	0	51	92	5	5	0	0	0	0	0	0	0	0	0
Building	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machine	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electronics Equipment	Foreign Currency	367	345	348	352	352	352	244	247	128	128	365	365	367	345
	Local Currency	5	3	3	2	2	3	1	1	1	1	3	5	5	3
	Total	372	349	351	355	355	356	245	248	129	129	368	370	372	349
Electrical Equipment	Foreign Currency	142	112	112	112	112	113	448	448	448	448	453	490	490	490
	Local Currency	2	1	1	1	1	2	3	5	5	5	5	3	3	3
	Total	144	113	113	113	113	116	452	453	453	453	457	493	493	493
Cable	Foreign Currency	52	9	9	9	9	9	0	0	0	0	0	0	0	0
	Local Currency	2	1	1	1	1	1	0	0	0	0	0	0	0	0
	Total	54	10	10	10	10	10	0	0	0	0	0	0	0	0
Structure	Foreign Currency	1	2	6	10	7	0	0	0	0	0	0	0	0	0
	Local Currency	194	89	253	524	470	49	0	0	0	0	0	0	0	0
	Total	195	91	259	535	477	49	0	0	0	0	0	0	0	0
Track	Foreign Currency	726	223	254	396	490	571	0	0	0	0	0	0	0	0
	Local Currency	450	137	152	236	298	322	0	0	0	0	0	0	0	0
	Total	1,177	360	407	632	788	893	0	0	0	0	0	0	0	0
Locomootive & Diesel Car	Foreign Currency	2,604	2,752	2,752	2,752	2,752	2,752	0	0	0	0	0	0	0	0
	Local Currency	289	306	306	306	306	306	0	0	0	0	0	0	0	0
	Total	2,893	3,058	3,058	3,058	3,058	3,058	0	0	0	0	0	0	0	0
Passenger Car & Freight Car	Foreign Currency	1,511	1,917	1,917	1,917	1,917	1,917	0	0	0	0	0	0	0	0
	Local Currency	168	213	213	213	213	213	0	0	0	0	0	0	0	0
	Total	1,680	2,131	2,131	2,131	2,131	2,131	0	0	0	0	0	0	0	0
Grand Total	Foreign Currency	5,404	5,361	5,398	5,550	5,640	5,715	692	695	576	576	818	855	857	835
	Local Currency	1,111	802	1,023	1,288	1,297	897	5	6	6	6	8	8	8	7
	Grand Total	6,515	6,164	6,421	6,838	6,936	6,612	696	701	582	582	826	863	865	842

Appendix 15.2.3 (3) Investment (Including Engineering Fee and Reinvestment)

Sensitivity Analysis: Investment 10% up (Unit: Million Syrian Pounds)

Item	Currency	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Land	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	0
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	4,047
	Total	0	0	0	0	0	0	0	0	0	0	0	0	4,047
Building	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	13,704
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	5,873
	Total	0	0	0	0	0	0	0	0	0	0	0	0	19,577
Machine	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	2,755
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	306
	Total	0	0	0	0	0	0	0	0	0	0	0	0	3,061
Electronics Equipment	Foreign Currency	348	352	352	352	244	247	128	128	365	365	367	345	11,296
	Local Currency	3	2	2	3	1	1	1	1	3	5	5	3	99
	Total	351	355	355	356	246	248	129	129	368	370	372	349	11,395
Electrical Equipment	Foreign Currency	490	494	141	141	141	141	142	112	112	112	112	113	11,931
	Local Currency	3	3	1	1	1	2	2	1	1	1	1	2	109
	Total	493	498	142	142	142	143	144	113	113	113	113	116	12,040
Cable	Foreign Currency	0	0	251	251	251	251	255	252	252	252	252	252	5,330
	Local Currency	0	0	3	5	5	5	5	3	3	3	3	5	94
	Total	0	0	254	255	255	255	260	255	255	255	255	256	5,424
Structure	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	869
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	38,928
	Total	0	0	0	0	0	0	0	0	0	0	0	0	39,797
Track	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	28,334
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	17,528
	Total	0	0	0	0	0	0	0	0	0	0	0	0	45,863
Locomootive & Diesel Car	Foreign Currency	1,060	1,062	1,062	1,060	1,060	873	873	875	873	873	2,604	2,604	51,332
	Local Currency	119	119	119	119	119	98	98	98	98	98	289	289	5,721
	Total	1,179	1,180	1,180	1,179	1,179	971	971	972	971	971	2,893	2,893	57,053
Passenger Car & Freight Car	Foreign Currency	0	0	0	0	0	0	0	0	0	0	0	0	20,918
	Local Currency	0	0	0	0	0	0	0	0	0	0	0	0	2,327
	Total	0	0	0	0	0	0	0	0	0	0	0	0	23,244
Grand Total	Foreign Currency	1,898	1,908	1,805	1,804	1,696	1,512	1,399	1,367	1,602	1,602	3,335	3,314	146,468
	Local Currency	126	125	126	128	126	106	106	104	106	107	299	300	75,032
	Grand Total	2,024	2,033	1,931	1,932	1,821	1,618	1,505	1,470	1,708	1,709	3,633	3,614	221,500

Appdndix 15.2.4(1) The Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Financial Analysis
P/L Statement & Financial Program

Conditions of Foreign Loan: Interest: 2.20%
Repayment: Semiannual Equal Instalment
Term: 30 Years
Grace: 10 Years

Passenger Fare: 0.1755 S.P./km Freight Charge: 0.8869 S.P./km

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Profit & Loss Statement														
Passenger Fare Revenue	20	30	41	51	61	74	86	99	112	124	142	159	176	194
Freight Charge Revenue	307	460	613	766	920	1,226	1,533	1,840	2,147	2,454	3,060	3,667	4,274	4,881
Miscellaneous Revenue	10	15	20	25	29	39	49	58	68	77	96	115	134	152
Operating Revenue Total	337	505	673	841	1,010	1,339	1,668	1,997	2,326	2,655	3,298	3,941	4,584	5,227
Personnel Cost	-22	-32	-43	-54	-65	-55	-45	-36	-26	-16	1	18	35	52
Lubricant & Fuel	57	79	99	114	126	164	201	239	276	314	384	455	526	596
Maintenance Expenses	42	59	73	85	93	121	149	177	204	232	284	337	389	441
Other Oerating Costs	23	32	40	46	51	67	82	98	113	129	158	187	216	245
Depreciation	203	509	800	1,072	1,303	1,521	1,752	2,012	2,222	2,365	2,634	2,914	3,245	3,555
Operating Expense Total	303	647	968	1,263	1,509	1,818	2,140	2,489	2,790	3,024	3,462	3,910	4,410	4,890
Operating Profit	33	-142	-295	-421	-499	-479	-472	-492	-464	-369	-164	31	174	337
Interest	79	226	371	512	632	717	824	958	1,062	1,191	1,267	1,348	1,461	1,560
Net Profit	-46	-369	-666	-933	-1,131	-1,196	-1,296	-1,451	-1,545	-1,560	-1,431	-1,317	-1,287	-1,223
Cumulative Net Profit	-46	-414	-1,080	-2,013	-3,144	-4,340	-5,636	-7,087	-8,632	-10,192	-11,623	-12,940	-14,227	-15,450
Rate of Return on Equity (%)	-1.1%	-3.4%	-3.7%	-3.8%	-3.9%	-3.5%	-3.2%	-3.1%	-3.1%	-3.0%	-2.7%	-2.4%	-2.3%	-2.2%
Rate of Return on Operating Revenue (%)	-13.4%	-73.0%	-99.0%	-110.9%	-112.0%	-89.3%	-77.7%	-72.6%	-66.4%	-58.8%	-43.4%	-33.4%	-28.1%	-23.4%
Transport Revenue per Employee ('000)	172.1	190.4	209.2	228.4	248.1	277.8	306.8	335.2	362.9	390.0	442.4	492.8	541.5	589.4
Passenger/Ton•KM per Employee ('000)	211.5	236.3	261.7	287.7	314.4	352.1	389.0	425.0	460.3	494.8	559.2	619.3	678.2	735.1
Financial Program														
Financing in Foreign Currency														
Borrowing	3,569	6,714	6,593	6,379	5,463	3,878	4,863	6,104	5,606	4,985	4,499	5,064	6,548	5,900
Repayment	0	0	0	0	0	0	0	0	0	0	1,401	1,401	1,401	1,401
Loan Balance	3,569	10,283	16,875	23,254	28,717	32,596	37,459	43,563	49,169	54,154	57,252	60,915	66,062	70,561
Interest	79	226	371	512	632	717	824	958	1,062	1,191	1,267	1,348	1,461	1,560
Financing in Local Currency														
Equity	3,956	6,863	7,148	6,294	4,865	5,026	5,864	6,119	3,976	1,335	1,253	1,099	1,459	851
Equity Balance	3,956	10,820	17,967	24,262	29,126	34,152	40,016	46,136	50,111	51,446	52,699	53,798	55,256	56,107

Appdndix 15.2.4(2) The Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Financial Analysis
P/L Statement & Financial Program

Conditions of Foreign Loan: Interest: 2.20%
Repayment: Semiannual Equal Instalment Term: 30 Years
Grace: 10 Years

Passenger Fare: 0.1755 S.P./km Freight Charge: 0.8869 S.P./km

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Profit & Loss Statement														
Passenger Fare Revenue	211	233	255	277	298	320	320	320	320	320	320	320	320	320
Freight Charge Revenue	5,488	6,435	7,383	8,331	9,278	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226
Miscellaneous Revenue	171	200	229	258	287	316	316	316	316	316	316	316	316	316
Operating Revenue Total	5,870	6,868	7,867	8,865	9,864	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862
Personnel Cost	69	96	124	151	179	207	207	207	207	207	207	207	207	207
Lubricant & Fuel	667	769	871	972	1,074	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176
Maintenance Expenses	494	569	644	719	794	870	870	870	870	870	870	870	870	870
Other Oerating Costs	274	318	363	407	451	495	495	495	495	495	495	495	495	495
Depreciation	3,784	4,034	4,287	4,546	4,803	5,059	5,027	4,979	4,937	4,893	4,794	4,699	4,604	4,505
Operating Expense Total	5,288	5,787	6,288	6,795	7,301	7,806	7,774	7,727	7,684	7,641	7,542	7,447	7,352	7,253
Operating Profit	582	1,082	1,578	2,070	2,563	3,057	3,088	3,136	3,178	3,222	3,321	3,416	3,511	3,610
Interest	1,633	1,684	1,729	1,777	1,827	1,878	1,798	1,712	1,625	1,538	1,451	1,345	1,232	1,120
Net Profit	−1,051	−602	−150	293	736	1,179	1,290	1,424	1,553	1,684	1,870	2,071	2,278	2,490
Cumulative Net Profit	−16,501	−17,103	−17,254	−16,960	−16,224	−15,045	−13,755	−12,331	−10,778	−9,094	−7,225	−5,154	−2,876	−386
Rate of Return on Equity (%)	−1.9%	−1.1%	−0.3%	0.5%	1.3%	2.1%	2.3%	2.5%	2.8%	3.0%	3.3%	3.7%	4.1%	4.4%
Rate of Return on Operating Revenue (%)	−17.9%	−8.8%	−1.9%	3.3%	7.5%	10.9%	11.9%	13.1%	14.3%	15.5%	17.2%	19.1%	21.0%	22.9%
Transport Revenue per Employee ('000)	633.7	700.1	763.0	822.6	879.1	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9
Passenger/Ton•KM per Employee ('000)	799.9	868.4	942.6	1,012.9	1,079.7	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2
Financial Program														
Financing in Foreign Currency														
Borrowing	4,698	4,659	4,690	4,824	4,905	4,974	0	0	0	0	0	0	0	0
Repayment	1,401	2,642	2,642	2,642	2,642	2,642	3,944	3,944	3,944	3,944	3,944	5,118	5,118	5,118
Loan Balance	73,858	75,875	77,923	80,105	82,369	84,701	80,756	76,812	72,868	68,923	64,979	59,861	54,743	49,625
Interest	1,633	1,684	1,729	1,777	1,827	1,878	1,798	1,712	1,625	1,538	1,451	1,345	1,232	1,120
Financing in Local Currency														
Equity	0	47	0	0	0	0	0	0	0	0	0	0	0	0
Equity Balance	56,107	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153

Appendix 15.2.4.(3) The Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Financial Analysis
P/L Statement & Financial Program

Conditions of Foreign Loan: Interest: 2.20%
Repayment: Semiannual Equal Instalment
Term: 30 Years
Grace: 10 Years

