The Islamic Republic of Pakistan
GENCO Holding Company Limited

Preparatory Survey on Lakhra Coal Fired Thermal Power Plant Construction Project in Pakistan

FINAL REPORT (APPENDIX) Vol.2

October 2016

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

Nippon Koei Co., Ltd
Mitsui Consultants Co., Ltd.

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Appendixes

Appendix 1 : Cost Breakdown

Table 1 Initial Cost Breakdown by Cases

I-1. Loop Extension Works

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
1	**Loop Extension Works**												
	(1) Budapur Station												
	Embankment	Cu.m	0	0	25,000	1,050	0	448	0	0	11	0	0
	Track	km	0	0	1	0.04	0	34,950,154	0	0	35	1	0
	Switching	L.S.	0	0	1	1	0	7,869,129	0	0	8	8	0
	(1) Budapur Station Subtotal								**0**	**0**	**54**	**10**	**0**
	(2) Cadet Collage Petaro Station												
	Embankment	Cu.m	3,250	0	25,000	3,250	0	448	1	0	11	1	0
	Track	km	0.13	0	1	0.13	0	34,950,154	5	0	35	5	0
	Switching	L.S.	1	0	1	1	0	7,869,129	8	0	8	8	0
	(2) Cadet Collage Petaro Station Subtotal								**14**	**0**	**54**	**14**	**0**
	(3) Unapur Station												
	Embankment	Cu.m	1,350	0	25,000	1,350	0	448	1	0	11	1	0
	Track	km	0.05	0	1	0.05	0	34,950,154	2	0	35	2	0
	Switching	L.S.	1.0	0	1	1	0	7,869,129	8	0	8	8	0
	(3) Unapur Station Subtotal								**10**	**0**	**54**	**10**	**0**
	(4) Sindh Univ. Station												
	Embankment	Cu.m	0	0	0	4,075	0	448	0	0	0	2	0
	Track	km	0	0	0	0.16	0	34,950,154	0	0	0	6	0
	Switching	L.S.	0	0	0	1	0	7,869,129	0	0	0	8	0
	(4) Sindh Univ. Station Subtotal								**0**	**0**	**0**	**15**	**0**
1	**Loop Extension Works Subtotal**								**24**	**0**	**162**	**49**	**0**

I-2. Additional Track Construction Works

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
2	**Additional Track Construction/ Track improvement Works**												
	Embankment	Cu.m	0	1,519,000	1,519,000	0	1,570,000	448	0	680	680	0	703
	Railway Bridge Construction	m2	0	3,334		0	3,334	966,011	0	3,220		0	3,220
	Bridge Rehabilitation	Lm			866			283,199			245		
	New Track	km	0	30.38		0	31.40	34,950,154	0	1,062		0	1,097
	Track improvement (LC)	km			30.38			21,545,854			655		
	Track improvement (FC)	km			30.38			14,989,389			455		
	Level Xing	No.	0	5	5	0	5	1,723,821	0	9	9	0	9
2	**Additional Track Construction/ Track improvement Works Subtotal**								**0**	**4,971**	**2,044**	**0**	**5,029**

I-3. Yard and the Access to Lakhra Plant Construction Works

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
3	**Yard and the Access to Lakhra Plant Construction Works**												
	Yard Construction works												
	Embankment	Cu.m	548,250	92,872	92,872	98,982	580,000	447.7456	245	42	42	44	260
	Cut	Cu.m	0	176,000	176,000	204,000	0	336	0	59	59	69	0
	Track	km	4.480	6.279	6	7.330	6.563	34,950,154	157	219	219	256	229
	Pavement	m2	109,650	0	0	0	0	3,694	405	0	0	0	0
	Base Course	m2	109,650	0	0	0	0	560	61	0	0	0	0
	Turnout 8#	set	9	14	14	16	15	7,256,760	65	102	102	116	109
	Switching	set	9	14	14	16	15	7,869,129	71	110	110	126	118
	Buffer Stop	No.	2	2	2	2	3	559,682	1	1	1	1	2
	Control Room	m2	100	100	100	100	100	50,371	5	5	5	5	5
	Yard Construction works Subtotal								**1,011**	**538**	**538**	**617**	**723**
	Transloading equipment												
	Reach Stacker	sets	3	0	0	0	0	88,202,146	265	0	0	0	0
	Unloading system	L.S.	0	1	1	1	1	161,031,936	0	161	161	161	161
	Transloading equipment Subtotal								**265**	**161**	**161**	**161**	**161**
	Access Road, Spur Line or Belt Conveyor Const.												
	Embankment	Cu.m		392,808	392,808	392,808	0	447.75		176	176	176	0
	Pavement, Emb. and Cut for Road Const. Works	m2	62,510	0	0	0	0	12,893	806	0	0	0	0
	Road Bridge Construction	m2	3,880	0	0	0	0	242,337	940	0	0	0	0
	Culvert	m2	9	0	0	0	0	8,706,164	78	0	0	0	0
	Wall works	m	400.0					279,841	112				
	Track	km		5.30	5	5.30	0	34,950,154		185	185	185	0
	Railway Bridge Construction	m2		12,947	12,947	12,947	0	966,011		12,507	12,507	12,507	0
	Belt Conveyor Construction	km					2.5	1,379,094,016					3,448
	Access Road, Spur Line or Belt Conveyor Const. Subtotal								**1,936**	**12,868**	**12,868**	**12,868**	**3,448**
3	**Yard and the Access to Lakhra Plant Construction Works Subtotal**								**3,212**	**13,567**	**13,567**	**13,646**	**4,331**

I-4. Signaling

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
4	**Signaling**												
	Station Room												
	Power Supply Unit		1	1	1	1	1	2,216,341	2	2	2	2	2
	Relay Shelf		1	1	1	1	1	185,814	0	0	0	0	0
	Signal Relay		290	290	290	290	290	22,387	6	6	6	6	6
	Terminal Shelf		1	1	1	1	1	886,536	1	1	1	1	1
	Track Circuit Resistor		64	64	64	64	64	194,769	12	12	12	12	12
	Apparatus Stand		1	1	1	1	1	44,775	0	0	0	0	0
	Indoor Cables		1,710	1,710	1,710	1,710	1,710	11,194	19	19	19	19	19
	Signal Panel		5	5	5	5	5	886,536	4	4	4	4	4
	Station Room Subtotal								**46**	**46**	**46**	**46**	**46**
	Field Apparatus												
	Electric Switch Machine		29	29	29	29	29	1,329,804	39	39	39	39	39
	Electric Signal Indicator		58	58	58	58	58	266,409	15	15	15	15	15
	Track Circuit(including Safety Devices & bonds)		64	64	64	64	64	310,064	20	20	20	20	20
	Insulated Rail Joint		76	76	76	76	76	44,775	3	3	3	3	3
	connecting box		18	18	18	18	18	176,860	3	3	3	3	3
	Signal Cables		6,840	6,840	6,840	6,840	6,840	5,597	38	38	38	38	38
	Field Apparatus Subtotal								**119**	**119**	**119**	**119**	**119**
	Removal & Delinery												
	Mechanical Switch Machine		5	5	5	5	5	176,860	1	1	1	1	1
	pipe, carrier, joint		50	50	50	50	50	44,775	2	2	2	2	2
	Mechanical Signal Indicator		7	7	7	7	7	3,358	0	0	0	0	0
	Lever, wheel, wire		700	700	700	700	700	1,119	1	1	1	1	1
	Removal & Delinery Subtotal								**4**	**4**	**4**	**4**	**4**
	Providing weight bridge		1	1	1	1	1	9,514,594	**10**	**10**	**10**	**10**	**10**
	Misc.		1	1	1	1	1	1,787,400	**2**	**2**	**2**	**2**	**2**
4	**Signaling Subtotal**								**180**	**180**	**180**	**180**	**180**

I-5. Locomotives and Wagons, Brake Vans

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
5	**Locomotives**												
	Locomotives												
	Locomotives (4,000HP)	trains	0	4	4	0	4	566,791,124	0	2,267	2,267	0	2,267
	Locomotives (2,268HP)	trains	10	0	0	10	0	378,631,501	3,786	0	0	3,786	0
	Shunting Locomotives	trains	1	3	3	3	3	378,631,501	379	1,136	1,136	1,136	1,136
	Locomotives Subtotal								**4,165**	**3,403**	**3,403**	**4,922**	**3,403**
	Containers												
	20' Open Containers	sets	456	0	0	0	0	2,300,899	1,049	0	0	0	0
	Containers Subtotal								**1,049**	**0**	**0**	**0**	**0**
	Track												
	Dump Track	sets	15	0	0	0	0	5,204,635	78	0	0	0	0
	Track Subtotal								**78**	**0**	**0**	**0**	**0**
	Wagons and Brake van												
	Flat Bed Wagons	trains	190	0	0	0	0	13,970,553	2,654	0	0	0	0
	Hopper Wagons	trains	0	160	160	190	160	12,254,943	0	1,961	1,961	2,328	1,961
	Brake Van	trains	5	4	4	5	4	12,254,943	61	49	49	61	49
	Wagons and Brake van Subtotal								**2,716**	**2,010**	**2,010**	**2,390**	**2,010**
5	**Locomotives Subtotal**								**8,008**	**5,413**	**5,413**	**7,312**	**5,413**

I-6. Jamshoro Revised PC-I Project Cost

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
6	Jumshoro Revised PC-I Project Cost												
	For LC	L.S.			1			561,355,449			561		
	For FC	L.S.			1			202,398,563			202		
6	**Jumshoro Revised PC-I Project Cost**								**0**	**0**	**764**	**0**	**0**

I-7. Land Acquisition

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
7	Land acquisition												
	Land for the Yard, Access Road and Railway Bridge are included.	m2	195,770	571,300	269,500	284,800	442,300	4,030	789	2,302	1,086	1,148	1,782
7	**Land acquisition Subtotal**								**789**	**2,302**	**1,086**	**1,148**	**1,782**

I-8. Consulting Fee

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
8	Consulting Fee												
	Civil Consulting service fee		3,081	16,786	15,019	12,431	8,844	8%	254	1,386	1,240	1,027	730
	Rolling Stock Consultin service fee		7,758	5,244	5,244	7,083	5,244	5%	400	271	271	366	271
8	**Consulting Fee Subtotal**								**655**	**1,657**	**1,511**	**1,392**	**1,001**

I-9. Price escalation

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
9	Price Escalation												
	For LC								915	5,722	4,798	4,210	1,892
	For FC								669	553	560	645	823
9	**Price Escalataion Subtotal**								**1,584**	**6,275**	**5,358**	**4,854**	**2,716**

I-10. Contingency

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
10	Contingency		13,762	31,967	28,055	26,742	19,365						
	For LC	LC							236	1,294	1,074	939	448
	For FC	FC							486	424	430	490	575
10	**Contingency Subtotal**								**723**	**1,718**	**1,504**	**1,429**	**1,023**

I-11. Tax

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
11	Tax												
	For Local procurement	LC	4,704	25,182	20,920	18,308	8,807		843	4,621	3,833	3,351	1,600
	For Foreign procurement	FC	9,931	8,654	8,789	10,014	11,731		2,247	1,958	1,989	2,266	2,654
11	**Tax Subtotal**								**3,090**	**6,579.2**	**5,822.1**	**5,616.8**	**4,254**

I. Initial Cost Total

I. Initial Cost

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Quantity						Cost in Mil. Rs.				
	I. Initial Cost Total incl. Price Esc. (Million Rs.)								**18,264**	**42,663**	**37,411**	**35,627**	**25,729**

Table 2 Railway O&M Cost Breakdown for 30 years by Cases

II-1. Railway O&M Costs (Variable)

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Qty	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Unit Cost in Mil. Rs.						Cost in Mil. Rs.				
O&M COSTS (Variable)													
	Train crews	MilRs./yr	32	23	23	30	22	30	954	679	679	894	668
	Fuel/energy consumption	MilRs./yr	296	271	271	298	267	30	8,865	8,116	8,116	8,952	8,006
	Locomotive maintenance	MilRs./yr	164	63	63	169	63	30	4,930	1,904	1,904	5,078	1,879
	Wagon maintenance	MilRs./yr	439	357	357	452	352	30	13,160	10,702	10,702	13,555	10,557
	Variable track maintenance	MilRs./yr	220	201	201	222	199	30	6,600	6,042	6,042	6,665	5,960
	SUB-TOTAL, O&M COST (variable)		1,150	915	915	1,171	902		34,509	27,443	27,443	35,145	27,069

II-2. Railway O&M Costs (Fixed)

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Qty	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Unit Cost in Mil. Rs.						Cost in Mil. Rs.				
O&M COSTS (Fixed)													
	Fixed cost of infra. Maint.		35	41	34	39	41	30	1,057	1,238	1,033	1,175	1,218
	Station operating cost		35	41	34	39	40	30	1,047	1,236	1,031	1,172	1,204
	SUB-TOTAL, O&M COST (fixed)		70	82	82	78	81		2,104	2,474	2,064	2,346	2,421

II-3. Overheads

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Qty	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Unit Cost in Mil. Rs.						Cost in Mil. Rs.				
OVERHEADS		26%							9,390	7,672	7,567	9,615	7,563

II-4. Renewal of Equipments

Work Item S.#	Item	Unit	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3	Qty	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
			Unit Cost in Mil. Rs.						Cost in Mil. Rs.				
Renewal Equipments													
	20' Open Containers		1,016	0	0	0	0	5	5,082	0	0	0	0
	Tax		5,082	0	0	0	0	22%	1,118	0	0	0	0
	SUB-TOTAL, Renewal Equipments								6,200	0	0	0	0

II. Railway O&M Cost for 30 years

Work Item		Unit	Dump Truck	RwySpurL1	RwySpurL1'	RwySpurL2	Conveyor	Qty	Dump Truck	RwySpurL1	RwySpurL1'	RwySpurL2	Conveyor
S.#	Item		Case1	Case2A	Case2AR	Case2B	Case3		Case1	Case2A	Case2AR	Case2B	Case3
			Unit Cost in Mil. Rs.						Cost in Mil. Rs.				
	II. Railway O&M Cost (30yrs) Total (Mil. Rs.)								52,203	37,589	37,075	47,106	37,053

Table 3 Unloading O&M Cost Breakdown for 30 years by Cases

III-1. Personnel Expense

Work Item S.#	Item	Unit	Qty			No. of Renewal Or MM	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
								Cost in Mil. Rs.				
Personnel Expense												
	Chief Drivers	Person		3		360		98				
	Drivers	Person		90		360		2495				
	Operators for Reach Stacker	Person		6		360		216				
	Security for Budapur Yard	Person		36		360		505				
	Security for Conveyor	Person		33	22	360						309
	Engineer	Person	2	3	2	360			75	75	112	75
	Unloading Operator	Person	20	30	20	360			281	281	421	281
	Railway operator for train shunting	Person	2	3		360			84	84	126	0
	Assistant for railway operator	Person	2	3		360			28	28	42	0
	Personnel Expense Subtotal							**3315**	**468**	**468**	**702**	**665**

III-2. Equipment Renewal Cost

Work Item S.#	Item	Unit	Qty	No. of Renewal Or MM	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
						Cost in Mil. Rs.				
O&M										
	Renewal of Dump Trucks	Nos.	15	5		505				
	Renewal of Stackers	Nos.	3	2		616				
	Belt and Roller	Nos.	5,000	6						1500
	Motor for Belt	Nos.	2	2						40
	O&M Subtotal					**1121**	**0**	**0**	**0**	**1540**

III-3. Fuel Cost

Work Item S.#	Item	Unit	Qty	No. of Renewal Or MM	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
						Cost in Mil. Rs.				
Fuel Expense										
	Diesel oil for Trucks*	L	57,497	360		2070				
	Electric Utility Expense	kw								360
	Fuel Expense Subtotal					2070	0	0	0	360

III-4. Tax

Work Item S.#	Item	Unit	Qty	No. of Renewal Or MM	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
						Cost in Mil. Rs.				
Tax										
	For Local procurement	LC				915	80	80	119	174
	For Foreign procurement	FC				247	0	0	0	339
	Tax Subtotal					1162	80	80	119	513

III. Unloading O&M Cost for 30 years

Work Item S.#	Item	Unit	Qty	No. of Renewal Or MM	Unit Cost in Rs.	Dump Truck Case1	RwySpurL1 Case2A	RwySpurL1' Case2AR	RwySpurL2 Case2B	Conveyor Case3
						Cost in Mil. Rs.				
	III. Unloading O&M Cost (30yrs) Total (Mil. Rs.)					**7,667**	**548**	**548**	**821**	**3,077**

Table 4 Life Cycle Cost for Railway

	Case 1	Case 2A	Case 2AR	Case 2B	Case 3
I. Initial Cost Total	18,264	42,663	37,411	35,627	25,729
II. Railway O&M Cost (30yrs) Total (Mil. Rs.)	52,203	37,589	37,075	47,106	37,053
III. Unloading O&M Cost (30yrs) Total (Mil. Rs.)	7,667	548	548	821	3,078
I+II. Railway Life Cycle Cost (30 yrs) Total (Million Rs.)	70,467	80,252	74,485	82,733	62,782
I+II+III. Grand Total (Million Rs.)	78,134	80,800	75,033	83,555	65,860

Appendix-2: PC-1 Proforma for Coal Transportation by Rail to Jamshoro Power Plant (May 2014)

GOVERNMENT OF PAKISTAN
MINISTRY OF RAILWAYS
ISLAMABAD

PC-I PROFORMA

FOR

COAL TRANSPORTATION BY RAIL TO JAMSHORO POWER PLANT

PLANNING COMMISSION
PC-I PERFORMA
(INFRASTRUCTURE SECTOR)

1.	**Name of the project**	Coal transportation by Rail to Jamshoro Power Plant.
2.	**Location of Project**	Port Bin Qasim in Karachi, Kotri, Jamshoro districts in Sindh Province. Site plan attached as Appendix-1.
3.	**Authorities responsible for:**	
	i). Sponsoring	Ministry of Railways, Government of Pakistan, Islamabad.
	ii). Execution	Pakistan Railways
	iii). Operation and Maintenance	Pakistan Railways
	iv). Concerned Federal Ministry	Ministry of Railways

4. a). ***Plan Provision.***

i). **If the project is included in the Medium Term/Five Year Plan, specify actual allocation.**

The project is not included in the MTDF/Five Year Plan (2013-18).

ii). **If not included in the current Plan, what warrants its inclusion and how is it now proposed to be accommodated.**

The project is not included in MTDF/Five Year Plan (2013-18) as a specific project rather it is linked with the Project of "Jamshoro 2x600 MW supercritical Coal Fired Power Project". The PC-I of Jamshoro Power Plant discussed in CDWP meeting held on 21-11-2013 and following was decided:- *"the options of providing funding for linking and enhancement of railway track, a separate PC-1 Scheme may be prepared, funded through PSDP or from the budget of the Jamshoro Power Project by Department of Railways".*

The project is accordingly being proposed for approval through this PC-1, to be financed through PSDP or from the budget of the Jamshoro Power Project.