Passenger Fare: 0.1755 S.P./km Freight Charge: 0.8869 S.P./km

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Profit & Loss Statement													
Passenger Fare Revenue	320	320	320	320	320	320	320	320	320	320	320	320	9,365
Freight Charge Revenue	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	279,806
Miscellaneous Revenue	316	316	316	316	316	316	316	316	316	316	316	316	8,675
Operating Revenue Total	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	297,847
Personnel Cost	207	207	207	207	207	207	207	207	207	207	207	207	4,671
Lubricant & Fuel	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	32,670
Maintenance Expenses	870	870	870	870	870	870	870	870	870	870	870	870	24,167
Other Oerating Costs	495	495	495	495	495	495	495	495	495	495	495	495	13,706
Depreciation	3,921	3,858	3,771	3,684	3,586	3,580	3,583	3,552	3,523	3,492	2,667	2,698	132,977
Operating Expense Total	6,669	6,606	6,518	6,431	6,333	6,327	6,330	6,300	6,270	6,240	5,415	5,446	208,192
Operating Profit	4,194	4,257	4,344	4,431	4,529	4,536	4,532	4,563	4,592	4,623	5,448	5,417	89,655
Interest	1,007	895	794	708	626	545	463	391	333	279	224	170	41,011
Net Profit	3,186	3,362	3,550	3,723	3,903	3,991	4,069	4,172	4,259	4,344	5,223	5,247	48,644
Cumulative Net Profit	2,800	6,163	9,713	13,436	17,339	21,330	25,399	29,571	33,830	38,174	43,397	48,644	
Rate of Return on Equity (%)	5.7%	6.0%	6.3%	6.6%	6.9%	7.1%	7.2%	7.4%	7.6%	7.7%	9.3%	9.3%	
Rate of Return on Operating Revenue (%)	29.3%	31.0%	32.7%	34.3%	35.9%	36.7%	37.5%	38.4%	39.2%	40.0%	48.1%	48.3%	
Transport Revenue per Employee ('000)	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	
Passenger/Ton•KM per Employee ('000)	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	
Financial Program													
Financing in Foreign Currency													
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	104,913
Repayment	5,118	5,118	4,417	3,717	3,717	3,717	3,717	3,096	2,476	2,476	2,476	2,476	97,809
Loan Balance	44,508	39,390	34,973	31,256	27,539	23,822	20,105	17,009	14,533	12,056	9,580	7,104	
Interest	1,007	895	794	708	626	545	463	391	333	279	224	170	41,011
Financing in Local Currency													
Equity	0	0	0	0	0	0	0	0	0	0	0	0	56,153
Equity Balance	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	56,153	

Appendix 15.2.5.(1) The Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Fina Cash Flow & FIRR
Loan Condition 1

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cash Flow Statement														
Net Cash Flow														
Operating Profit	33	-142	-295	-421	-499	-479	-472	-492	-464	-369	-164	31	174	337
Depreciation	203	509	800	1,072	1,303	1,521	1,752	2,012	2,222	2,365	2,634	2,914	3,245	3,555
Borrowing	3,569	6,714	6,593	6,379	5,463	3,878	4,863	6,104	5,606	4,985	4,499	5,064	6,548	5,900
Equity	3,956	6,863	7,148	6,294	4,865	5,026	5,864	6,119	3,976	1,335	1,253	1,099	1,459	851
Total	7,762	13,944	14,245	13,323	11,131	9,947	12,008	13,743	11,339	8,317	8,223	9,107	11,425	10,643
Investment	7,683	13,718	13,874	12,812	10,499	9,230	11,184	12,785	10,258	7,126	5,555	6,359	8,563	7,682
Salvage Value (-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	0	0	0	0	0	0	0	0	0	0	1,401	1,401	1,401	1,401
Interest	79	226	371	512	632	717	824	958	1,082	1,191	1,267	1,348	1,461	1,560
Total	7,762	13,944	14,245	13,323	11,131	9,947	12,008	13,743	11,339	8,317	8,223	9,107	11,425	10,643
Net Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative Net Cash Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash Flow for FIRR (ROI)														
Operating Profit	33	-142	-295	-421	-499	-479	-472	-492	-464	-369	-164	31	174	337
Depreciation	203	509	800	1,072	1,303	1,521	1,752	2,012	2,222	2,365	2,634	2,914	3,245	3,555
Investment (-)	7,683	13,718	13,874	12,812	10,499	9,230	11,184	12,785	10,258	7,126	5,555	6,359	8,563	7,682
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	-7,447	-13,351	-13,369	-12,161	-9,696	-8,188	-9,903	-11,265	-8,499	-5,129	-3,084	-3,414	-5,144	-3,789
FIRR (ROI)	2.0%													
Cash Flow for FIRR (ROE)														
Cash Flow for ROI	-7,447	-13,351	-13,369	-12,161	-9,696	-8,188	-9,903	-11,265	-8,499	-5,129	-3,084	-3,414	-5,144	-3,789
Borrowing	3,569	6,714	6,593	6,379	5,463	3,878	4,863	6,104	5,606	4,985	4,499	5,064	6,548	5,900
Repayment (-)	0	0	0	0	0	0	0	0	0	0	1,401	1,401	1,401	1,401
Interest (-)	79	226	371	512	632	717	824	958	1,082	1,191	1,267	1,348	1,461	1,560
Total	-3,956	-6,863	-7,148	-6,294	-4,865	-5,026	-5,864	-6,119	-3,976	-1,335	-1,253	-1,099	-1,459	-851
FIRR (ROE)	2.0%													

Appendix 15.2.5.(2) The Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Fina Cash Flow & FIRR
Loan Condition 1

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Cash Flow Statement														
Net Cash Flow														
Operating Profit	582	1,082	1,578	2,070	2,563	3,057	3,088	3,136	3,178	3,222	3,321	3,416	3,511	3,610
Depreciation	3,784	4,034	4,287	4,545	4,803	5,059	5,027	4,979	4,937	4,893	4,794	4,699	4,604	4,505
Borrowing	4,698	4,659	4,690	4,824	4,905	4,974	0	0	0	0	0	0	0	0
Equity	0	47	0	0	0	0	0	0	0	0	0	0	0	0
Total	9,064	9,821	10,556	11,439	12,271	13,089	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115
Investment	5,923	5,603	5,837	6,216	6,306	6,011	633	637	529	529	751	784	786	765
Salvage Value (-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	1,401	2,642	2,642	2,642	2,642	2,642	3,944	3,944	3,944	3,944	3,944	5,118	5,118	5,118
Interest	1,633	1,684	1,729	1,777	1,827	1,878	1,798	1,712	1,625	1,538	1,451	1,345	1,232	1,120
Total	8,957	9,929	10,208	10,635	10,774	10,530	6,376	6,293	6,098	6,012	6,146	7,247	7,137	7,003
Net Cash Flow	107	-107	348	804	1,497	2,559	1,739	1,822	2,017	2,103	1,969	868	978	1,112
Cumulative Net Cash Flow	107	0	348	1,152	2,649	5,208	6,947	8,769	10,785	12,889	14,858	15,725	16,704	17,816
Cash Flow for FIRR (ROI)														
Operating Profit	582	1,082	1,578	2,070	2,563	3,057	3,088	3,136	3,178	3,222	3,321	3,416	3,511	3,610
Depreciation	3,784	4,034	4,287	4,545	4,803	5,059	5,027	4,979	4,937	4,893	4,794	4,699	4,604	4,505
Investment (-)	5,923	5,603	5,837	6,216	6,306	6,011	633	637	529	529	751	784	786	765
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	-1,557	-487	28	399	1,060	2,105	7,482	7,478	7,586	7,586	7,364	7,331	7,329	7,350
FIRR (ROI)														
Cash Flow for FIRR (ROE)														
Cash Flow for ROI	-1,557	-487	28	399	1,060	2,105	7,482	7,478	7,586	7,586	7,364	7,331	7,329	7,350
Borrowing	4,698	4,659	4,690	4,824	4,905	4,974	0	0	0	0	0	0	0	0
Repayment (-)	1,401	2,642	2,642	2,642	2,642	2,642	3,944	3,944	3,944	3,944	3,944	5,118	5,118	5,118
Interest (-)	1,633	1,684	1,729	1,777	1,827	1,878	1,798	1,712	1,625	1,538	1,451	1,345	1,232	1,120
Total	107	-154	348	804	1,497	2,559	1,739	1,822	2,017	2,103	1,969	868	978	1,112
FIRR (ROE)														

Appendix 15.2.5(3) The Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Fina Cash Flow & FIRR
Loan Condition 1

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Cash Flow Statement													
Net Cash Flow													
Operating Profit	4,194	4,257	4,344	4,431	4,529	4,536	4,532	4,563	4,592	4,623	5,448	5,417	89,655
Depreciation	3,921	3,858	3,771	3,684	3,586	3,580	3,583	3,552	3,523	3,492	2,667	2,698	132,977
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	104,913
Equity	0	0	0	0	0	0	0	0	0	0	0	0	56,153
Total	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	383,699
Investment	1,840	1,848	1,756	1,757	1,656	1,471	1,368	1,337	1,553	1,554	3,303	3,285	201,364
Salvage Value (–)	0	0	0	0	0	0	0	0	0	0	0	57,666	57,666
Repayment	5,118	5,118	4,417	3,717	3,717	3,717	3,717	3,096	2,476	2,476	2,476	2,476	97,809
Interest	1,007	895	794	708	626	545	463	391	333	279	224	170	41,011
Total	7,965	7,860	6,966	6,182	5,999	5,732	5,548	4,824	4,362	4,309	6,004	–51,734	282,518
Net Cash Flow	151	255	1,149	1,934	2,116	2,383	2,567	3,291	3,753	3,806	2,112	59,850	101,181
Cumulative Net Cash Flow	17,966	18,221	19,370	21,303	23,419	25,802	28,370	31,660	35,413	39,219	41,331	101,181	
Cash Flow for FIRR (ROI)													
Operating Profit	4,194	4,257	4,344	4,431	4,529	4,536	4,532	4,563	4,592	4,623	5,448	5,417	89,655
Depreciation	3,921	3,858	3,771	3,684	3,586	3,580	3,583	3,552	3,523	3,492	2,667	2,698	132,977
Investment (–)	1,840	1,848	1,756	1,757	1,656	1,471	1,368	1,337	1,553	1,554	3,303	3,285	201,364
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	57,666	57,666
Total	6,276	6,267	6,360	6,359	6,459	6,644	6,747	6,779	6,562	6,561	4,812	62,496	78,934
FIRR (ROI)													
Cash Flow for FIRR (ROE)													
Cash Flow for ROI	6,276	6,267	6,360	6,359	6,459	6,644	6,747	6,779	6,562	6,561	4,812	62,496	78,934
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	104,913
Repayment (–)	5,118	5,118	4,417	3,717	3,717	3,717	3,717	3,096	2,476	2,476	2,476	2,476	97,809
Interest (–)	1,007	895	794	708	626	545	463	391	333	279	224	170	41,011
Total	151	255	1,149	1,934	2,116	2,383	2,567	3,291	3,753	3,806	2,112	59,850	45,027
FIRR (ROE)													

Appendix 15.2.6.(1) Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Financial Analysis
P/L Statement & Financial Program

Conditions of Foreign Loan: Interest: 0.0075
Repayment: from 11th to 20th Year 0.025 of Total Loan Term: 35 Years
from 21st to 35th Year 0.05 of Total Loan Grace: 10 Years

Passenger Fare: 0.1755 S.P./km Freight Charge: 0.8869 S.P./km

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Profit & Loss Statement														
Passenger Fare Revenue	20	30	41	51	61	74	86	99	112	124	142	159	176	194
Freight Charge Revenue	307	460	613	766	920	1,226	1,533	1,840	2,147	2,454	3,060	3,667	4,274	4,881
Miscellaneous Revenue	10	15	20	25	29	39	49	58	68	77	96	115	134	152
Operating Revenue Total	337	505	673	841	1,010	1,339	1,668	1,997	2,326	2,655	3,298	3,941	4,584	5,227
Personnel Cost	-22	-32	-43	-54	-65	-55	-46	-36	-26	-16	1	18	35	52
Lubricant & Fuel	57	79	99	114	126	164	201	239	276	314	384	455	526	596
Maintenance Expenses	42	59	73	85	93	121	149	177	204	232	284	337	389	441
Other Operating Costs	23	32	40	46	51	67	82	98	113	129	158	187	216	245
Depreciation	203	509	800	1,072	1,303	1,521	1,752	2,012	2,222	2,365	2,634	2,914	3,245	3,555
Operating Expense Total	303	647	968	1,263	1,509	1,818	2,140	2,489	2,790	3,024	3,462	3,910	4,410	4,890
Operating Profit	33	-142	-295	-421	-499	-479	-472	-492	-464	-369	-164	31	174	337
Interest	27	77	127	174	215	244	281	327	369	406	440	472	516	555
Net Profit	7	-219	-422	-596	-715	-724	-753	-819	-832	-775	-604	-442	-343	-218
Cumulative Net Profit	7	-213	-635	-1,230	-1,946	-2,669	-3,421	-4,240	-5,073	-5,848	-6,451	-6,893	-7,235	-7,453
Rate of Return on Equity (%)	0.2%	-2.1%	-2.4%	-2.5%	-2.6%	-2.2%	-2.0%	-1.9%	-1.8%	-1.6%	-1.3%	-0.9%	-0.7%	-0.5%
Rate of Return on Operating Revenue (%)	2.0%	-43.5%	-62.7%	-70.8%	-70.8%	-54.0%	-45.1%	-41.0%	-35.8%	-29.2%	-18.3%	-11.2%	-7.5%	-4.2%
Transport Revenue per Employee ('000)	172.1	190.4	209.2	228.4	248.1	277.8	306.8	335.2	362.9	390.0	442.4	492.8	541.5	588.4
Passenger/Ton•KM per Employee ('000)	211.5	236.3	261.7	287.7	314.4	352.1	389.0	425.0	460.3	494.8	558.2	619.3	678.2	735.1
Financial Program														
Financing in Foreign Currency														
Borrowing	3,569	6,714	6,593	6,379	5,463	3,878	4,863	6,104	5,606	4,985	4,499	5,064	6,548	5,900
Repayment	0	0	0	0	0	0	0	0	0	0	0	718	718	718
Loan Balance	3,569	10,283	16,875	23,254	28,717	32,596	37,459	43,563	49,169	54,154	58,653	62,999	68,829	74,010
Interest	27	77	127	174	215	244	281	327	369	406	440	472	516	555
Financing in Local Currency														
Equity	3,904	6,714	6,903	5,957	4,448	4,554	5,321	5,488	3,263	550	0	0	0	0
Equity Balance	3,904	10,619	17,522	23,479	27,927	32,481	37,801	43,289	46,552	47,101	47,101	47,101	47,101	47,101