The project is essentially required to be implemented for efficient transportation of coal to the power plants at Jamshoro by improving the infrastructure, procuring requisite locomotives and rolling stock.

No provision has been made in current year's PSDP but the same is likely to appear in the PSDP for next financial year (2014-2015). The project is proposed to be financed through PSDP out of the project cost of the Jamshoro Power Project.

iii). **If the project is proposed to be financed out of block provision or included in the current plan block provision indicate.**

The project will be financed out of block provision for the Transport Sector.

(Rs in Million)

Total block provision	Amount already committed	Amount proposed for this project	Balance available
-	-	Rs.15495.600	-

b). **Provision in the current year PSDP/ADP.**

Nil

5. **PROJECT OBJECTIVES AND ITS RELATIONSHIP WITH SECTOR OBJECTIVES**

The existing power generation capacity is not sufficient to meet the ever increasing demand of the country. To cope with this growth and demand additional capacity augmentation would be required annually. The project at Jamshoro for setting up 2x600 MW supercritical Coal Fired Power Project is highly efficient and environmental friendly, and will reduce the overall cost of electricity generation.

Pakistan Railways has committed to transport coal from Port Bin Qasim to Jamshoro power plants. For safe and efficient transportation, the additional railway tracks along with rehabilitation of existing infrastructure including sidings from Kotri to Jamshoro and Port Muhammad Bin Qasim to Bin Qasim Railway Stations are considered essential. It will also involve yard remodeling of Port Muhammad Bin Qasim, Bin Qasim, Kotri, Sindh University, Akhundabad Railway Stations and at Jamshoro Power Plant.

- **In case of revised projects, indicate objectives of the projects different from original PC-I.**

Not Applicable

6. **DESCRIPTION AND JUSTIFICATION OF THE PROJECT.**

The PC-I of 2x600 MW supercritical Coal Fired Power Project at the cost of Rs.240,094.00 Million was presented by the Ministry of Power & Water in the Planning Commission and was considered by the CDWP in its meeting held on 28-10-2013. The project was recommended in principle for approval by ECNEC. It was also decided that modified PC-I would be submitted in the next CDWP meeting for revalidation. Accordingly, the Ministry of Water & Power submitted a modified PC-1 with the revised amount of Rs. 237,822.03 million.

On 21-11-2013, a committee chaired by Member (Energy), Planning Commission with representatives of Ministry of Ports & Shipping, Railways, Water & Power, Finance & Economic Affairs, Petroleum & Natural Resources, Chairman NEPRA and Secretary Coal & Energy Department, Government of Sindh as its member was constituted to resolve the issue pertaining to logistic arrangements for transportation and storage of coal. It was decided by the committee *that "the options of providing funding for linking and enhancement of railway track, a separate PC-1 Scheme may be prepared, funded through PSDP or from the budget of the Jamshoro Power Project*

by Department of Railways". Accordingly, the PC-I has been framed to improve the infrastructure of railways and procurement of requisite number of locomotives and hopper wagons for efficient logistic arrangements and coal transportation.

The current level of power shortage in Pakistan requires shouldering base-load and peak-load generation, with priority for additional affordable base load generation. The energy sector is currently experiencing an acute and worsening energy crisis, which is devastating for the economy, as well as for the well-being of the population. The energy shortage peaked at 6000 MW in the summer of 2012, representing around 30% of unfilled demand. Depletion of domestic natural Gas and delays in development of indigenous coal and hydro resources have increased reliance on imported fuels. Data from the National Electric Power Regulatory Authority (NEPRA) shows that the total amount paid for furnace oil procurement for the oil-fired power stations during 2012-2013 reached about US$ 2.6 Billion. This has increased the circular debt of Pakistan – the cash shortage within the Central Power Purchase Authority (CPPA) that it cannot pay to the power supply companies-amounting to about US$ 5.00 billion, or about 4% of the nominal GDP loss annually. The growing dependence on expensive imported furnace oil for power generation has added to the difficulties in meeting demand and has led to widespread load shedding, interruption of industrial and commercial activities, lost productivity and public dissatisfaction. Fuel oil was expected to generate only about 38% of power, even though it accounts for 79% of costs. Compared to 2006, the dependence on fuel oil has gone up from 16% to 38% and costs have increased by 236%. To reduce load shedding, the government has committed to adding affordable generating capacity with higher efficiency power technology.

Demand is expected to reach 32,000 MW by 2020, with current available capacity at 19,000 MW. Therefore, all affordable generation must be expanded. The sector will need to add base load and peaking plants to ensure this demand is met. The estimate for hydropower potential in Pakistan is 40,000 MW, with only 6500 MW exploited. Large-scale dams are needed for water storage, as well as cheap electricity production. However, some of these projects have been delayed. The addition of run-of-river hydropower plants has also been slow, with only the Neelam Jhelum hydropower plant added in the last 10 years.

To meet the future requirement of electricity and reduce the power demand and supply gap in the country in the coming years, GOP has taken various initiatives to increase power generation capacity. To complement the NTDC plan to have reliable power supply, the proposed project offers to add coal fired Power Plant of 2 x 600 MW capacity, highly efficient and environment friendly at Jamshoro. This will help to reduce cost of supply resulting from current use of furnace oil as fuel. The new facility will also result in reduction of bulk tariff, subsequent subsidy and ultimately the circular debt.

Technical parameters i.e. input and output of the project and technological aspect of the project.

The new track as additional line will be laid with new UIC-54/60 Kg rails on prestressed concrete (PSC) mono block sleepers having elastic (W-14) fastenings over 30cm ballast cushion. This will also involve the widening of existing level crossings and provision of new bridges. The existing track will be rehabilitated by replacing unserviceable sleepers with new PSC mono block sleepers providing full ballast

cushion. Land acquisition will be required in case of new track from Kotri to Jamshoro power plant and from Bin Qasim to Port Muhammad Bin Qasim. The remodeling/rehabilitation of station yards at Port Muhammad Bin Qasim, Bin Qasim, Kotri, Sindh University and Akhundabad will be required alongwith revamping of signaling system to ensure efficient train operation.

7. **CAPITAL COST ESTIMATES**

Description	Cost (Rs. In Million)
Local	6025.912
FEC	9469.688
Total	**15495.600**

i). **Date of estimation of project.** **April, 2014**

ii). **Basis of determining the capital cost, including market survey, schedule rates, estimation on the basis of provision work done etc.**

The basis of determining the cost is Pakistan Railway's Composite Schedule of Rates (CSR), 2003, prevailing market rates of civil works, Railway price catalogue for track material and last purchase rates of equipment.

iii) **Year wise estimation of physical activities is as under:-**

The year-wise/component-wise physical activities are as under:-

Sr	Description	Unit	2014-15	2015-16	Total
			Qty	Qty	Qty
1	**a. Track works** Additional line from Kotri to Jamshoro Power plant (14.82 Kms)	Km	2.00	12.82	14.82
2	Additional loop Line at Sindh University and Jamshoro (2.20 Kms)	Km	0.50	1.70	2.20
3	Additional Lines between Port Bin Qasim to Muhammad Bin Qasim Station (13 Kms)	Km	3.00	10.00	13.00
4	Rehabilitation of existing track between Port Bin Qasim to Muhammad Bin Qasim Stations (13 Kms)	Km	3.00	10.00	13.00
5	Rehabilitation of existing track between Akhundabad to Jamshoro alongwith 3 No. loop lines (6.12 Kms)	Km	3.00	3.12	6.12
6	Remodelling of Signalling system from Bin Qasim-Port Muhammad Bin Qasim, Kotri-Akhundabad & at Sindh University station yards	L.S	25%	75%	100%
7	**b. Structural Works** Extension of Bridges and level crossings between Port Qasim-Port Muhammad Bin Qasim station and Kotri to Akhundabad station	Nos.	30	18	48
8	**c. Mechanical Works** i). Procurement of New Locomotives	Nos.	-	10	10
	ii). Procurement of High capacity Hopper wagons including 09 Nos. brake vans.	Nos.	125	375	500

iv). **Phasing of capital cost on the basis of each item of work as stated above.**

Total Cost = Rs.15495.600 Million

(Figures in Rs. Million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	Foreign exchange	Total
2014-15	25 %	1342.963	2566.237	3909.200
2015-16	75 %	4682.949	6903.451	11586.400
Total	**100%**	**6025.912**	**9469.688**	**15495.600**

Note:-

Detail of phasing of capital cost is placed as Appendix-3

The total estimated cost of the project is Rs.15495.600 million including an FEC of Rs.9469.688 million. The project is proposed to be completed in 2 years.

Year of phasing	Foreign Exchange	Total cost	CD&ST	Net Cost
2014-15	2566.237	3909.200	414.986	3494.214
2015-16	6903.451	11586.400	3098.380	8488.020
Total:-	**9469.688**	**15495.600**	**3513.366**	**11982.234**

- **CALCULATION OF ESCALATION**

Year	Phasing of Capital Cost		Total	Escalation				Total Cost		
	Local	FEC		%age	Local	FEC	Total	Local	FEC	Total
2014-15	1342.963	2566.237	3909.200	0	-	-	-	1342.963	2566.237	3909.200
2015-16	4393.135	6903.451	11300.586	6.5%	285.814	-	285.814	4682.949	6903.451	11586.400
Total:-	**5740.098**	**9469.688**	**15209.786**		285.814	-	285.814	**6025.912**	**9469.688**	**15495.600**

8. **ANNUAL OPERATING / MAINTENANCE COST**

Item-wise annual operating / maintenance cost based on proposed capacity utilization to be worked out for 5 years and sources of its financing.