Appendix 15.2.6.(2) Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Financial Analysis
P/L Statement & Financial Program

Conditions of Foreign Loan: Interest: 0.0075
Repayment: from 11th to 20th Year 0.025 of Total Loan Term: 35 Years
from 21st to 35th Year 0.05 of Total Loan Grace: 10 Years

Passenger Fare: 0.1755 S.P./km Freight Charge: 0.8869 S.P./km

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Profit & Loss Statement														
Passenger Fare Revenue	211	233	255	277	298	320	320	320	320	320	320	320	320	320
Freight Charge Revenue	5,488	6,435	7,383	8,331	9,278	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226
Miscellaneous Revenue	171	200	229	258	287	316	316	316	316	316	316	316	316	316
Operating Revenue Total	5,870	6,868	7,867	8,865	9,864	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862
Personnel Cost	69	96	124	151	179	207	207	207	207	207	207	207	207	207
Lubricant & Fuel	667	769	871	972	1,074	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176
Maintenance Expenses	494	569	644	719	794	870	870	870	870	870	870	870	870	870
Other Oerating Costs	274	318	363	407	451	495	495	495	495	495	495	495	495	495
Depreciation	3,794	4,034	4,287	4,545	4,803	5,059	5,027	4,979	4,937	4,893	4,794	4,699	4,604	4,505
Operating Expense Total	5,288	5,787	6,289	6,795	7,301	7,806	7,774	7,727	7,684	7,641	7,542	7,447	7,352	7,253
Operating Profit	582	1,082	1,578	2,070	2,563	3,057	3,088	3,136	3,178	3,222	3,321	3,416	3,511	3,610
Interest	585	614	640	666	692	719	709	689	668	648	627	606	577	547
Net Profit	-3	467	939	1,405	1,871	2,337	2,379	2,447	2,510	2,574	2,694	2,809	2,934	3,063
Cumulative Net Profit	-7,456	-6,989	-6,050	-4,645	-2,775	-437	1,942	4,389	6,899	9,473	12,167	14,976	17,910	20,973
Rate of Return on Equity (%)	0.0%	1.0%	2.0%	3.0%	4.0%	5.0%	5.1%	5.2%	5.3%	5.5%	5.7%	6.0%	6.2%	6.5%
Rate of Return on Operating Revenue (%)	-0.1%	6.8%	11.9%	15.6%	19.0%	21.5%	21.9%	22.5%	23.1%	23.7%	24.8%	25.9%	27.0%	28.2%
Transport Revenue per Employee ('000)	633.7	700.1	763.0	822.6	879.1	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9
Passenger/Ton･KM per Employee ('000)	789.9	868.4	942.6	1,012.9	1,079.7	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2
Financial Program														
Financing in Foreign Currency														
Borrowing	4,698	4,659	4,690	4,824	4,905	4,974	0	0	0	0	0	0	0	0
Repayment	718	718	1,354	1,354	1,354	1,354	1,354	2,739	2,739	2,739	2,739	2,739	3,977	3,977
Loan Balance	77,990	81,931	85,267	88,737	92,288	95,908	94,555	91,815	89,076	86,336	83,597	80,857	76,880	72,904
Interest	585	614	640	666	692	719	709	689	668	648	627	606	577	547
Financing in Local Currency														
Equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Equity Balance	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101

Appendix 15.2.6.(3) Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Financial Analysis
P/L Statement & Financial Program

Conditions of Foreign Loan: Interest: 0.0075
Repayment: from 11th to 20th Year 0.025 of Total Loan Term: 35 Years
from 21st to 35th Year 0.05 of Total Loan Grace: 10 Years

Passenger Fare: 0.1755 S.P./km Freight Charge: 0.8869 S.P./km

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Profit & Loss Statement													
Passenger Fare Revenue	320	320	320	320	320	320	320	320	320	320	320	320	9,365
Freight Charge Revenue	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	10,226	279,806
Miscellaneous Revenue	316	316	316	316	316	316	316	316	316	316	316	316	8,675
Operating Revenue Total	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	10,862	297,847
Personnel Cost	207	207	207	207	207	207	207	207	207	207	207	207	4,671
Lubricant & Fuel	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	32,670
Maintenance Expenses	870	870	870	870	870	870	870	870	870	870	870	870	24,167
Other Oerating Costs	495	495	495	495	495	495	495	495	495	495	495	495	13,706
Depreciation	3,921	3,858	3,771	3,694	3,596	3,590	3,583	3,552	3,523	3,492	2,667	2,698	132,977
Operating Expense Total	6,669	6,606	6,518	6,431	6,333	6,327	6,330	6,300	6,270	6,240	5,415	5,446	208,192
Operating Profit	4,194	4,257	4,344	4,431	4,529	4,536	4,532	4,563	4,592	4,623	5,448	5,417	89,655
Interest	517	487	457	422	388	353	318	283	255	226	197	169	17,289
Net Profit	3,677	3,770	3,887	4,009	4,141	4,183	4,214	4,280	4,338	4,397	5,250	5,248	72,366
Cumulative Net Profit	24,650	28,420	32,307	36,315	40,456	44,639	48,853	53,133	57,471	61,868	67,118	72,366	
Rate of Return on Equity (%)	7.8%	8.0%	8.3%	8.5%	8.8%	8.9%	8.9%	9.1%	9.2%	9.3%	11.1%	11.1%	
Rate of Return on Operating Revenue (%)	33.8%	34.7%	35.8%	36.9%	38.1%	38.5%	38.8%	39.4%	39.9%	40.5%	48.3%	48.3%	
Transport Revenue per Employee ('000)	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	932.9	
Passenger/Ton•KM per Employee ('000)	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	1,143.2	
Financial Program													
Financing in Foreign Currency													
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	104,913
Repayment	3,977	3,977	3,977	4,644	4,644	4,644	4,644	4,644	3,810	3,810	3,810	3,810	82,401
Loan Balance	68,927	64,950	60,974	56,329	51,685	47,041	42,396	37,752	33,942	30,132	26,322	22,513	
Interest	517	487	457	422	388	353	318	283	255	226	197	169	17,289
Financing in Local Currency													
Equity	0	0	0	0	0	0	0	0	0	0	0	0	47,101
Equity Balance	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	47,101	

Appendix 15.2.7.(1) The Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Fina Cash Flow & FIRR
Loan Condition 2

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cash Flow Statement														
Net Cash Flow														
Operating Profit	33	-142	-295	-421	-499	-479	-472	-492	-464	-369	-164	31	174	337
Depreciation	203	509	800	1,072	1,303	1,521	1,752	2,012	2,222	2,365	2,634	2,914	3,245	3,555
Borrowing	6,080	11,027	11,250	10,512	8,710	7,575	9,303	10,744	8,688	6,057	4,669	5,359	7,061	6,314
Equity	1,412	2,462	2,332	1,941	1,342	1,026	1,084	1,085	441	0	0	0	0	0
Total	7,729	13,846	14,087	13,103	10,856	9,643	11,667	13,349	10,887	8,054	7,139	8,304	10,479	10,206
Investment	7,683	13,718	13,874	12,812	10,499	9,230	11,184	12,785	10,259	7,126	5,555	6,359	8,563	7,682
Salvage Value (-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	0	0	0	0	0	0	0	0	0	0	0	1,190	1,190	1,190
Interest	46	128	213	292	357	414	483	564	629	675	710	741	785	823
Total	7,729	13,846	14,087	13,103	10,856	9,643	11,667	13,349	10,887	7,800	6,264	8,289	10,537	9,695
Net Cash Flow	0	0	0	0	0	0	0	0	0	253	875	15	-58	511
Cumulative Net Cash Flow	0	0	0	0	0	0	0	0	0	253	1,129	1,144	1,085	1,597
Cash Flow for FIRR (ROI)														
Operating Profit	33	-142	-295	-421	-499	-479	-472	-492	-464	-369	-164	31	174	337
Depreciation	203	509	800	1,072	1,303	1,521	1,752	2,012	2,222	2,365	2,634	2,914	3,245	3,555
Investment (-)	7,683	13,718	13,874	12,812	10,499	9,230	11,184	12,785	10,259	7,126	5,555	6,359	8,563	7,682
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	-7,447	-13,351	-13,369	-12,161	-9,696	-8,188	-9,903	-11,265	-8,499	-5,129	-3,084	-3,414	-5,144	-3,789
FIRR (ROI)	2.0%													
Cash Flow for FIRR (ROE)														
Cash Flow for ROI	-7,447	-13,351	-13,369	-12,161	-9,696	-8,188	-9,903	-11,265	-8,499	-5,129	-3,084	-3,414	-5,144	-3,789
Borrowing	6,080	11,027	11,250	10,512	8,710	7,575	9,303	10,744	8,688	6,057	4,669	5,359	7,061	6,314
Repayment (-)	0	0	0	0	0	0	0	0	0	0	0	1,190	1,190	1,190
Interest (-)	46	128	213	292	357	414	483	564	629	675	710	741	785	823
Total	-1,412	-2,452	-2,332	-1,941	-1,342	-1,026	-1,084	-1,085	-441	253	875	15	-58	511
FIRR (ROE)	8.1%													

Appendix 15.2.7.(2) The Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Financial ,Cash Flow & FIRR
Loan Condition 2

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Cash Flow Statement														
Net Cash Flow														
Operating Profit	582	1,082	1,578	2,070	2,563	3,057	3,068	3,136	3,178	3,222	3,321	3,416	3,511	3,610
Depreciation	3,784	4,034	4,287	4,545	4,803	5,059	5,027	4,979	4,937	4,893	4,794	4,699	4,604	4,505
Borrowing	4,850	4,539	4,704	5,091	5,167	4,920	0	0	0	0	0	0	0	0
Equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	9,216	9,655	10,570	11,707	12,532	13,035	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115
Investment	5,923	5,603	5,837	6,216	6,306	6,011	633	637	529	529	751	784	786	765
Salvage Value (-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	1,190	1,190	2,249	2,249	2,249	2,249	2,249	4,144	4,144	4,144	4,144	4,144	5,814	5,814
Interest	851	876	894	916	938	958	941	910	879	847	816	785	742	698
Total	7,963	7,669	8,980	9,381	9,492	9,217	3,823	5,691	5,552	5,521	5,712	5,714	7,342	7,278
Net Cash Flow	1,253	1,986	1,589	2,326	3,041	3,818	4,293	2,424	2,563	2,594	2,404	2,401	773	837
Cumulative Net Cash Flow	2,850	4,836	6,425	8,751	11,792	15,610	19,902	22,326	24,889	27,483	29,886	32,287	33,060	33,898
Cash Flow for FIRR (ROI)														
Operating Profit	582	1,082	1,578	2,070	2,563	3,057	3,068	3,136	3,178	3,222	3,321	3,416	3,511	3,610
Depreciation	3,784	4,034	4,287	4,545	4,803	5,059	5,027	4,979	4,937	4,893	4,794	4,699	4,604	4,505
Investment (-)	5,923	5,603	5,837	6,216	6,306	6,011	633	637	529	529	751	784	786	765
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	-1,557	-487	28	399	1,060	2,105	7,462	7,478	7,586	7,586	7,364	7,331	7,329	7,350
FIRR (ROI)														
Cash Flow for FIRR (ROE)														
Cash Flow for ROI	-1,557	-487	28	399	1,060	2,105	7,462	7,478	7,586	7,586	7,364	7,331	7,329	7,350
Borrowing	4,850	4,539	4,704	5,091	5,167	4,920	0	0	0	0	0	0	0	0
Repayment (-)	1,190	1,190	2,249	2,249	2,249	2,249	2,249	4,144	4,144	4,144	4,144	4,144	5,814	5,814
Interest (-)	851	876	894	916	938	958	941	910	879	847	816	785	742	698
Total	1,253	1,986	1,589	2,326	3,041	3,818	4,293	2,424	2,563	2,594	2,404	2,401	773	837
FIRR (ROE)														

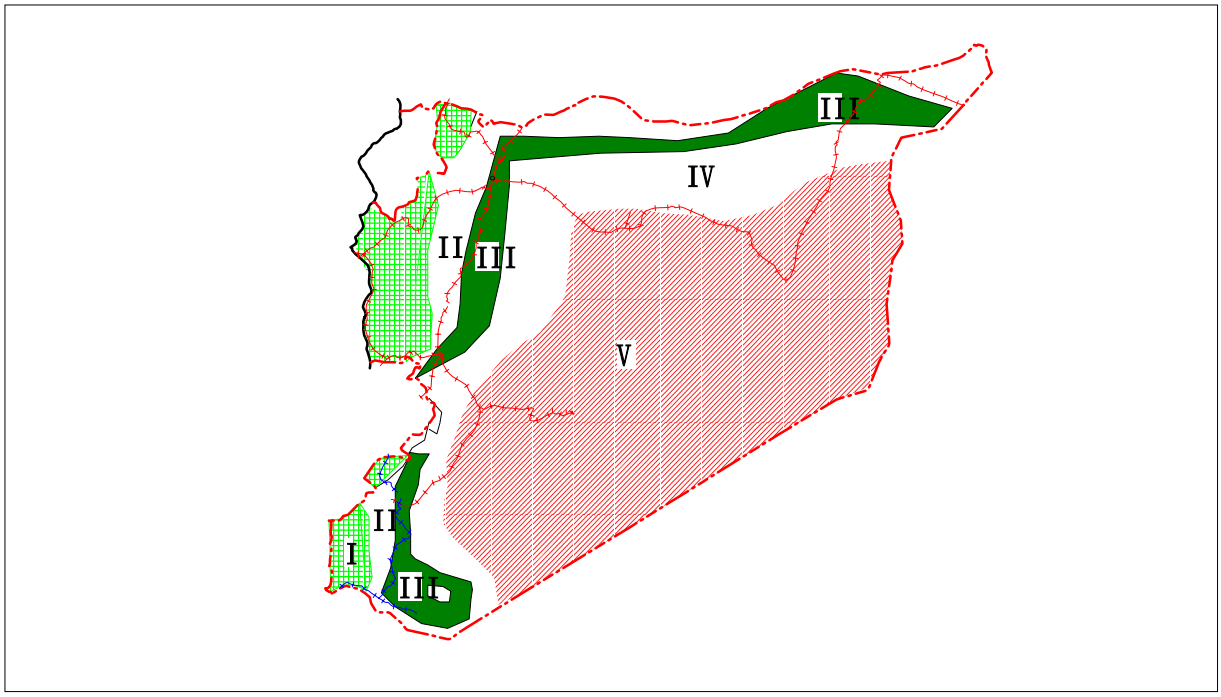
Appendix 15.2.7.(3) The Master Plan Study on the Development of Syrian Railways in the Syrian Arab Republic Financial / Cash Flow & FIRR
Loan Condition 2

Sensitivity Analysis: Revenue: 0% down Investment: 0% up (Unit: Million Syrian Pounds)

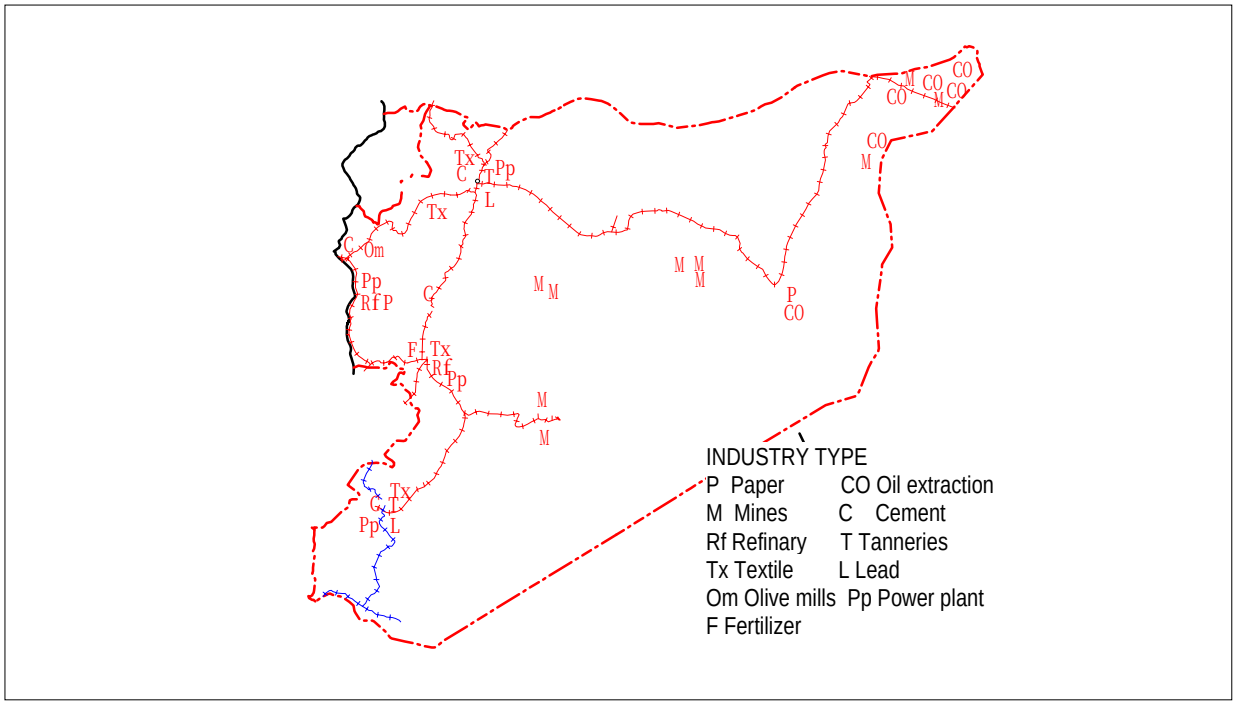
	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Cash Flow Statement													
Net Cash Flow													
Operating Profit	4,194	4,257	4,344	4,431	4,529	4,536	4,532	4,563	4,592	4,623	5,448	5,417	89,655
Depreciation	3,921	3,858	3,771	3,684	3,586	3,580	3,583	3,552	3,523	3,492	2,667	2,698	132,977
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	142,619
Equity	0	0	0	0	0	0	0	0	0	0	0	0	13,115
Total	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	8,115	378,366
Investment	1,840	1,848	1,756	1,757	1,656	1,471	1,368	1,337	1,553	1,554	3,303	3,285	201,364
Salvage Value (-)	0	0	0	0	0	0	0	0	0	0	0	57,666	57,666
Repayment	5,814	5,814	5,814	6,520	6,520	6,520	6,520	6,520	4,752	4,752	4,752	4,752	118,594
Interest	654	611	567	518	469	421	372	323	287	251	216	180	23,778
Total	8,308	8,273	8,137	8,795	8,646	8,412	8,260	8,180	6,592	6,557	8,271	-49,448	286,070
Net Cash Flow	-193	-158	-22	-680	-531	-297	-145	-65	1,523	1,558	-156	57,563	92,296
Cumulative Net Cash Flow	33,704	33,547	33,525	32,845	32,314	32,017	31,872	31,808	33,331	34,888	34,733	92,296	
Cash Flow for FIRR (ROI)													
Operating Profit	4,194	4,257	4,344	4,431	4,529	4,536	4,532	4,563	4,592	4,623	5,448	5,417	89,655
Depreciation	3,921	3,858	3,771	3,684	3,586	3,580	3,583	3,552	3,523	3,492	2,667	2,698	132,977
Investment (-)	1,840	1,848	1,756	1,757	1,656	1,471	1,368	1,337	1,553	1,554	3,303	3,285	201,364
Salvage Value	0	0	0	0	0	0	0	0	0	0	0	57,666	57,666
Total	6,276	6,267	6,360	6,359	6,459	6,644	6,747	6,779	6,562	6,561	4,812	62,496	78,934
FIRR (ROI)													
Cash Flow for FIRR (ROE)													
Cash Flow for ROI	6,276	6,267	6,360	6,359	6,459	6,644	6,747	6,779	6,562	6,561	4,812	62,496	78,934
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	142,619
Repayment (-)	5,814	5,814	5,814	6,520	6,520	6,520	6,520	6,520	4,752	4,752	4,752	4,752	118,594
Interest (-)	654	611	567	518	469	421	372	323	287	251	216	180	23,778
Total	-193	-158	-22	-680	-531	-297	-145	-65	1,523	1,558	-156	57,563	79,181
FIRR (ROE)													

Appendix 17

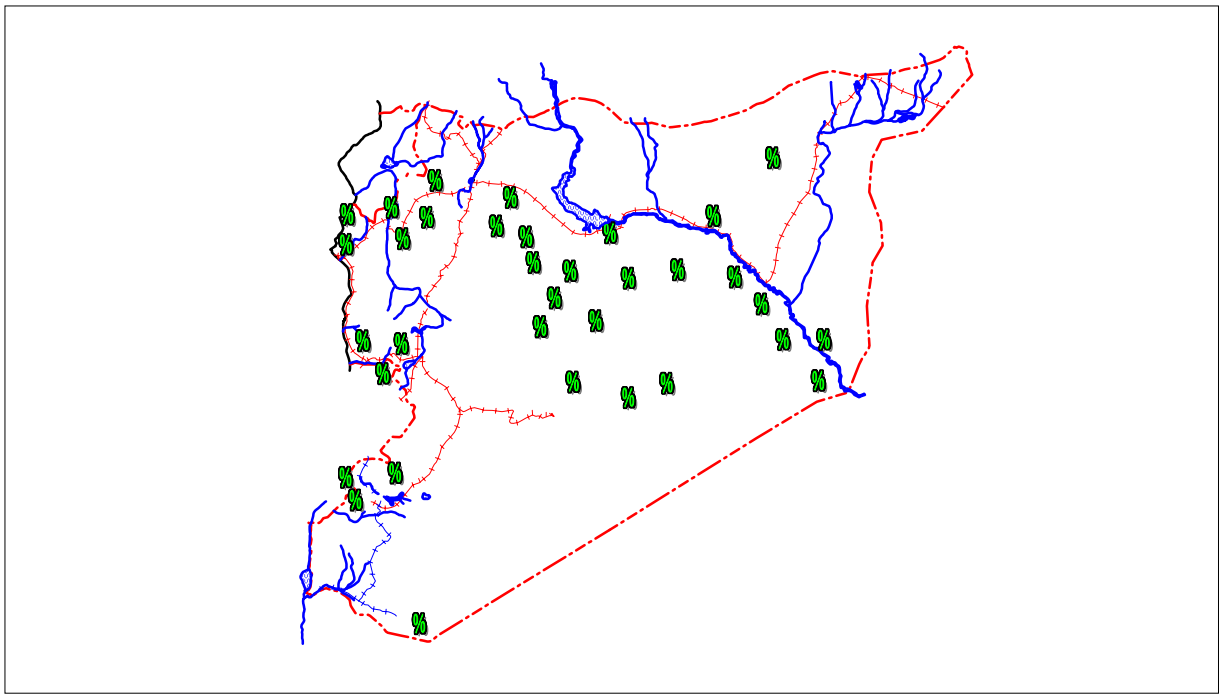
- **Appendix Figure 17.1.1 Agricultural Zones in Syria**
- **Appendix Figure 17.1.2 Distribution of Industrial Activities**
- **Appendix Figure 17.1.3 Rivers and Protected Areas**
- **Appendix Figure 17.2.1 Appropriation under Property Development Method**
- **Appendix Figure 17.3.1 Existing Environmental Issues in GESR Operation**
- **Appendix Figure 17.3.2 Existing Environmental Issues in GEHR Operation**
- **Appendix 17 Process of Environmental Impact Assessment**



Appendix Figure 17.1.1 Agricultural Zones in Syria



Appendix Figure 17.1.2 Distribution of Industrial Activities



Appendix Figure 17.1.3 Rivers and Protected Areas

Appendix Table 17.2.1 Appropriation under Property Development Method

Step	Authority responsible
A. PROJECT PREPARATION AND SURVEYS	
Step 1: Project plan preparation and ratification	⇒ Preparation by implementing agency and concerned local authorities ⇒ Ratification by the Ministry of Transport and/or the Ministry of Housing and Utilities
Step 2: Site survey and mapping (scales 1/2000 and 1/500) identifying proposed project boundaries and properties required to be appropriated.	Implementing agency (GESR or GEHR)
Step 3: Issue draft decree on ratification.	Executive Office (Committee of the elected representatives in the respective Governorate Council)
Step 4: Ratify the decree.	Governorate Council (as a whole)
Step 5: Prepare draft appropriation regulations, which include detailed documents as available and maps.	Implementing agency (GESR or GEHR)
Step 6: Check contents of draft regulations and recommend modifications as necessary	Ministry of Transport and/or the Ministry of Housing and Utilities
Step 7: Issue the regulation officially	Cabinet of Ministers
Step 8: Commence studies to determine; 1) Preliminary property values 2) Definition of properties (number and borders)	Two committees are formed, the first from the relevant governorate, and the second from that governorate's council: 1) Preliminary Evaluation Committee 2) Properties Committee
Step 9: Investigate property ownership deeds	Deeds Registration, Ministry of Justice (Registration records may not be available for all identified properties and other methods are followed to determine property owners and affected parties)
B. INVOLVEMENT OF GENERAL PUBLIC	
Step 10: Announcement made to the general public	Implementing agency and concerned governorate
Step 11: People holding registered deeds and other effected parties are informed of the estimated values	Legal Affairs Department of the relevant governorate
Step 12: Within a specified time (say 30 days) the public may submit objections on; 1) The preliminary evaluation 2) Determined property owners and effected people	Two committees are formed from members of the Ministry of Justice, Governorate, effected peoples' representatives and specialists (as necessary); 1) Re-evaluation Committee (decision binding) 2) Disputes Resolution Committee (appeal possible in a court of law)
Step 13: Overall value broken down by individual property (agricultural, vacant land, commercial, residential)	Relevant Governorate
Step 14: Deposit appropriated properties values in a special bank account	Implementing agency
Step 15: Transfer ownership of properties to be appropriated to the implementing agencies	Deeds Registration, Ministry of Justice