The breakup of annual recurring cost for operation and maintenance after completion of the project is as under (Please refer Annexure-8 & 9).

i).	Track	= Rs. 5.978 Million
ii).	Rolling Stock including operations	= Rs. 469.60 Million
	Total:-	**= Rs. 475.578 Million**

FINANCING PLAN

i) Please give a complete source of financing of the project. Clarify sources of financing such as Federal/Provinces.

Federal Government

ii) Provide details of recurring expenditure on the basis of fixed and variable costs also specify the items such as establishment charges, interest payments, duplication and non-salary item, maintenance charges, implementation and agency responsible for meeting the recurring cost.

Not Applicable.

9. DEMAND SUPPLY ANALYSIS.

a). Existing capacity of services its supply/demand.

Taking into consideration the number of 08 trains per day to meet the requirement of transportation of 6.60 million tons of coal from Karachi to Jamshoro Power Plant, the existing track requires improvement/rehabilitation and provision of additional lines, as summarized below:-

The existing track between Port Muhammad Bin Qasim and Bin Qasim Railway stations is in deplorable condition requiring complete rehabilitation with new PSC Sleepers and ballasting of track. The line capacity of existing track is insufficient to meet the requirement of future freight traffic of coal. In addition to this, a new track alongwith the extension of existing bridges, has been proposed to be laid parallel to the existing one, in order to have double line to facilitate directional traffic.

Similarly a new railway line has been proposed to be laid from Kotri to Akhundabad to maintain uninterrupted flow of freight. For this purpose, existing bridges will be suitably extended.

The procurement of 10 Nos. DE locomotives (4000-4500 HP) and 500 new design high speed/capacity hopper bogie wagons (491 wagons and 09 nos brake vans) is essential to meet the demand for the transportation of 6.60 million tons per annum coal from Karachi to Jamshoro Power Plan via Kotri.

The present fleet owned by Pakistan Railway contains mostly overage and obsolete design wagons which are not capable to operate at high speed resulting into higher turn round. New design bogie wagons, fitted with roller bearings and air brakes etc., will work at higher speeds to achieve lesser turn round and down time for maintenance. This will lead to better operational efficiency and effective utilization of operational assets.

At present, Pakistan Railway has 16179 wagons = 21471 units in-terms of 4-wheeler wagons. 67% of these (10887 wagons) consist of 4-wheeler wagons which are being phased out. Currently Pakistan Railway does not have any High Capacity Hopper wagons. Pakistan Railways has only 625 ballast trucks, out of which 122 are already over-aged. Besides these have a maximum permissible speed of 55 KMH which makes them operationally un-viable.

b). **Projected demand for 10 years.**

The present capacity of Pakistan Railways to carry freight traffic is approximately 5.000 billion tonnes kilometers annually, which is not sufficient to meet the needs of developing economy which requires growing volumes of freight to be transported across the length and breadth of the country. Pakistan Railways is at present, carrying only 4% of the total freight traffic market, moving from Karachi. The balance 96% traffic is carried by pipe line & road which is more expensive as compared to rail and also generates excessive pollution besides being less safe. This is an additional

demand of 6.60 million ton per annum coal to be moved from Karachi upto Jamshoro power plant for which Pakistan Railways is required to augment its transportation capacity. The requirement of hopper wagons will be as under:-

- Coal to be transported per annum = 6.60 million tons
- Lead = 160 Km
- Turn round = 1.4 Days
- No. of working days = 360
- Coal to be transported per day = 6600000/360 = 18333.383 ton
- Axle load of Hopper Wagon = 21 Tones
- Pay load per wagon = 60 tones
- Requirement of Wagons per day = 427
- In effective allowance @ 15% = 64
- Hopper wagons requirement = 491 wagons
- Total brake vans = 09 Nos.
- Total requirement = 500 Nos.

The requirement of locomotives will be as under:-

- Nos. of wagons per day 18333.383/60 = 305 wagons
- No. of train per day = 305/40 = 7.6 Nos.
- Locomotive required per day = 7.6 Nos.
- Total requirement of locomotives = 7.6x1.4 = 10.6 = 10 Nos. (Say)

10. **FINANCIAL PLAN**

(Figures in Rs. Million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	Foreign exchange	Total
2014-15	25 %	1342.963	2566.237	3909.200
2015-16	75 %	4682.949	6903.451	11586.400
Total	**100%**	**6025.912**	**9469.688**	**15495.600**

The project will be financed by the Government of Pakistan.

A. ROAD

i) Land Acquisition.
ii) Sub grade.
iii) Small bridges and culverts.
iv) Sub-base.
v) Base.
vi) Surfacing.
vii) Road Signs, road markings and ancillaries.
viii) Work charged establishment.
ix) Contingencies.
x) Interest on Capital during construction.

Not Applicable.

B. BRIDGES

i) Land acquisition.
ii) Preparatory Works.
iii) Sub-Structure.
iv) Super Structure.
v) Approaches.
vi) River Training Works, Miscellaneous.
vii) Work charged establishment.
viii) Contingencies.
ix) Interest on Capital during construction.

Not Applicable.

C. AIRPORT

i) Land acquisition, reclamation and development.
ii) Runway and cleared strip.
iii) Taxiways.
iv) Aprons.
v) Airfield lighting and landing aids.
vi) Terminal building.
vii) Other terminal facilities.
viii) Utilities.
ix) Road/rail improvement outside airport boundary.
x) Firefighting equipment.

Not Applicable.

D. PORTS

i) Acquisition of land, reclamation and development of land.
ii) Harbour works including dredging, retaining walls.
iii) Break water, approach channels, navigational channels and basins.
iv) Navigational Aids.
v) Berths, warehouses and sheds.
vi) Administrative and Residential building.
vii) Cargo handling equipment.
viii) Water and other services.
ix) Approach roads.
x) Vehicles.
xi) Railway yards and rolling stock.
xii) Fire fighting.

Not Applicable.

E. ROLLING STOCK, LOCOMOTIVE, AIRCRAFT AND BUSES ETC.

i) Vehicles (separately for each type of vehicle).
ii) Renovation costs.
iii) Capitalized cost of training (if aircraft etc. are new models).

Following vehicles have been proposed for procurement against this PC-I.

i) - DE Locomotive 4000-4500 HP = 10 Nos.
- High capacity Hopper wagons including brake vans (Gross Load 84-Tonnes, Pay Load 60-Tonnes) = 500 Nos.
- Self propelled material lorry (heavy duty) = 02 Nos.

ii) Not applicable.

iii) Not applicable.

If new aircraft etc. are being acquired in replacement of existing aircraft give following details.

Date of purchase of machine to be replaced	Type and carrying capacity	Capital cost	Maintenance cost for last five years	Reasons for acquisition of new machines

Not Applicable.

F. OTHER PROJECTS

Land and land development.
Equipment.
Engineering Costs.
Utility services
Other costs (give details)

Not Applicable.

BUILDING / CIVIL WORKS:

Is any Civil Work of any kind including Building, Housing, Town Planning, Water Supply and Sewerage activities included in the project? If yes, provide the following information:

Total covered area of the Building (basis for determining the space requirements) along with line plans, number of stores etc.

If houses provided, their number and categories along with covered area and line-plans.

Not Applicable.

Size of the plot, on which Building/Houses are to be constructed viz-a-viz the percentage of open and constructed area.

Not Applicable.

Give description of already completed or under construction Building/Houses viz. the new proposed construction.

Not Applicable.

Existing Water Supply and Sewerage arrangement in the area as well as for the present project.

Not Applicable.

Unit-cost supported by item-wise detailed estimates of the Building/Houses, separately for Civil Works, Water Supply and Sewerage, other utilities including HVAC, (if present), external development etc.

Not Applicable.

Percentage of Contingencies, Departmental Charges and Escalation based on Base - cost.

As per usual practice, 3% contingencies have been included in all estimates.

11. PROJECT BENEFITS AND ANALYSIS

i). Financial

It is a support project for the project of 2x600 MW supercritical Coal Fired Power Project at Jamshoro. According to the PC-I of Jamshoro Power Plant EIRR has been worked out as 36.60%.

However, the total estimated cost of the project, including escalation during the period of execution, is estimated as Rs.15495.600 million including FEC of Rs.9469.688 million at an interest rate of 12%; the Net Present Value (NPV) after 20 years is Rs.3080.487 million. The Internal Rate of Return (IRR) after 20 years is 13.032% and Cost Benefit Ratio (CBR) is 1:1.192. The project is thus financially viable. The detailed financial analysis is given in Annexure- 10 to 10/2.

ii/iii). Socio-Economic Benefits

The power demand in the country is continuously rising due to increased momentum of economic activities in the agriculture sector and in manufacturing. The fast urbanization has also increased the demand for electricity in the households. The households are using a greater number of electrical equipment and appliances than ever before vis-à-vis increase in the standard of living. The additional supply of electricity to rural areas will go a long way to contain large scale migration of rural labour force to urban centers. The requirement of power demand for accelerated village / rural electrification programme will also be adequately met. The Jamshoro Power Project is proposed to tremendously decrease the existing power short fall.