C. APPROPRIATION COMMENCEMENT	
Step 17: Issue decree ratifying names of people to be effected by the appropriation (and therefore to be compensated)	Executive Office
Step 18: Serve evacuation notifications to effected people (after securing alternative housing for those eligible)	Implementing agency and concerned governorate
Step 19: Provide alternative housing units as required	Housing Dept., relevant governorate

Source: Damascus Governorate officials hearing, 1997

Appendix Table 17.3.1 Existing Environmental Issues in GESR Operation

Environmental management	Physical			Social		
	Air	Water	Noise/ Vibration	Safety, health	Passengers	Culture/ Land value
1. No institutional setup for environmental issues within the GESR organization						
X						
2. No environmental monitoring at the facilities						
X						
3. Many stations utilize well water but no analysis of the well water in most stations						
		X		X		
4. Drainage of wastewater generated in the stations and depots directly into the city drainage system without any treatment for oils and other materials						
		X				
5. Oils are mixed within the wastewater and drained together. All depots are designed on the old Soviet standards and there is a pit for separation of oil from wastewater but in most of the stations the wastewater from the locomotives depot is not drained into the pit because of the clogging of pipes						
		X		X		
6. The locomotive depot floors are very dirty with grease and oil and working conditions appear to be very hazardous for the workers						
		X		X		
7. Structural stability at the locomotive depot of one station was in doubt because of the cracked walls, and thereby the work environment is dangerous at that station						
X				X		
8. Fuel is stored in underground storage tanks but no leakage or other problems were reported						
		X		X		
9. Inside the trains there are no wastewater storage facilities and all waste is directly discharged outside the train while it is in motion						
				X	X	
10. Between Damascus and Aleppo the vertical vibration of the train was not a big problem however horizontal swaying at certain curves or at high speeds was sharply felt						
					X	
11. GESR trains passing through the urban fabric are not segregated from other traffic and potential for accidents involving pedestrian and vehicular traffic are high						
				X	X	X
12. Throwing of stones at passing trains is a common past time and many of the car windows are damaged because of this (GESR has gone as far as making a commercial on TV to deal with this problem)						
					X	X
13. Loading/ unloading of cereals (wheat) and phosphates at ports and stations are done under very poor environmental conditions for workers. In addition there are no container unloading facilities at stations and unloading may be dangerous for workers.						
X	X			X		
14. GESR housing within the stations are not well segregated from tracks and noise and vibration problems exist for occupants						
	X		X	X		X
15. No environmental impact assessment for new projects under study/construction						
X						

Appendix Table 17.3.2 Existing Environmental Issues in GEHR Operation

Environ-mental management	Physical			Social		
	Air	Water	Noise/ Vibration	Safety, health	Passengers	Culture/ Land value
1. No institutional setup for environmental issues within the GESR organization						
X						
2. No environmental monitoring at the facilities						
X						
3. Some stations utilize well water but there is no analysis of the well water						
		X		X		
4. Drainage of wastewater generated in the stations and depots directly into the city drainage system without any treatment for oils and other materials						
		X				
5. Oils are mixed within the wastewater and drained together. Designs are very old and there is no effective facility for separating oils from water.						
		X		X		
6. Locomotive depot floors are very dirty with grease and oil and working conditions appear to be very hazardous for the workers						
X				X		X
7. Structural stability of most of the ancient buildings are in doubt, and thereby the work environment is dangerous at that station						
		X		X		
8. Fuel is stored in underground storage tanks but no leakage or other problems were reported						
		X		X		
9. Inside the trains there are no wastewater storage facilities and all waste is directly discharged outside the train while it is in motion						
				X	X	
10. On a trip between Damascus and Dar'a the horizontal swaying of the train at certain curves or at speeds higher than about 35 km/h was sharply felt						
					X	
11. GEHR trains passing through the urban fabric to reach the station are not segregated from other traffic and accidents involving pedestrian and vehicular traffic are numerous						
				X	X	X
12. Throwing stones at passing trains is a common past time and damages many car windows						
					X	X
13. Manual loading/unloading of packed mixed goods at stations is tedious and dangerous work						
X				X		
14. Lack of maintenance and repairs for most of GEHR buildings of historical value (related with item 7)						
X						X

Appendix 17

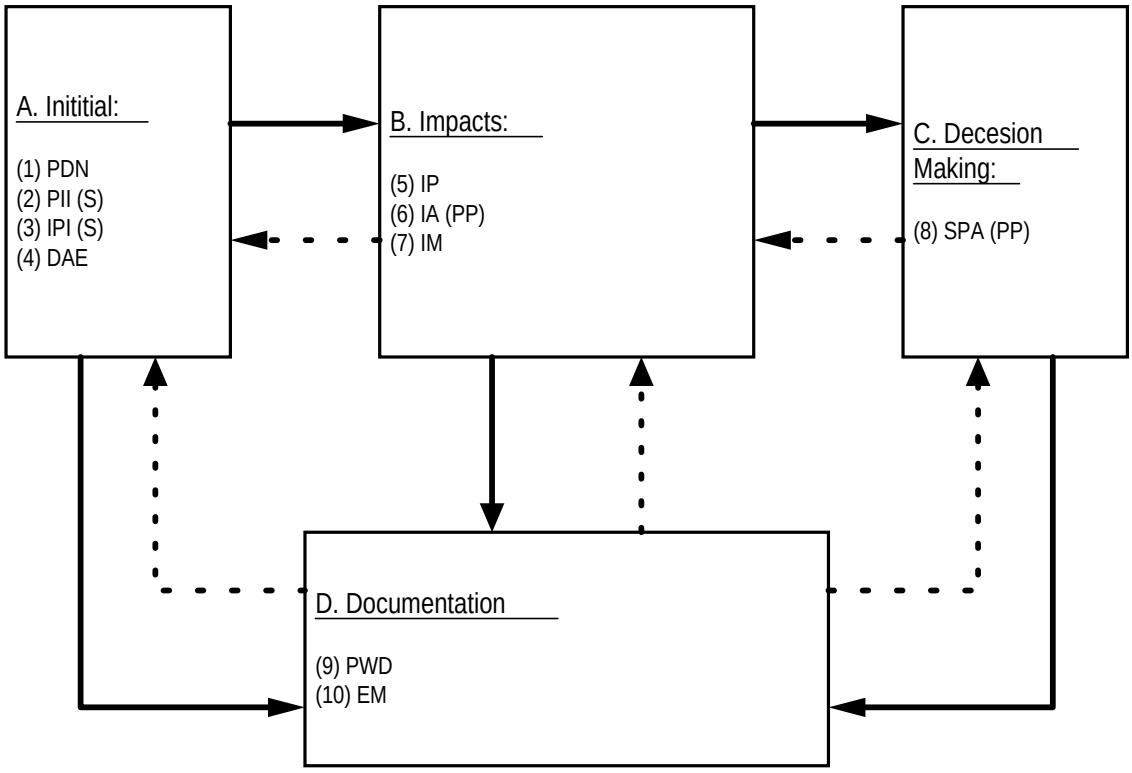
Process for Environmental Impact Assessment

There is much literature that may be referred to on this subject. For preliminary environmental evaluation, the JICA procedure has been applied as explained in the main report. The following table shows the sequence of environmental impact assessment followed in the Netherlands (reference: The Environmental Impact of Railways, Carpenter, 1994).

EIA Procedure in the Netherlands

A. Initiation:	
Starting the Document Publication of the Document	By Initiator (i.e. GESR or GEHR) By the competent authority(s) (Ministry of Transport and Ministry of Environment)
B. Scoping Phase:	
Public participation and advice Guidelines concerning the contents of the EIA	By the public, NGO's, railway employees unions and other relevant social groups By technical team set-up by the Initiator and taking into consideration advice and comments of the public
C. Environmental Impact Assessment:	
Preparation of EIA Publication of EIA	By Initiator through his technical team By competent authority
D. Public Review	
Public participation and advice Reaction of Public and Advisers	Review of the quality of the EIA by public and advisers
E. Decision Phase:	
Decision on Project and Evaluation	By competent Authority

The above procedure involves many steps and going back to previous steps for modification or feedback while continuing the analyses. A conceptual approach for the process that may be followed in the case of the new GESR and GEHR projects is shown in the following figure and explained in the accompanying text.



This process is implemented through a ten-step approach as explained hereafter.

A. Initial Stage

Step 1: Project description and need (PDN)

- Description of the project in a technical context
- Project location and reasoning behind location selection
- Time required for project construction
- Potential environmental issues resulting from project implementation
- Identification of project need
- Description of alternatives to the project that may have been considered

Step 2: Pertinent institutional information (PII)

- Preliminary scoping (S) in order to identify significant environmental issues relative to the project and determine pertinent information to be collected.
- Institutional information refers to environmental laws, regulations, and policies or regulations relevant to the physical-chemical, biological, cultural and socioeconomic environments.

Step 3: Identification of potential impacts (IPI)

- Identification of project qualitative potential impacts through a scoping process.
- Impacts include direct as well as ultimate impacts of the project.
- Impacts may be portrayed through check-list, matrices and networks in order to highlight interaction points between various project actions and environmental factors.

Step 4: Description of the affected environment (DAF)

- This involves the description of the environment in which the project will be implemented; the environmental setting.
- To focus this description it is necessary to early on identify the key environmental factors anticipated to be changed by the project and prepare extensive descriptions of the environmental conditions relative to these particular factors.
- A technical team should be set up at this stage to include specialists in related fields, recruited from inside the project initiator, governmental agencies as well as academic and private sectors.
- The environmental description may cover air quality, water quality, soils, habitat, flora and fauna, cultural assets, and socioeconomic conditions (population, income levels, industries, land use, etc.).

B. Impacts identification and mitigation stage

Step 5: Impact prediction (IP)

- This is the most important technical step and should be undertaken by specialists in the related environmental factors.
- This step involves quantification as much as possible (or at least the qualitative) description of the anticipated impacts of the project on various environmental factors.
- Quantitative analysis may involve application of mathematical models, laboratory testing and construction of scale models to collect experimental data.
- Application of risk-assessment analysis as practical.

Step 6: Impact assessment (IA)

- The predicted impacts are assessed in terms of the significance of the anticipated changes that will be generated by the project.

- There is usually much technical debate related to assessment of impacts and therefore a number of technical opinions should be garnered, especially in the case of large-scale projects.
- Another component of the impact assessment is public input through public participation (PP) programs.
- Numerical standards or criteria may be used for some types of impacts, such as air quality standards, environmental-noise criteria, surface and groundwater quality standards, and wastewater discharge for particular facilities.

Step 7: Impact mitigation (IM)

- Under this step the potential impact mitigation measures are analyzed.
- Mitigation measures may include:
  - Avoiding the impact all together by eliminating the causing action or part of it
  - Minimizing impact by limiting degree or magnitude of the action
  - Rectifying the impact by repairing, rehabilitating or restoring the affected environment
  - Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action
  - Compensating for the impact by replacing or providing substitute resources or environments

C. Decision-making stage

Step 8: Selecting the proposed action (SAP)

- It is important to identify and evaluate the alternatives to the proposed project from the point of view of environmental consequences.
- Public participation (PP) is encouraged in this evaluation.
- In case of proposed new railway lines, alternatives for rehabilitating existing lines, route selection for new lines and dependence on road transport should be evaluated.

D. Documentation

Step 9: Preparing the written documentation (PWD)

- Documentation may include a preliminary EIA report or a complete EIA report.
- Sound principles of technical writing should be employed in the documentation. These include:

- Development of outlines
- Careful documentation of data and information
- Usage of visual display materials (charts, graphs and figures)
- Careful review of the written materials so as to ensure understanding by both technical and non-technical readers

Step 10: Environmental-monitoring program (EM)

- This activity is very important for large-scale projects such as railway projects.
- It is necessary in order to establish baseline conditions in the area of the project
- Methods applied to measure and document impacts need to be set up at this stage prior to the project construction, but may be reviewed as to their adequacy once project is implemented.

Reference material: “Environmental Impact Assessment”, Canter, McGraw-Hill International, 1996

Special Appendix

Preliminary Technical Study on Future 160km/h Passenger Train Operation on Damascus～Aleppo Section

Special Appendix

Preliminary Technical Study on Future 160km/h Passenger Train Operation on Damascus～Aleppo Section

1. Introduction

At present, GESR is operating the passenger train tracted by DEL at the maximum speed of 100km/h. JICA Study Team recommended the maximum speed of 130km/h for Diesel car passenger train, taking into consideration the various deteriorated and inadequate conditions of the existing railway facilities/equipments.

GESR has a desire to raise the maximum speed in future to 160km/h to match with UIC standards. This paper discusses the various requirements for realizing 160 km/h train operation safely and reliably.

2. Train Operation

2.1 In Master plan, travel time between Aleppo and Damascus (Kadam) is proposed to be 4 hours on the following conditions.

(1) Train maximum speed = 130km/h
(2) No speed restrictions on the level crossings.
(3) No realignment of existing plane curves.
(4) 100km/h speed on the tangent side of turnout.
(5) Stopping only at Homs for 2 minutes.
(6) Performance characteristics of diesel car is similar to that of JR's diesel car used for express train.

2.2 For the maximum speed of 160km/h, travel time between Aleppo and Damascus (Kadam) will be about 3 hours and half on the following conditions.

(1) Train maximum speed = 160km/h
(2) No speed restriction on the level crossings.
(3) No realignment of existing plane curves.
(4) 160km/h speed on the tangent side of turnout.
(5) Stopping only at Homs for two minutes.
(6) Performance characteristics of diesel car is similar to that of JR's diesel car used for

express train

2.3 With respect to 2.2 above, if all curves restricting Vmax=160m/h are to be improved and allow Vmax=160km/h, and all other conditions are the same as 2.2 above, travel time between Aleppo and Damascus (Kadam) will be about 3 hours.

3. Track

3.1 Track Structure

(1) Introduction

The possibility of passenger diesel car train operation at a speed of 160km/h by using the existing track structure is studied. In this case, emphasis is placed on the analysis on whether there are any problems related to track strength and practical problems from the aspect of track maintenance.

(2) Preconditions of the study

(a) Track structure

Rail	：P50, Long rail Zx＝286cm3 EIx= 4.2378MNm2
Sleeper	：PC sleeper Bottom area＝0.6776m2 （Effective support area 75% of actual area ＝ 0.5082m2）
Sleeper spacing	：1600 pieces/km＝62.5 cm
Ballast thickness	：25 cm under sleepers
Roadbed strength	： K30value (MN/m3)＝45、（equivalent to ballast coefficient of 9.06kg/cm3）
Rail Fastening	：Track pad spring constant=100MN/m
Spring coefficient of ballast crushed stone	＝200MN/m

(b) Rolling stock conditions

- Diesel car train
- Axle load : 13 tons
- Vibration coefficients (vertical) of rolling stock：

  Kv = 0.0010（DC：air spring）

  Kv＝0.0015（locomotive and freight car：non-air spring）
- Maximum velocity ： 160km/h

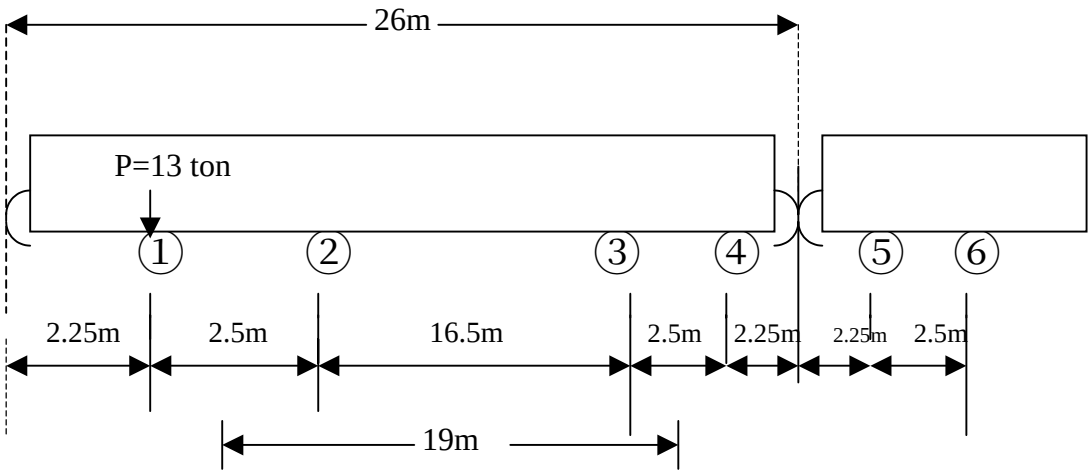


Fig-1　Axle Arrangement of Diesel Cars

(c) Yearly passing tonnage per track by section（Year 2020）

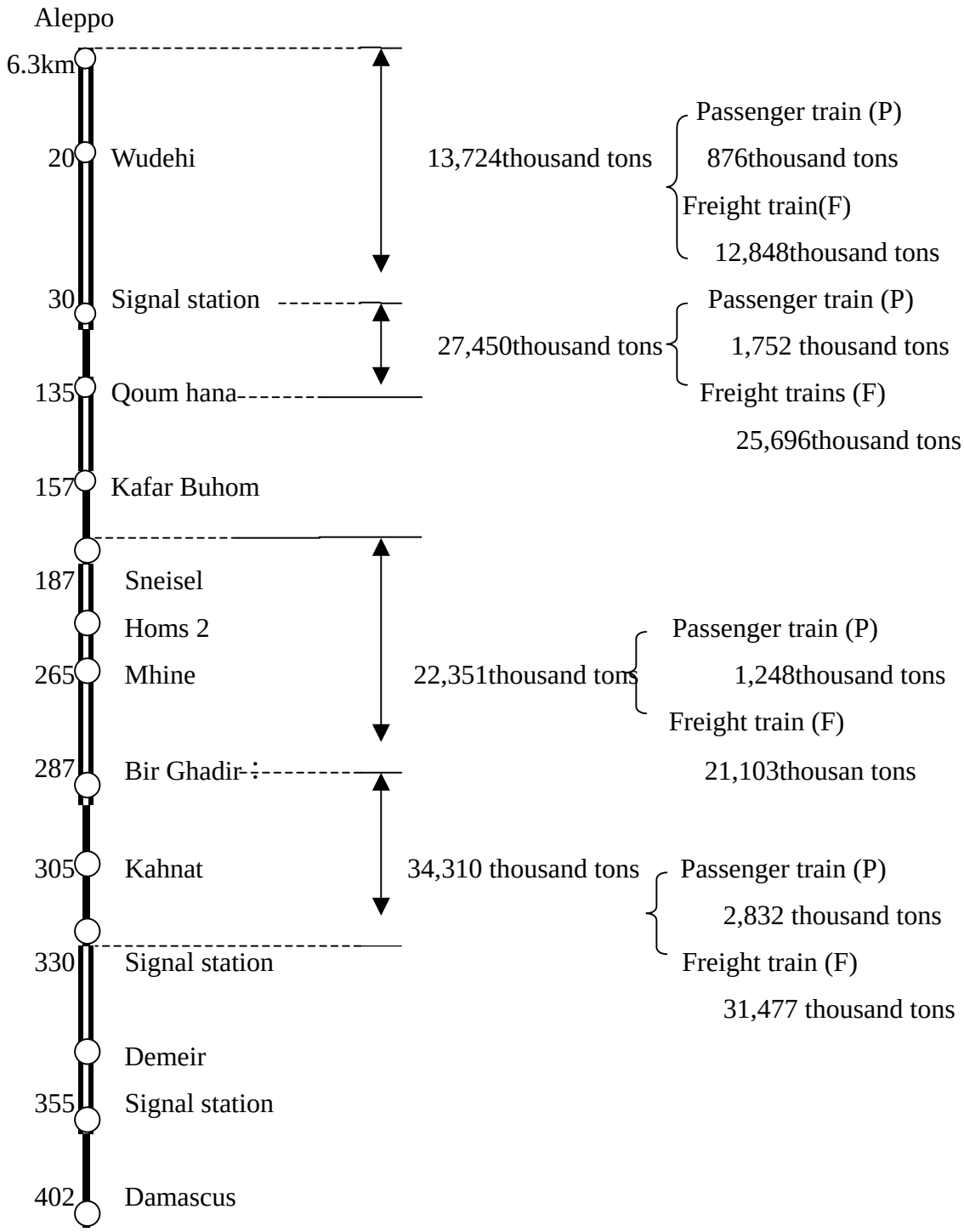


Fig-2　Yearly Passing Tonnage by Section（Year 2020）

Of the sections shown in Fig-2, analysis is made concerning the sections between Bir Ghadir and Signal Station (330km) where the burden on tracks is the largest (annual

passing tonnage of 34,310 thousand tons: 2,832 thousand tons by passenger train, 31,477 thousand tons by freight trains).

(3) Study on track structure strength

Track structure strength is analyzed from the two aspects: (a) Strength of track members(whether the members can sufficiently cope with the recurrent stress by train load) ; and (b) Volume of track maintenance (whether the progress speed of track irregularity is allowable and can sufficiently be dealt with by practical-level maintenance).

(a) Study on track member strength

As for the study on track member strength, since rail stress is the severest factor, analysis is made on whether the recurrent bending stress of rail is within the permissible range of rail fatigue strength.

① Calculation of rail bending stress by using the model of elastic support at equal interval.

The rail stress which occurs just under the wheels is calculated with the case where wheels are just on a sleeper and the case where wheels are between sleepers. Among the bending stresses calculated for each of the two cases, the largest value is adopted. The calculation results are as follows.

	Just on a sleeper
Bending stress（MPa）	72.4

Pdy = Pst + △Pst, where Pdy = dynamic wheel load, Pst =static wheel load and △Pst = dynamic increment of wheel load.

△Pst is assumed to be equal to 3 σ, where σ= standard deviating of dynamic wheel load.

According to experimental results, 2 σPst = 0.3V/100, where V= speed of train.

Therefore, $\triangle Pst = 3\sigma = 3 \times 1/2 \times 0.3V/100 \times Pst = 1.5Pst \times 0.3V/100$.

$$\therefore Pdy = Pst + 1.5Pst \times \frac{0.3V}{100}$$

$$\therefore Pdy/Pst = 1 + 1.5 \times \frac{0.3V}{100}$$

If V=160km/h, $\frac{Pdy}{Pst} = 1.72$

Namely, the dynamic axle load is estimated to be 1.72 times the static axle load.

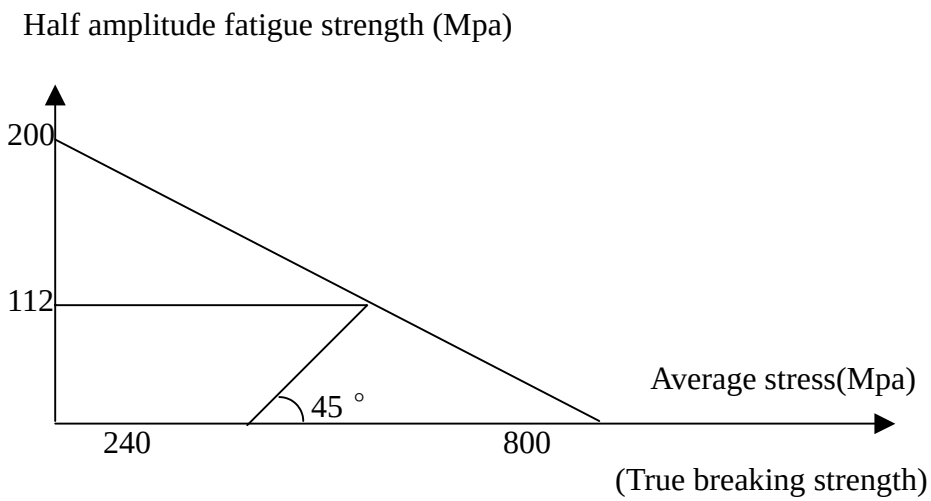
② Study on permissible stress

（i）Rail residual stress ： 120 Mpa

(ii) Axle thermal stress due to the use of long rail： 120 Mpa（△t = 50℃）

(iii) Average stress ＝(i) + (ii) = 240 Mpa

(iv) Half amplitude fatigue strength(Mpa）



(v) Total amplitude fatigue strength ：

112×2 = 224 Mpa

(vi) Consideration on wheel lateral pressure ：164Mpa (reduction by 60Mpa)

(vii) Consideration of safety factor：

164×0.8 = 131.2 Mpa＞72.4 Mpa

③ According to the analysis described above, the rail bending stress is within the permissible range, and there is no problem related to rail strength.

(b) Analysis from track maintenance aspect

① Permissible range of total amplitude of rolling-stock vertical movement:

Safety limit	αs	0.40g
Target value of riding comport	αc	0.25g

② Maximum total amplitude of rolling-stock vertical movement：

It is estimated that $\alpha max = 6\ \sigma_{\alpha v}$. In this case, $\sigma\ \alpha\ \nu$ ＝standard deviation of half amplitude of rolling-stock vertical movement.

③ The following formula is used as an expression showing relations between the standard deviation of longitudinal-level track irregularity （σy） and the standard deviation of half amplitude of rolling-stock vertical movement （$\sigma\ \alpha\ \nu$）. (This is an experimental relation expression developed by Japanese Railways.)

$\sigma_{\alpha v} = Kv \cdot \sigma y \cdot V$

In this case, Kv =rolling-stock vibration coefficient (m/s2/mm/(km/h))

〔from Item (2)、（b）, Kv = 0.001〕

σy = Standard deviation of longitudinal-level track irregularity（mm）

$\sigma_{\alpha v}$ =Standard deviation of half amplitude of rolling stock vertical movement （m/S^2）

V = train velocity（km/h）

④ σycr ＝ safety limit of standard deviation of longitudinal-level track irregularity

σytg ＝ riding comfort target of standard deviation of longitudinal-level track irregularity

σyhi ＝ maintenance upper limit of standard deviation of longitudinal-level track irregularity

σylo ＝ maintenance lower limit of standard deviation of longitudinal-level track irregularity

The relations among the above values are as shown in Fig.-4.