The implementation of the project will augment/promote socio-economic achievements being a more economical mode of transport as Railway is five times more efficient in fuel consumption as compared to roads. The railways are also 125 times safer than road thus providing improved safety to the travelling public, the benefits of which can hardly be converted into monetary terms. The railways are also environment friendly transport system both as regard noise and emission of harmful gases. Expected diversion of traffic from Road to Rail will reduce pollution due to reduction in traffic on roads.

iv) Employment Generation (Direct & Indirect)

Detail of man power required for execution of project and for operation after completion is as under:-

S.#	Description	For execution (No of jobs)	For operation (no of jobs)
(i)	Administrative, Executive & Managerial	13	Nil
(ii)	Clerical & Drawing Office	14	Nil
(iii)	Supervisory	27	Nil
(iv)	Skilled Staff	21	2
(v)	Un-skilled Staff	33	38

(Detail at Annexure-7 to 7/2)

v) Environmental Impact

Currently modal split between Rail and Road in Pakistan is extremely imbalanced in favour of roads. It is an established fact that Railway as a mode of transport is far more environmental friendly than Roads. As such no environmental degradation is anticipated with the implementation of this project.

INDICATE ENVIRONMENTAL IMPACT LIKELY TO BE GENERATED AS A RESULT OF IMPLEMENTATION OF THE PROJECT. DETAILED QUANTIFICATION AND ANALYSIS OF THE LIKELY IMPACTS SEPARATELY ON HUMAN LIFE, ANIMAL LIFE, FORESTS AND VEGETATION ETC. SHOULD BE PROVIDED. THE QUANTIFICATION OF IMPACTS SHOULD INCLUDE THE FOLLOWING.

i) Traffic noise.
ii) Air pollution.
iii) Water pollution.
iv) Drainage/Run off.
v) Community severance.
vi) Crop yield.
vii) Ground water contamination.
viii) People's Health.
ix) Wild Life.
x) Ecology.
Bio-physical characteristics of the project site including water, geology and soils, ecological (aquatic & terrestrial), natural resources (mineral/forestry/ agriculture), and visual quality etc.

xi) ***Restoration/preservation and re-use of disturbed areas, through embankments etc.***
xii) ***Protection of habitats along communication routes i.e. roadways, rail track and around an airport etc.***

The potential impact on the physical environment by the project of Jamshoro Power Plant has been accounted for and measures will be taken to control it. For air quality impact, there are two modes of air pollution from the thermal

power plant; namely point emissions from the stack and fugitive emissions from the coal and ash handling. 2x600 MW Super Critical coal/lignite fired units alongwith other measures will be done to reduce the emissions from the plant. Fugitive dust is minimized by using conveyor belts, wherever practical in the design of coal handling system, alongwith other measures done to control it. Potential negative socioeconomic impact includes land acquisition resulting in physical and economic displacement of people. However, a land acquisition and resettlement framework has been developed to minimize the impact.

Railway transport system is an established mode of transport resulting in less pollution and most economical for mass movement. Under this PC-I, certain priority rehabilitation / improvement to infrastructure has been proposed to improve the efficiency of the existing Railway System.

vi) Impact of Delay on Project Cost and Viability

The delay in implementation of the project will not only cause increase in the cost, but will hamper the operation of Jamshoro Power Plant.

12. **A. IMPLEMENTATION SCHEDULE**

i). Starting and Completion date of the project. **02 Years**

ii). Item-wise/year-wise implementation schedule in line chart co-related with the phasing of physical activities.

The details attached as **Appendix–3**.

B. RESULT BASED MONITORING (RBM) INDICATORS

S. No.	Input	Output	Outcome		Targeted Impact
			Base line indicator	Targets after completion of project	
1	Procurement of 10 Nos new DE Locomotives And 500 nos. High capacity Hopper Wagons.	Efficient transportation and availability of specially designed locomotives /wagons dedicated for coal.	Locomotives not available with Pakistan Railways to meet traffic requirement. Also wagons available with Pakistan Railway contain mostly overage and obsolete design wagons which are not capable to operate at high speeds resulting	Pakistan railways will become capable for timely and efficient transportation of coal to operate power plants in full swing.	Increase in transportation capacity, enhance safety, speed of train, saving in fuel cost, reducing the chances of accident due to efficient and punctual train operations. Higher level of financial earning which

			into higher turn round.		will be beneficial for Pakistan Railways. This will also provide timely supply of coal to operate power plants.
2	Providing new additional track from Port Muhammad Bin Qasim to Bin Qasim and from Kotri to Akhundabad along with provision of new bridges. Rehabilitation of existing railway track from Port Muhammad Bin Qasim to Bin Qasim and from Kotri to Jamshoro Power plant.	Increase in the line capacity at higher speed and efficient transportation. Increase in safety and higher turn round of trains.	The existing track between Port Muhammad Bin Qasim to Bin Qasim and from Kotri to Akhundabad Railway stations is in deplorable condition. The line capacity of existing track is insufficient to meet the freight traffic requirements.	Enhance speed & increase in Line Capacity.	

13. **MANAGEMENT STRUCTURE AND MANPOWER REQUIREMENTS FOR EXECUTION OF PROJECT**

i). **Administrative arrangements for implementation of project.**

ii). **The manpower requirements by skills during execution and operation of the project be provided.**

iii). **The job description, qualification, experience, age and salary of each post be provided.**

The details attached as Annexure-7

14. **ADDITIONAL PROJECTS/DECISIONS REQUIRED**

Additional projects/decisions required to optimize the investment being undertaken on the project.

Not Applicable.

15. **Certified that the Project proposal has been proposed on the basis of instructions provided by the Planning Commission for the preparation of PC-I for Infrastructure Sector Project.**

Prepared & Checked by	**(Basharat Waheed)** Chief Engineer/S&C, Pakistan Railways, Lahore. Ph: 042-99201625.
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Approved by	**(Perveen Agha)** Secretary/Chairperson, Pakistan Railways, Islamabad. Ph: 051-9211991.
Sanctioned by	**"ECNEC"**

APPENDICES

Appendix-2

ABSTRACT ESTIMATE FOR IMPROVEMENT OF INFRASTRUCTURE IN CONNECTION WITH COAL TRANSPORTATION BY RAILWAYS FOR JAMSHORO POWER PLANT

S.No	DESCRIPTION OF WORKS	COST (Rs. In Million)		
		Local	FEC	TOTAL
1	**a. Estimated Cost for the provision of Additional Railway Lines /Sidings and Rehabilitation of Existing Track**			
	i). Additional line from Kotri to Jamshoro Power Plant (14.82Km) (Annexure-1)	276.259	202.219	478.478
	ii). Additional loop Line at Sindh University and Jamshoro (2.20 Km) (Annexure-1)	41.01	30.019	71.029
	iii). Additional Lines between Bin Qasim to Port Muhammad Bin Qasim Station (13 Km) (Annexure-1)	242.333	177.385	419.718
	iv).). Rehabilitation of existing track between Bin Qasim to Port Muhammad Bin Qasim Station (13 Km) (Annexure-1)	242.333	177.385	419.718
	v). Rehabilitation of existing track between Akhundabad to Jamshoro including loop lines (3 Nos.) (6.12 Km) (Annexure-1)	54.737	13.384	68.121
2	Remodeling of Signaling system from Bin Qasim-Port Muhammad Bin Qasim , Kotri-Akhundabad & Sindh University station yards (Annexure-2)	24	--	24
3	**b. Structural Works** Extension of Bridges and level crossing between Bin Qasim-Port Muhammad Bin Qasim station and Kotri to Akhundabad station (Annexure-3)	1141.214	--	1141.214
4	**c. Mechanical Works** i). Procurement of 10 Nos. New DE Locomotives (Annexure-4)	1568.8	3922	5490.8
	ii). Procurement of 500 High capacity Hopper wagons including 09 Nos. brake van (Annexure-4)	1696	4240	5936
5	Procurement of Track Machinery, Vehicles and Equipments (Annexure-5)	190.3	431.48	621.78
6	Renovation/Construction of Offices, Office Equipments and General Expenses (Annexure-6)	35.47	--	35.47
7	Temporary Establishment charges (Annexure-7)	60.455	--	60.455
	Total	5572.911	9193.872	14766.783
	Add 3% contingencies	167.187	275.816	443.003
	Total	5740.098	9469.688	15209.786
	Escalation @6.5% from July 2015 to June 2016(2nd Financial Year)	285.814		285.814
	Grand Total	**6025.912**	**9469.688**	**15495.6**

Annexure-1

Estimated Cost for the Provision of Additional Railway Lines / Sidings and Rehabiitation of Existing Track

(Track Portion) **(Rs. In Million)**

S. No	Description	Qty	UNITS	Unit Rate			Total Cost			Remarks
				Local	FEC	Total	Local	FEC	Total	
1	Additional Line from Kotri to Jamshoro Power Plant	14.82	km	18.641	13.645	32.286	276.259	202.219	478.478	Providing & laying new track with UIC 54 / 60 rails. PSC sleepers (1640 per Km) 30 cm ballast cushion and W-14 fastenings as per sample edtimate as Annexure-1/1
2	Additional loop Line at Sindh University and Jamshoro	2.20	km	18.641	13.645	-do-	41.010	30.019	71.029	-do-
3	Additional line between Port Qasim to Muhammad Bin Qasim Station	13	km	18.641	13.645	-do-	242.333	177.385	419.718	-do-
4	Rehabilitation of existing track between Port Qasim to Muhammad Bin Qasim Station	13	km	18.641	13.645	-do-	242.333	177.385	419.718	-do-
5	Rehabilitation of existing track between Akhundabad to Jamshoro alongwith 3 Nos of loop lines	6.12	km	8.944	2.187	11.131	54.737	13.384	68.121	Sleeper Renewal with PSC Sleeper & W-14 Fastenings as per sample estimate as Annexure-1/2
	Grand Total:-						**856.672**	**600.392**	**1457.064**	

Annexure-2

Remodeling of Signalling System from Bin Qasim-Port Muhammad Bin Qasim and Kotri-Akhundabad-Sindh University

(Signalling Portion)

S.No	Stations	Cost (Rs.in Million)
1	Bin Qasim and Port Muhammad Bin Qasim Station yards (Lumpsum)	7.000
2	Kotri station Yard (Lumpsum)	10.000
3	Sindh University Station Yard (Lumpsum)	3.500
4	Jamshoro Power Plant Station Yard (Lumpsum)	3.500
	TOTAL	**24.000**

Annexure-3

Extension of Bridges and level crossing between Bin Qasim-Port Muhammad Bin Qasim and Kotri-Akhundabad

(Structural works)

S.No	Description	No. of Bridges	Cost (Rs. In Million)		
			Cash	Store	Total
	Bin Qasim-Port Qasim				
1	Estimated cost for extension of bridge No.4 & 5 (4 Span (4x60)	2	236.000	-	236.000
2	Estimated cost of one Girder bridge (2x60), 03 nos RCC box culvert(3x3), 02 nos RCC box culvert(4x3).	6	59.000	-	59.000
3	Estimated Cost of construction of Protection wall for railway embankment as per Annexure-3/1	-	65.810	-	65.810
4	Estimated Cost of earthwork for embankment (cutting & filling) as per Annexure-3/2	-	107.255	-	107.255
5	Estimated Cost for extension of 1 Level crossing as per Annexure-3/3	-	0.856	-	0.856
6	Estimate Cost of Bridge (single span) between Bin Qasim to Port Muhammad Bin Qasim as per Annexure-3/4	2	9.700	-	9.700
	Kotri-Akhundabad				
7	Estimate Cost of Bridge (single span) between Kotri-Akhundabad	40	250.000		250.000
8	Estimated Cost of Bridge (Hume Pipe) 4x18"	1	0.860	-	0.860
9	Estimated cost of Steel Girder for Bridge (1x67-3")(Lumpsum)	1	13.000	-	13.000
10	Estimated cost of extension of bridge built on RBOD project between Kotri-Sindh University(1x40,2x60)(Lumpsum)	1	34.000	-	34.000
10	Land Acquisition charges @ 3000/Sq Yard i). Bin Qasim-Port Muhammad Bin Qasim Area of Land=94756 Sq. Yd ii) Akhundabad-Jamshoro area of land = 16222 Sq.Yd Total area of land = 110978 Sq.Yd Cost of land = 110978x3000 =Rs.332933000	-	332.933	-	332.933
11	Construction of Signal cabin (20 liver)		0.800		0.800
12	Construction of Turn Table at Jamshoro Power Plant (Lumpsum)	-	31.000		31.000
	TOTAL		**1141.214**	**-**	**1141.214**

Say Rs. 1141.214 Million

Annexure-4

Estimate for Procurement of New DE Locomotives and High Capacity Hopper Wagons

S.No	Description	Qty	Rate		Unit	Cost (Rs. In Million)		
			Local	FEC		Local	FEC	Total
1	Procurement of DE Locomotives (4000-4500 HP)	10	156.88	392.2	Each	1568.800	3922.000	5490.800
2	Procurement of 500 High capacity Hopper wagons includeing 09 Nos. brake vans (gross load 84 tonnes, pay load 60 tonnes)	500	3.392	8.48	Each	1696.000	4240.00	5936.000
					Total:-	**3264.800**	**8162.000**	**11426.800**

Annexure-5

Estimated Cost of
Procurement of Track Machinery and Other Equipments

S.No	Description	Qty	Unit Rate		Cost		Total
			Local	FEC	Local	FEC	
1	Self Propelled material lorry (Heavy Duty)	2	84.00	210.00	168.000	420.000	588.00
2	Rail cutting machine with 200 disks	4	0.16	0.39	0.640	1.560	2.200
3	Rail drilling machine with 100 bits	4	0.40	0.99	1.600	3.960	5.560
4	Universal power wrench	8	0.05	0.11	0.400	0.880	1.280
5	Motor Cycles	2	0.07		0.140	0.000	0.140
6	Tractor with blades and trolley	2	1.60		3.200	0.000	3.200
7	Motorized Dip lorries	2	0.83	1.85	1.660	3.700	5.360
8	Miscellanceous track tools and equipment	L.S			0.620	1.380	2.000
9	Motor Trolleys with T&P	2	0.50		1.000	0.000	1.000
10	Push Trolleys	4	0.06		0.240	0.000	0.240
11	Suzuki Jeep 1000 CC	3	1.50		4.500	0.000	4.500
12	Mini Truck	2	2.00		4.000	0.000	4.000
13	Suzuki Cultus 1000 CC	1	1.30		1.300	0.000	1.300
14	Repair, POL, Mainteance including registration, taxes etc.	L.S			3.000		3.000
				Total:-	**190.300**	**431.480**	**621.780**

Annexure-6

Estimated Cost of Renovation / Construction of Office, Office Equipments, and General Expenses

S.No	Description	Qty	Unit	Rate Rs. Million	Cost Rs. Million
1	Renovation / construction of site officers	–	–	–	10.000
2	Renovation / Construction of rooms for field staff.	–	–	–	5.000
3	Provision of electricity bills for Head Office & Site offices.	24	Month	0.050	1.200
4	Provision for new telephones, bills, Suigas and Electric Bills	–	LS	–	1.500
5	Office Stationery	24	Month	0.025	0.600
6	Drawing Office Stationery + Tracing Cloth etc	24	Month	0.015	0.360
7	Drawing instruments & Plotter	–	LS	–	0.500
	Photocopier	2	Nos.	0.500	1.000
	Computers / Laptops	6	Nos.	0.100	0.600
	Printer	6	Nos.	0.050	0.300
	Scanners	2	Nos.	0.025	0.050
	UPS	4	Nos.	0.025	0.100
	Digital Camera	2	Nos.	0.060	0.120
	Fax Machine and Misc equipment	2	Nos.	0.020	0.040
8	Cash Imperest for Maintenance and operation of office, equipments and petty purchases/works.	24	Month	0.300	7.200
9	Repair & Maintenance of vehicles	24	Month	0.050	1.200
10	POL Charges of Motor Trolleys	–	LS	–	3.000
11	Repair & maintenance of Motor trolleys / push trolleys	–	LS	–	0.300
12	Contingent / Misc Expenditure for Head Office	24	Month	0.050	1.200
13	Contingent / Misc Expenditure for Site Offices.	24	Month	0.050	1.200
	Total:-				**35.470**

Annexure-7

Summary of Estimated
Cost of Temporary Establishment

S.No	Description	Cost Rs. Million
1	P.D and site Office Establishment (Annexure-7.1)	46.537
2	Account Office Establishment (Annexure-7.2)	13.918
	Total:-	**60.455**