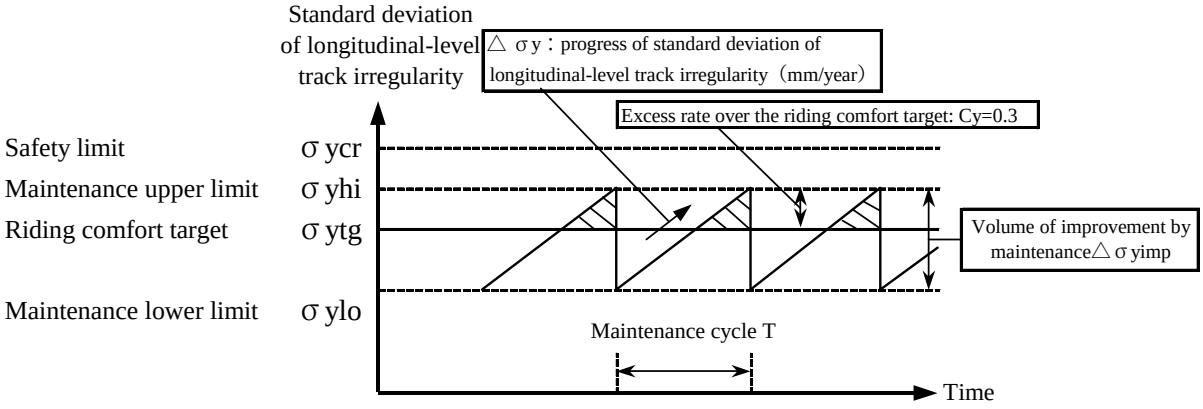


Fig.-4 Progress and Maintenance Cycle of Standard Deviation of Longitudinal-level Track Irregularity

⑤ αmax (which corresponds to σycr) = 0.4 g

αmax (which corresponds to σytg)= 0.25 g

From the above items ②、③ and ④,

$$\sigma ycr = \frac{0.40g}{6}/(kv \cdot V) = \frac{0.4 \times 9.8}{6 \times 0.001 \times 160} = 4.1mm$$

$$\sigma ytg = \frac{0.25g/6}{Kv.V} = \frac{0.25 \times 9.8}{6 \times 0.001 \times 160} = 2.6mm$$

⑥ σyhi = σytg＋Cy×△σyimp

In this case, △σyimp＝σyhi－σylo

It is planned that Cy＝0.3 and it is assumed that σylo＝0.3 σyhi (according to actual experiences, this value shows good maintenance performance).

⑦ From the above items ⑤ and ⑥,

σyhi＝2.6＋0.3(σyhi －σylo)

σylo＝0.3 σyhi

∴ σyhi＝2.6 ＋0.3×0.7 σyhi

$\therefore \sigma yhi = \frac{2.6}{0.79} = 3.3mm$

$\therefore \sigma ylo = 0.3 \times 3.3 \quad 1mm$

⑧ From the calculations described so far, the values shown in the following table are obtained.

Limit Values of Standard Deviation of Longitudinal-level Track Irregularity

Safety limit	σycr	4.1mm
Maintenance upper limit	σyhi	3.3mm
Riding comfort target	σytg	2.6mm
Maintenance lower limit	σylo	1.0mm

⑨ Progress of the standard deviation of longitudinal-level track irregularity,

△ σy(mm／year), is estimated.

(i) Track subsidence due to rail pressure inflicted by wheel axles, βy(mm)／axle, is calculated as follows.

βy＝ βby+ βsy, where βby is the amount of settlement of ballast and can be calculated by the following formula. (This is a formula obtained by experimental study)

βby＝a(Pt-b)^2 ÿ

In this case,

a ＝ 2.7×10^{-10}

b ＝ 39.6

ÿ ＝ ballast vibration acceleration coefficient 1.26 for the case of 〔ballast thickness, 25cm, K30value, 45MN/m^3 〕

Pt ＝ Pressure on the lower surface of sleeper = rail pressure／(effective support area of sleeper per rail)

βsy is the amount of settlement of roadbed and can be calculated by the following formula. (obtained by experimental study)

$\beta sy = a \times P_{s\,meen}{}^{b} \times q_c{}^{c}$ a ＝ 6.0×10^{-9}, b＝3.6, c＝－1.5

$q_c = 100 \times 3 \times 10^{0.0115} \times K_{30} - 0.192$

q_c ＝ Core Penetration resistance (kgf/cm^2)

K_{30}＝resistance coefficient of road bed (MN/m^3)

For rolling stock of i type, β by is multiplied by Ni, the total number of axles passing in a year. Then, values of all types of rolling stock are calculated and accumulated to obtain the volume of track subsidence in a year, δy(mm／year).

$\delta y = \Sigma i \quad \beta^{(i)}{}_{by} Ni$

Values of δy are calculated for two types of rolling stock: diesel car trains; and locomotive-hauled freight car trains.

For diesel car trains, δy (P) ＝ 1.52 mm

For freight car trains, δy (F) ＝ 22.03 mm

Total δy = 23.55 mm

(ii) [Progress of the standard deviation of longitudinal-level track irregularity (mm/year)], $\triangle \sigma y$, is calculated as follows.

Since it is estimated that track subsidence (δ) maximum longitudinal-level track irregularity＝(6 σ), $\delta i - \delta o = 6(\sigma i - \sigma o)$, when

track subsidence immediately after track maintenance is δo,

standard deviation of longitudinal-level track irregularity immediately after track maintenance is σo,

track subsidence after a certain lapse of time (i) from track maintenance is δi, and

standard deviation of longitudinal-level irregularity after a certain lapse of time (i) from track maintenance is σi

Therefore, [progress of track subsidence：$\triangle \delta = \delta i - \delta o$] = 6 times of 〔progress of standard deviation of longitudinal-level track irregularity・$\triangle \sigma = \sigma i - \sigma o$〕,

$$\therefore \triangle \sigma = \frac{1}{6} \triangle \delta$$

Yearly progress of standard deviation of longitudinal-level track irregularity, $\triangle \sigma y$, is obtained by dividing $\triangle \sigma$ by [i].

Since $\sigma y = \triangle \sigma / [\,i\,]$, or $\delta y = \dfrac{\triangle \delta}{[i]}$,

$$\triangle \sigma y = \frac{1}{6} \frac{\triangle \delta}{[i]} = \frac{1}{6} \delta y$$

⑩ Maintenance cycle, T, is obtained as follows.

$$T = (\sigma yhi - \sigma ylo) / \triangle \sigma y$$

$$= \frac{6\,(\sigma yhi - \sigma ylo)}{\delta y} = \frac{6 \times 2.3}{\delta y} = \frac{13.8}{23.55} = 0.58 \text{ year} = 7 \text{ months}$$

⑪ The maintenance cycle obtained by the above calculation is 7 months as shown above. In this calculation, as the transport condition, the severest condition among values shown in (2)－(c) Fig. –2, namely the annual passing tonnage on the single-track section between BirGhadir and Demeir (34,310 thousand tons: passenger trains 2,830 thousand tons and freight trains 31,480 thousand tons), is applied. Trains operated are assumed to be locomotive-hauled freight trains (V=100m/h) and diesel-car passenger trains (V=160m/h).

In view of the above, it is considered that there is no practical problem.

DC trains can be operated on the existing track structure at the speed of 160km/h as far as track strength and maintenance of track irregularity are concerned.

3.2 Curve and Permissible Speed

Plane curve of track is the major cause to restrict the train operation speed. Table 1 is the summary of existing plane curves between Damascus and Aleppo.

In order for train or rolling stock to pass through the curve safely and comfortably, cant and transition curve must be suitably provided.

Table 1 Table of Curve on Damascus – Aleppo

Curve	Aleppo - Homs 2			Homs 1 - Damascus		
	Length			Length		
R (m)	(m)	(%)	No.	(m)	(%)	No.
200≦R<300						
300≦R<400				1,123	2.5	3
400≦R<500	4,932	10.1	12	942	2.1	2
500≦R<600	2,100	4.3	6	1,690	3.8	2
600≦R<700	12,480	25.5	25	8,553	19.3	13
700≦R<800						
800≦R<900	9,063	18.5	11	6,337	14.3	9
900≦R<1000						
1000≦R<1100	3,541	7.2	6	1,865	4.2	6
1100≦R<1200						
1200≦R<1300	7,712	15.7	16	12,140	27.4	21
1300≦R<1400						
1400≦R<1500						
1500≦R<1600	950	1.9	2	1,488	3.4	2
1600≦R<1700						
1700≦R<1800						
1800≦R<1900	1,365	2.8	1			
1900≦R<2000						
2000≦R<3000	6,071	12.4	12	7,528	17.0	16
3000≦R<4000	220	0.4	1	2,611	5.9	5
4000≦R<5000	573	1.2	1			
5000≦R						
Curve Total	49,007	100.0	93	44,277	100.0	79
Straight	153,596	75.8		155,458	77.8	
Curve	49,007	24.2		44,277	22.2	
Total	202,603			199,735		

(1) Cant (C)

Acceleration force and wheel load will jointly act on the track when trains pass through the curve and if this joint force is directed to the track center, it is the most preferable condition and such amount of cant is called the “balanced cant”.

Table 2 shows the relation between radius of curve, passing speed and balanced cant.

However, on a given curve, various trains having various speeds run. Accordingly cant amount provided to the curve is generally some kind of average of various balance cants corresponding to various train speeds.

When the train speed must be raised into 160km/h, the existing given cant amount must be

recalculated and the recalculated amount should be provided to each curve.

(2) Maximum Cant (Cm): Maximum Cant Deficiency (Cd)

(a) Maximum Cant Amount (Cm)

The maximum cant amount is determined with the consideration of the rolling stock to be completely safe from overturn inside by the wind from outside and not to give any bad riding comfort to passengers by the inclination of the rolling stock when the rolling stock is stopped at curved section or running at slow speed. In GESR, 150 mm is given as stipulation.

(b) Cant Deficiency (Cd)

Deficiency of cant is brought about when the provided cant is less than balanced cant amount and the limit of cant deficiency is determined on the condition that the riding comfort will not be over the allowable limit and the rolling stock will not turn over because of vibration or lateral wind from inside direction when the rolling stock go through the curved section. In GESR, no such cant deficiency is defined. 90～100 mm of cant deficiency corresponds to excess centrifugal force of 0.067g～0.06g which are adopted in Germany and Britain. Accordingly 60mm which is 60% of 100mm is tentatively suggested as maximum cant deficiency amount considering some allowance.

(3) Relation among Maximum Cant (Cm), Maximum Cant Deficiency (Cd), Radius of Curvature (R) and Maximum Speed (V).

Among the maximum speed V (km/h), maximum cant (Cm: mm), maximum cant deficiency (Cd: mm) and radius of curvature (R: m), the following relation exists.

$$Cm + Cd = 11.8\frac{V^2}{R}$$

Inserting Cm = 150mn, Cd = 60mm, and V=160km/h,

$$R = \frac{11.8 \times 160^2}{150 + 60} = 1438\text{m} \quad 1450\text{m}$$

Namely, for allowing Vmax=160km/h, radius of curvature must be equal to or larger than 1450m.

Table 2 Table of Cant

$$C = 11.8\frac{V^2}{R}$$

V(km/h) / R(m)	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
300	98	142	193	252	319	393	476	566	665	771	885	1,007	1,137	1,274	1,420	1,573	1,735	1,904	2,081	2,266	2,458	2,659	2,867	3,084	3,308	3,540
400	74	106	145	189	239	295	357	425	499	578	664	755	853	956	1,065	1,180	1,301	1,428	1,561	1,699	1,844	1,994	2,151	2,313	2,481	2,655
500	59	85	116	151	191	236	286	340	399	463	531	604	682	765	852	944	1,041	1,142	1,248	1,359	1,475	1,595	1,720	1,850	1,985	2,124
600	49	71	96	126	159	197	238	283	332	385	443	503	568	637	710	787	867	952	1,040	1,133	1,229	1,329	1,434	1,542	1,654	1,770
700	42	61	83	108	137	169	204	243	285	330	379	432	487	546	609	674	743	816	892	971	1,054	1,140	1,229	1,322	1,418	1,517
800	37	53	72	94	119	148	178	212	249	289	332	378	426	478	532	590	650	714	780	850	922	997	1,075	1,156	1,240	1,328
900	33	47	64	84	106	131	159	189	222	257	295	336	379	425	473	524	578	635	694	755	819	886	956	1,028	1,103	1,180
1,000	30	42	58	76	96	118	143	170	199	231	266	302	341	382	426	472	520	571	624	680	738	798	860	925	992	1,062
1,100	27	39	53	69	87	107	130	154	181	210	241	275	310	348	387	429	473	519	567	618	670	725	782	841	902	965
1,200	25	35	48	63	80	98	119	142	166	193	221	252	284	319	355	393	434	476	520	566	615	665	717	771	827	885
1,300	23	33	44	58	74	91	110	131	153	178	204	232	262	294	328	363	400	439	480	523	567	614	662	712	763	817
1,400	21	30	41	54	68	84	102	121	142	165	190	216	244	273	304	337	372	408	446	485	527	570	614	661	709	759
1,500	20	28	39	50	64	79	95	113	133	154	177	201	227	255	284	315	347	381	416	453	492	532	573	617	662	708
1,600	18	27	36	47	60	74	89	106	125	145	166	189	213	239	266	295	325	357	390	425	461	499	538	578	620	664
1,700	17	25	34	44	56	69	84	100	117	136	156	178	201	225	251	278	306	336	367	400	434	469	506	544	584	625
1,800	16	24	32	42	53	66	79	94	111	128	148	168	189	212	237	262	289	317	347	378	410	443	478	514	551	590
1,900	16	22	30	40	50	62	75	89	105	122	140	159	179	201	224	248	274	301	329	358	388	420	453	487	522	559
2,000	15	21	29	38	48	59	71	85	100	116	133	151	171	191	213	236	260	286	312	340	369	399	430	463	496	531
2,500	12	17	23	30	38	47	57	68	80	93	106	121	136	153	170	189	208	228	250	272	295	319	344	370	397	425
3,000	10	14	19	25	32	39	48	57	66	77	89	101	114	127	142	157	173	190	208	227	246	266	287	308	331	354
3,500	8	12	17	22	27	34	41	49	57	66	76	86	97	109	122	135	149	163	178	194	211	228	246	264	284	303
4,000	7	11	14	19	24	30	36	42	50	58	66	76	85	96	106	118	130	143	156	170	184	199	215	231	248	266
4,500	7	9	13	17	21	26	32	38	44	51	59	67	76	85	95	105	116	127	139	151	164	177	191	206	221	236
5,000	6	8	12	15	19	24	29	34	40	46	53	60	68	76	85	94	104	114	125	136	148	160	172	185	198	212
5,500	5	8	11	14	17	21	26	31	36	42	48	55	62	70	77	86	95	104	113	124	134	145	156	168	180	193
6,000	5	7	10	13	16	20	24	28	33	39	44	50	57	64	71	79	87	95	104	113	123	133	143	154	165	177
6,500	5	7	9	12	15	18	22	26	31	36	41	46	52	59	66	73	80	88	96	105	113	123	132	142	153	163
7,000	4	6	8	11	14	17	20	24	28	33	38	43	49	55	61	67	74	82	89	97	105	114	123	132	142	152
7,500	4	6	8	10	13	16	19	23	27	31	35	40	45	51	57	63	69	76	83	91	98	106	115	123	132	142
8,000	4	5	7	9	12	15	18	21	25	29	33	38	43	48	53	59	65	71	78	85	92	100	108	116	124	133
8,500	3	5	7	9	11	14	17	20	23	27	31	36	40	45	50	56	61	67	73	80	87	94	101	109	117	125
9,000	3	5	6	8	11	13	16	19	22	26	30	34	38	42	47	52	58	63	69	76	82	89	96	103	110	118
9,500	3	4	6	8	10	12	15	18	21	24	28	32	36	40	45	50	55	60	66	72	78	84	91	97	104	112
10,000	3	4	6	8	10	12	14	17	20	23	27	30	34	38	43	47	52	57	62	68	74	80	86	93	99	106