Annexure-7/1

TEMPORARY ESTABLISHMENT REQUIRED FOR EXECUTION OF THE PROJECT

Project duration **24** **months**

S.No	TEMPORARY ESTABLISHMENT FOR CONSTRUCTION / DESIGN	BASIC PAY SCALE	NO. OF POSTS			MAN MONTH	Average Rate of Pay.	Allowances	Total.	G.Total.
			GENERAL STAFF	SITE OFFICE STAFF	TOTAL					
A.	**ADMINISTRATION & EXECUTION**									
1	PROJECT DIRECTOR	19/20	1	0	1	24	68,900	103,350	172,250	4,134,000
2	DEPUTY PROJECT DIRECTOR	19	1	0	1	24	29,380	26,443	55,823	1,339,752
3	EXECUTIVE ENGINEER	18	2	0	2	48	22,210	19,505	41,715	2,002,320
4	SME	18	1	0	1	24	22,210	19,505	41,715	1,001,160
5	ASSISTANT EXECUTIVE ENGINEER	17	0	2	2	48	17,250	15,603	32,853	1,576,944
6	ASSISTANT SIGNAL INSPECTOR	17	0	1	1	24	17,250	15,603	32,853	788,472
7	SENIOR ACCOUNTS OFFICER	17/18	0	1	1	24	17,250	15,603	32,853	788,472
	Total		**5**	**4**	**9**	**216**	**194,450**	**215,612**	**410,062**	**11,631,120**
B.	**CLERICAL & DRAWING STAFF**									
1	OFFICE SUPERINTENDENT / CONSTRUCTION	14	1	0	1	24	10,620	9,878	20,498	491,952
2	SUPERINTENDENT DRAWING / AUTOCAD OPERATOR	16	2	0	2	48	13,110	12,855	25,965	1,246,320
3	HEAD CLERK	14	2	0	2	48	10,620	9,878	20,498	983,904
4	ACCOUNTS CLERK	14	0	2	2	48	10,620	9,878	20,498	983,904
5	SUB - DIVISIONAL CLERK	14	0	2	2	48	10,620	9,878	20,498	983,904
6	DRAFTSMAN	14	1	0	1	24	10,620	9,878	20,498	491,952
7	COMPUTER OPERATOR	12	2	0	2	48	9,005	8,762	17,767	852,816
8	STORE CLERK	10	0	2	2	48	7,855	7,500	15,355	737,040
	Total		**8**	**6**	**14**	**336**	**83,070**	**78,507**	**161,577**	**6,771,792**
C	**SUPERVISORY STAFF**									
1	PWI / GRADE Ⅱ	16	0	2	2	48	13,110	12,855	25,965	1,246,320
2	IOW / GRADE Ⅱ	16	0	2	2	48	13,110	12,855	25,965	1,246,320
3	BRIDGE INSPECTOR GRADE Ⅱ	16	0	1	1	24	13,110	12,855	25,965	623,160
4	SIGNALING & INTERLOCKING INSPECTOR / GRADE Ⅱ	16	0	1	1	24	13,110	12,855	25,965	623,160
5	SUB ENGINEER MECHANICAL TM	16	0	1	1	24	13,110	12,855	25,965	623,160
6	SUB ENGINEER ELECTORONIC TM	16	0	1	1	24	13,110	12,855	25,965	623,160
7	BALLAST INSPECTOR	12	0	1	1	24	9,005	8,762	17,767	426,408
8	AWI	12	0	2	2	48	9,005	8,762	17,767	852,816
9	AIOW	12	0	2	2	48	9,005	8,762	17,767	852,816
10	ASSISTANT BRIDGE INSPECTOR	12	0	1	1	24	9,005	8,762	17,767	426,408
11	ASSISTANT SIGNALLING & INTERLOCKING INSPECTOR	12	0	1	1	24	9,005	8,762	17,767	426,408
12	PERMANENT WAY MISTRY	8	0	2	2	48	6,816	6,832	13,648	655,104
13	WORK MISTRY	8	0	2	2	48	6,816	6,832	13,648	655,104
14	BRIDGE MISTRY	8	0	2	2	48	6,816	6,832	13,648	655,104
15	BLOCK MISTRY	8	0	1	1	24	6,816	6,832	13,648	327,552
16	SIGNALLING & INTERLOCKING MISTRY/Maintainer	8	0	1	1	24	6,816	6,832	13,648	327,552
	Total		**0**	**23**	**23**	**552**	**157,765**	**155,100**	**312,865**	**10,590,552**
D.	**SKILLED STAFF**									
1	STORE ISSUER	6	0	2	2	48	6,055	6,333	12,388	594,624
2	SKILLED LABOUR	6	0	4	4	96	6,055	6,333	12,388	1,189,248
3	JAMADAR / PEON	4	2	0	2	48	5,340	5,617	10,957	525,936
4	DRIVER	4	1	5	6	144	5,340	5,617	10,957	1,577,808
5	Head Trolly man	3	0	5	5	120	12,100	956	13,056	1,566,720
6	Driver for self Propelled material lorry	4	0	2	2	48	5,340	5,617	10,957	525,936
	Total		**3**	**18**	**21**	**504**	**40,230**	**30,473**	**70,703**	**5,980,272**
E.	**UN-SKILLED STAFF**									
1	MUAWAN	2	0	5	5	120	4,535	5,140	9,675	1,161,000
2	OFFICE KHALASI	2	0	3	3	72	4,535	5,140	9,675	696,600
3	CHOWKIDAR	2	1	3	4	96	4,535	5,140	9,675	928,800
4	SWEEPER / SENITORY WORKER	2	1	1	2	48	4,535	5,140	9,675	464,400
5	TROLLEY MAN	2	0	15	15	360	4,535	5,140	9,675	3,483,000
	Ferro colly	2	1	0	1	24	4,535	5,140	9,675	232,200
	Total		**3**	**27**	**30**	**720**	**27,210**	**30,840**	**58,050**	**6,966,000**
	Grand Total		**19**	**78**	**97**	**2328**	**502,725**	**510,532**	**1,013,257**	**41,939,736**

(i).	Establishment charges for 24 months	41.940	Million
(ii).	Project allowance	2.000	Million
	5% TA/DA	2.097	Million
	Pass & PTOs (Lumpsum)	0.500	Million
	Total Establishment charges	**46.537**	**Million**

Annexure-7/2

Estimated Cost of Temporary Establishment

(Account Branch)

S.No	Designation	Scale	No. of Posts	Period	Average Basic Pay	Gross Pay including	Amount in Million Rs.
2	SF&AO	BS-18	1	24	50,000	71,500	1.716
3	AO	BS-18	1	24	50,000	71,500	1.716
4	AAO	BS-17	2	24	40,000	57,200	2.746
5	Sr.Auditor	BS-16	2	24	34,000	44,000	2.112
6	Jr.Auditor	BS-11	2	24	20,400	27,627	1.326
7	Naib Qasid	BS-1	3	24	13,200	18,660	1.344
						Total:-	10.959
	Project Allowance to Regular Staff						0.600
	Add Leave Salary, pension and Gratuity @33.3% to regular staff					Rs. 4.982 Million	1.659
	Passes and PTOs						0.200
	Honourarium						0.100
	TA's DA's etc						0.400
						Total:-	**13.918**

Say Rs. 13.918 Million

Appendix-3: Revised PC-1 Proforma-2005 Upgrading of Signaling & Telecomm. by Providing Computer Based Interlocking with CTC & Auto Block Signaling on Lodhran (EXCL) – Kotri Section Plan Period 2014-15 to 2017-18 (04 Years) & Providing CTC at Multan (Lodhran – Sahiwal) & Lahore (Sahiwal (EXCL) – Shahdra Bagh) Main Line Section of PR Plan Period (18 Months) June 2014

GOVERNMENT OF PAKISTAN

MINISTRY OF RAILWAYS

RAILWAY BOARD

REHABILITATION OF RAILWAT ASSETS DAMAGED DURING THE RIOTS OF 27th and 28th DECEMBER, 2007

REVISED PC-I PROFORMA

May 2009

GOVERNMENT OF PAKISTAN
PLANNING COMMISSION

1. NAME OF PROJECT

Rehabilitation of assets damaged during the riots of 27th and 28th December, 2007

2. LOCATION

Karachi and Sukkur Divisions of Pakistan Railways, failing within territorial limits of Karachi, Larkana, Jacobabad and Dadu districts.

3. AUTHORITIES RESPONSIBLE FOR:

i. Sponsoring	Ministry of Railways
ii. Execution	Pakistan Railways
iii. Operation and maintenance	Pakistan Railways
iv. Concerned federal ministry	Ministry of Railways

4. PLAN PROVISION

(i) If the project is included in the current five year plan, specify actual allocation.

The project is not included in the current FIVE YEAR Plan or Medium Team Development Framework (MTDF).

(ii) If not included in the current plan, how it is now proposed to e accommodated (Inter-Intra sectoral) adjustments in allocation or other resources may be indicated.

The project has been necessitated due to disruption of railway traffic, caused due to the mayhem that followed on 27th and 28th December, 2007 as a result of assassination of Mohtarma Benazir Bhutto at Rawalpindi.

(iii) If the project is proposed to be financed out of block provision or included in the current plan block provision indicate.

The project will be financed out of block provision for transport center.

Rs in Million

Total block provision	Amount already committed	Amount proposed for this project	Balance available
-	7834.867 (Approved PC-1 cost)	7855.953 (Revised PC-1 cost)	-

5. PROJECT OBJECTIVES

Consequent upon the assassination of Mohtarma Benazir Bhutto, ex: Prime Minister of Pakistan on 27th December, 2007, violence erupted across the country and enraged mobs attacked the Railway infrastructure including stations, other buildings, signaling/telecommunication network, trains and other vital installations resulting in heavy losses. The objective of the project is to rehabilitate, rebuild and refurbish the damaged assets so as to bring the Railway infrastructure and operations at the level of 26th December, 2007 i.e. before the damages.

6. DESCRIPTON AND JUSTIFICATION OF PROJECT (ENCLOSE FEASIBILITY STUDY FOR PROJECTS COSTING RS.300 MILLION and ABOVE.)

Turbulent protests erupted in the entire country after the tragic assassination of Pakistan Peoples Party's Chairman and ex. Prime Minister Mohtarma Benazir Bhutto in Rawalpindi on 27th December, 2007. The entire country went into the grip of shock and awe with violent public reaction which crippled the country, specially the Province of Sindh, where the protesting mobs smashed Railway installations, ransacked station buildings, setting ablaze locomotives, coaches, track machines/cranes and other important infrastructure. There was total anarchy as hundreds of peoples went on the rampage. These attacks on the Railway property had far reaching implications. On Karachi and Sukkur division 65 stations were either set ablaze or damaged, 23 locomotives were burnt while 12 were damaged, 139 coaches of passenger trains and 2track machines were set ablaze while a number of cranes were burnt and damaged. The havoc completely paralyzed the Railway system from Karachi to Sadiqabad for five days (December 27th to 31st). The train operation was restored on 31-12-2007, at a modest level with hectic efforts. The major set back was to the Signaling infrastructure as the apparatus, internal cabling and connections etc at the stations were completely burnt. This has caused serious disturbance to normal operation as a number of stations are still closed. The train operation is being managed by extending the block sections and reception/dispatch of trains being worked on Paper Line Clear (PLC) in the absence of normal signaling which is causing a detention of almost four hours to each express train.

The assets damaged and lost have to be re-built as their absence will have a collateral effect, affecting even those that continue to function. The asset destruction would affect the targets for both Passenger and Freight sectors and cause decline in the long term growth potential of the Railway. It is, therefore, extremely vital that the damaged assets are rehabilitated as quickly as possible to ensure normal train operation on Sukkur and Karachi Divisions thus eliminating detentions and improve punctuality.

The damages were mainly caused to the locomotives, passenger coaches, station buildings, bridges, track machines, signaling and telecommunications. The details in respect of each are given as under:-

i) LOCOMOTIVES

Pakistan Railways owns, 520 diesel electric and 16 electric locomotives, out of which 302 Diesel Electric Locomotives and 16 Electric Locomotives have already outlived their normal economic life by the end of April, 2009. The annual requirement of induction of new locomotives is approximately 20 whereas actual induction of new locomotives during the last 10 years has only been 86 (i.e. about nine Locos per year) which has resulted into shortage of locomotives for working passenger and freight trains. The position has further deteriorated as 15 locomotives have completely been burnt as a result of the riots which erupted on 27th December, 2007.