(4) Transition Curve

The minimum length of the transition curve must be determined from the view points of safety and riding comfort as shown below.

1) Safety limit preventing derailment due to the 3 point support of the rolling stock bogie (L1)
2) Riding comfort limit for time-wise changing ratio of cant amount (L2)
3) Riding comfort limit for time-wise changing ratio of excess centrifugal force (L3)

The longest length among the above 3 shall be determined as transition curve length. The following formula are used in Japan.

1) L1 = 0.8 Cm (m)
2) L2 = 0.0062 Cm × V (m)
3) L3 = 0.0075 Cd × V (m)

Where Cm, Cd in mm and V in km/h

In case the existing lengths of transition curve is shorter than the length determined by the above formula, the transition curves must be prolonged into desirable length.

Different shapes of transit curves are used in different countries. In Japan, “SINE” half wave form for reducing cant amount is used for transition curve (in case of V≧160 km/h).

In Germany, 4^{th} degree parabola is used for transition curve for Vmax≧100km/h. In France, 3^{rd} degree parabola is used with doucine at both ends of transition curve.

3.3 Curvature Improvement

As indicated in 3.2 (3) above, train can be operated by Vmax = 160km/h for the curves having radius of 1450m or more.

As shown Table 1, the total length of 72.478km at 208 places has the radius of curvature less than 1300m and speed of 160km/h can not be allowed.

As it is explained in 2.1, in case travel time between Aleppo and Damascus (Kadam) must be shortened to 3 hours, all these speed restricting curves must be improved to R=1450m, and the total improvement track length will be around 148km including transition curves.

3.4 High Speed Turnout

Turnout is the track facility to restrict the high speed train operation in many cases.

The major causes to restrict the train speed on tangent side of turnout are:

① Joint structure at the end of tongue rail is generally weak and joint bolt becomes loose due to impact from vehicle wheel:

② Because running rail gap exists at the crossing point, guard rail must be provided at the crossing point to guide the wheel and big lateral pressure is generated to the guard rail.

To solve these problems and to raise the train speed on the tangent side of turnout, the following counter-measures must be established.

For ① above: To use elastic tongue rail. (Fig.3) (The end of tongue rail is welded to lead rail and the tongue rail will be elastically bent at the flexible portion)

For ② above: Guiding angle and length of guide rail will be suitably designed and guide rail will be fixed to sleeper plate firmly.

The joint connecting the crossing to adjacent rails should be preferably welded so as to minimize the shock from train.

If the above counter-measures are established, train speed can be raised on the tangent side of turnout.

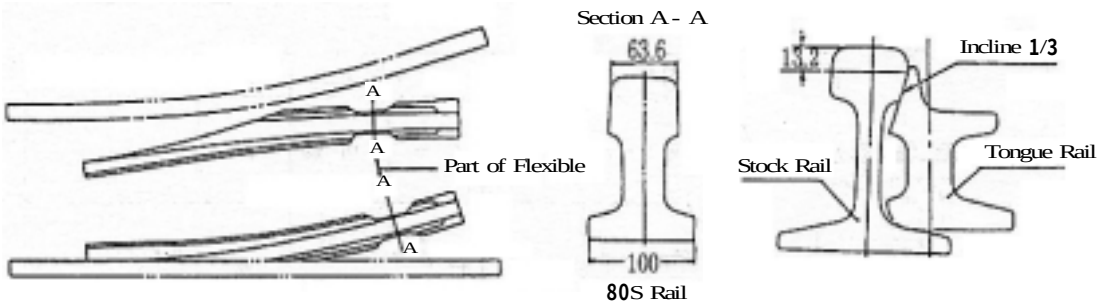


Fig. 3 Elastic Point

If movable nose mangenese crossing is used (Fig. 4), these will be no running rail gap, and there will be no needs for guide rail. In this case there will not occur any problems relating to ② above.

In Japan, movable nose crossing is used for high speed train of V≧ 160km.

Structure of main portion is consisted of 3 parts, i.e. movable nose rail, wing rail and crossing steel and all these are high manganese steel casting.

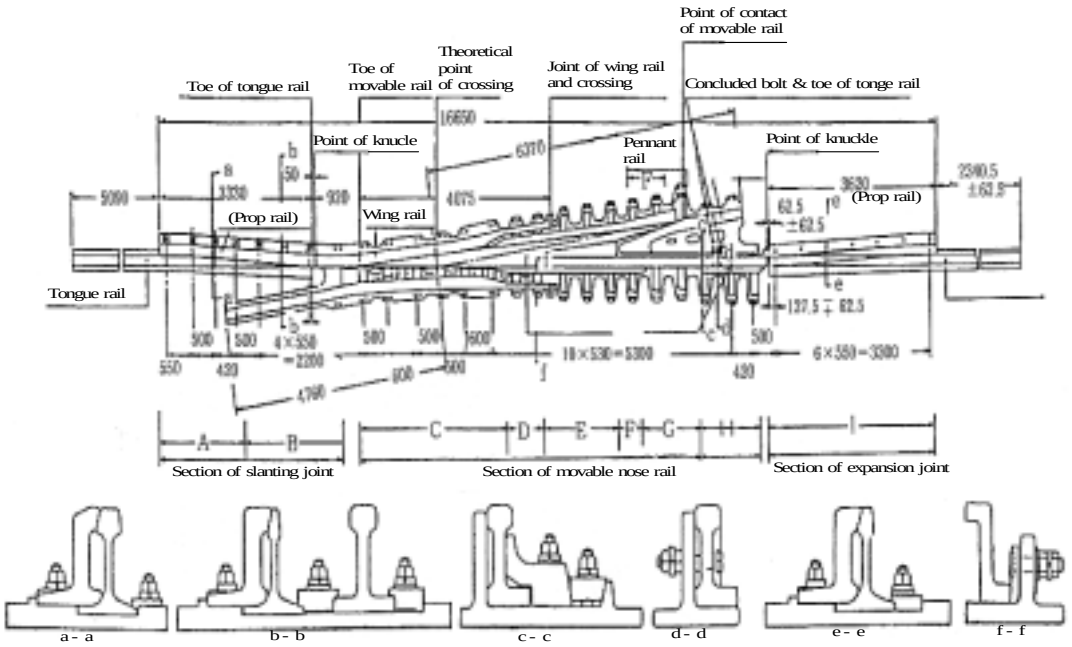


Fig. 4 Movable Nose Crossing

3.5 Turnout Improvement

Based on the Layout of Signal Station and Double Tracking as indicated in Appendix 10.2, 203 sets of main track turnout at each station needed to be replaced with high speed turnout as described in 3.4 above. As the existing turnout is No.11 on main track, movable nose manganese turnout of No. 12 is recommend for 160km/h operation section so as to minimize the realignment work associated with turnout replacement.

The section between Homs 2 and 5km of Damascus – Aleppo, is the very difficult section to operate 160km/h train even after alignment is improved. Therefore the speeding up on that section should be carefully studied when the Feasibility Study will be carried out later.

4. Railway Crossing Improvement.

There are 92 railway level crossings between Aleppo and Damascus (Kadam). For safe and reliable train operation with Vmax = 160km/h, it is desirable to make level crossing grade separated. Viewing from the convenience for the condition along the line, it is considered more gainful to have the railway to step over the road., however, at cut section, to have the road to cross over the railway is more gainful.

5. Protective Facilities Along the Line

It is very dangerous to let pedestrians or animals to recklessly trespass the railway, which will hinder the high speed operation.

Both side of track on the whole line, i.e. Damascus – Aleppo, entry protection fence at land boundary must be installed.

6. Signal and telecommunication

In case maximum speed of 160 km/h is allowed on the existing railway line, signal devices such as signals, obstruction detection and warning devices, level crossing protection devices

and ATS/ATP system should be reexamined.

(1) signals

In the case of maximum speed of 160 km/h in the train operation, with respect to railway signal system, it is desirable to have a cab signal system (signal system to continuously display a maximum allowable speed in the cab) from the visibility view point.

However on the existing railway line, not only passenger trains but also freight trains are running in the same railway line sections. There are different types of trains, in term of train speed, running on the same railway line. In other words all trains on the line do not run at a maximum speed of 160 km/h. So it will be cost expensive and troublesome for maintenance to install a cab signal equipment on all rolling stock including locomotives running at a maximum speed of 100 km/h in the line.

Accordingly, for the Allep～Damascus section, way side signal systems will be recommended to be used to control a train speed on the line because it is not dedicated to high speed train operation, but allows mixed train operation.

In Japan, in general, railway signal indication shows the maximum train allowable speed in the proceeding block section. Yellow signal indicates the maximum allowable speed of 45km/h. (or 55km/h, depending on the section) Accordingly, in three aspect signal system it becomes necessary to reduce train speed from 160km/h to 45km/h (55km/h) within one block length by using normal brake. In such case deceleration rate will become large and it is not good from the points of the comfortable riding of the passenger and the wheel protection against becoming flat.

Therefore, one more aspect (G, G) should be added in order to allow trains run at a maximum speed of 160km/h on the line already equipped with three aspect signal system on the way side. In order to add one aspect (G, G) to the existing three aspect signal system, ATS-P (Transponder) will be effectively used, by which information from a train

(maximum running speed of 160km/h) is transmitted to the way side signal so as to make the signal to indicate GG aspect.

(2) Obstruction detection and warning devices

It becomes inevitable to install such obstruction detection and warning devices as falling stone detector, level crossing obstruction warning device and sand avalanche detector at the necessary locations for the protection of trains for the high speed train operation.

(3) Level crossing protection devices

For train operation of maximum train speed of 160km/h, it is most desirable to have no level crossing in the line.

However, if some level crossings can not be grade separated, it becomes necessary to have level crossing obstruction warning devices and countermeasures to secure an appropriate warning time to road and proper timing of warning to train in spite of train speed difference.

In Japan, in general, by using ATS-P (transponder), information of high speed train will be transmitted to controller of level crossing protection devices, and warning for train stop from the level crossing obstruction warning devices is transmitted to ATS-P located at the two points corresponding to two different emergency brake distances (around 800m, 600m) from the level crossing.

(4) ATS/ATP system

On the lines where trains run at maximum speed of 160km/h, it becomes inevitable for train protection to install ATS/ATP system, which is more functional and reliable.

In the ATS-P type system of Japan, wayside and train information are exchanged through the ground devices and on-board equipment to stop a train automatically just before the stop signal or the level crossing obstructed with car or others, in case driver does not take

necessary action beforehand because of oversight of the signals.

7. Rolling stock

In procuring the diesel car train for 160km/h, light axle weight is desirable from the view point of track structure and maintenance, for example 13 ton as assumed in JICA Study Report.

8. Concluding Remarks

JICA Study Team presented various technical requirements for achieving safe and reliable 160km/h train operation.

In order to meet these requirements, considerable investment will be necessary.

Therefore it is suggested that for the time being GESR may promote the present Master Plan in which the maximum speed of passenger trains is set at 130km/h. After about 10 years, the Master Plan may be reviewed on the basis of the changes in socioeconomic situations, progress of the Master Plan, actual situation of improvement in GESR and other related factors. At the time of reviewing the Master Plan, study could be made on whether further increase in the maximum speed beyond 130km/h should be aimed at or not.