The complete details of losses/damages to locomotives are gives as under:-

- Locomotives set on Fire =23
- Locomotives damaged =12
- Locomotives affected during riots =35
- Locomotives attended and made fit =20
  (within existing resources)
- Locomotives requiring Special repairs =15

ii) PASSENGER COACHES

At present, there are 1941 (PCVs) coaches on the system which include 175 PCVs coaches already procured/manufactured under the project of 175 new design high speed passenger coaches (See Annexure-11). Out of the remaining 1766 coaches, 132 coaches had completed their economic life of 35 years by the end of 2006-2007. This number would increase with the passage of time and figure of 132 would rise to 449 by the year 2010-2011 as a number of coaches would require condemnation on age-cum-condition basis. The details of losses/damages to passenger coaches during the riots are given as under:-

- Coaches set on Fire =139
- Coaches needing rehabilitation/ special repair =87
- Coaches condemned due to extensive damages and needing replacement =52

iii) STATION BUILDINGS and OTHER STRUCTURES INCLUDING ELECTRICAL WORKS

A total of 65 station buildings were damaged besides a number of other service buildings and structures. Twenty four stations on Karachi Railway Division were damaged; out of which twelve stations were set on fire and damaged on Karachi-Tando Adam main line section, six stations on Kotri-Dadu section, three on Hyderabad-Mirpurkhas section and three stations on Hyderabad-Badin section. Similarly, forty one stations on Sukkur Division were damaged; out of which twenty four stations were set on fire and damaged on Tando Adam-Rohri-Khanpur main line section and seventeen stations on Sukkur-Jacobabad-Sibi section Dadu-Shikarpur and Jacobad-Kashmore section. Twelve station buildings will need rebuilding while 53 stations need special repairs. A number of other important buildings like offices and stores of various officers/officials were burnt, hospital building at Dadu was destroyed, washing lines/sick lines, stores rest houses, power houses, running rooms, cabins and a number of residences were also damaged at Dadu, Larkana, Shikarpur, Mirpur Mathelo and Jacobabad rendering most of the structures unsafe and unfit for occupation.

iv) BRIDGES

The girder bridges were also damaged by setting wooden bridge timbers on fire, besides dismantling track at places. In total thirty six bridges were damaged both on Karachi and Sukkur Divisions, out of which twenty two bridges were damaged on Karachi Division and fourteen on Sukkur Division including burning of 2733 wooden sleepers, crossings and bridge timbers.

v) TRACK MACHINES AND CRANES

Pakistan Railways has a fleet of 13 track machines (ranging from 05 years to 29 years of age) for track maintenance out of which only 6 machines were in working condition before 27th December, 2008. The rest of the machines were stabled being under major repairs at Track Machine Shop/Raiwind. The existing fleet is inadequate to meet the work load as most of these machines are utilized on Track Rehabilitation and Doubling of Track Projects leaving little time for ordinary maintenance. With two machines (No.PU-2589 and DU-3082) having been burnt, the overall

productivity of the fleet has substantially been reduced whereas the back log of packing of long welded track laid with pre-stressed concrete sleepers has been accumulating over the years, seriously undermining the safety of track. The shortage of these two track machines would further compound the problems. It is accordingly proposed to rehabilitate the two burnt machines to strengthen the existing fleet and ultimately enhance the progress of mechanized track maintenance. The track cranes were also damaged during the riots and require special repairs.

vi) SIGNALING

Signaling systems play an important role in smooth, safe and efficient train operation. These systems are used to protect trains from accidents, operate trains safely, enhance transportation efficiency and increase speed and line capacity. Modern systems such as Electronic Interlocking Auto Block System, Centralized Traffic Control (CTC), Automatic Train Protection (ATP), Cab signaling etc are being extensively used by all the modern and developing Railways of the world. Pakistan Railways also installed CTC and Auto Block systems in 1970 and 1993 on main line from Karachi to Kotri. However, most of the existing systems are very old and obsolete.

The operation of cabin interlocked mechanical signaling is very slow and time consuming, specially at Junctions and big stations being very cumbersome, time consuming, causing delays especially in the case of crossing of trains, thus affecting punctuality. Similarly impaired visibility of kerosene lit semaphore signals during night compels driver to check speed thus affecting punctuality.

The Signaling systems on various station (Appendix-A) in Karachi and Sukkur Divisions of Pakistan Railways were badly damaged during riots on Dec 27 and 28, 2007. Due to extensive damage to signal gear, the train operation was affected badly. Piloting and Paper Line Clear System had to be introduced resulting in additional journey time and delay to trains. The safety is also at risk due to manual operations.

It is now planned to provide Electronic Interlocking at Bin Qasim, Shahdad Pur-Begmanji section, Pano Aqil, Mahesar, Ghotki and Mir Pur Mathelo stations. Gaddar, Dabheji, Jungshah and Jhimpir stations shall be restored with All Relay Interlocking and Auto Block from Bin Qasim-Hyderabad shall be restored with similar equipment by replacing the burnt items. The remaining mechanically interlocked stations on main and branch lines shall be restored to their original condition. The released materials from the stations where Electronic Interlocking shall be utilized as far as possible.

vii) TELECOMMUNICATIONS

The telecommunication equipment provided in the ASM offices such as control telephone, RAD phone, V-wireless telephone, VHF radio sets including power supplies, batteries, stabilizers, circuit breakers, wooden racks, coaxial cables etc. were totally burnt on main line between Mirpur Methelo-Rohri-Nawab Shah-Hyderabad-Karachi and on branch line between Kotri-Dadu-Larkana-Habib Kot-Jacobabad-Kashmor Colony. Resultantly 6 UHF sites, 53 VHF radios complete with accessories, 54 control phones , 37 V-wireless telephones, 77 batteries, 70telephone sets, 07 diesel generators, 07 telegraphic consoles, 55 wooden racks and 02 public address systems complete with accessories were burnt. VHF radios have since been replaced due to urgency. It is now planned to provide digital transmission equipment on the section where new signaling system is being installed by using spare Fiber Optic pair. The released radio equipment and available signal cables shall be utilized to restore the damaged UHF sites.

RESTORATION PLAN

The above described situation compelled Pakistan Railway to scale down its operations keeping in view the resource constraint. P.R.had curtailed 19 trains (16 passenger and 3 freight trains) on main line corridor and branch lines. The trains were suffering four hours extra time between Karachi and Khanpur resulting in extra fuel consumption and inconvenience to traveling public.

In order to overcome this situation the following repair/rehabilitation package has been prepared:-

a) Special repairs/rehabilitation of 15 diesel locomotives.
b) Special repairs/rehabilitation of 87 passenger coaches.
c) Rebuilding of 13 station buildings and other service buildings at Dadu. Larkana, Shikarpur, Jacobabad and Mirpur Methelo.
d) Special repair/rehabilitation of 52 stations and other service buildings.
e) Replacement of wooden bridge timbers of 36 bridges.
f) Special repairs/rehabilitation of two track machines.
g) Special repairs to track cranes.
h) Provision/installation of Electrical/Electronic interlocking at 27 stations.
i) Restoration of Automatic Block signaling from Bin Qasim to Hyderabad section.
j) Restoration/replacement of telecommunications facilities.

The Summary Cost of the Project and detail of works to be carried out for each component is shown in the respective Indices.

VARIATION IN SCOPE OF WORK AS COMPARED TO ORIGINAL PC-1

a) There is no change in scope of work for rehabilitation of locomotives. The work is well in progress and shall be completed during 2009-10.

b) There is no change in scope of work of coaches as it was planned to rehabilitate 87 coaches and procure 52 new coaches as envisaged in the original PC-1. As another separate PC-1 for procurement of 150 coaches is under process, it has been proposed to procure the new 52 coaches also along with these 150 coaches so that similar coaches are procured and better price may be achieved due to bulk purchase. Accordingly procurement of 52 new coaches has been deleted from the scope of this revised PC-1. The work of rehabilitation of 87 coaches is in progress and shall be completed during 2009-10.

c) There is no major change in the scope of civil Engineering works except that provision of tools and machinery essentially required to execute the work has been included against the savings in repair charges. The work is in progress and shall be completed during 2009-10.

d) There is no change in the scope of signaling work. The work of restoration of 4 All Relay interlocked stations and Auto Block system on Bin Qasim-Hyderabad section is in progress and is scheduled to be completed during 2009-10. The tenders for remaining stations are under finalization and the work is expected to be completed by June 2011.

e) It was originally planned to restore the communication by providing underground copper cable in various sections. It is now proposed to use the Fiber optic cable being provided for signaling equipment and install digital transmission equipment on the section where new signaling system is being installed. The released radio equipment from these sites and the available signal cables shall be utilized to restore the damaged radio sites. VHF equipment has already been restored from available sources.

7. CAPITAL COST ESTIMATES

The original cost estimates were prepared in January-2008 and were based on market rates and last available rates prevailing at that time. These costs however had to be revised (mainly for signaling

portion of the project) due to the reasons given below against each component. The asset wise comparison of original cost and revised cost is as follows:-

(In Million Rs)

Asset	Original Cost		Revised Cost	
	Total	**FEC**	**Total**	**FEC**
Locomotives	600.000	408.270	600.000	409.956
Passenger Coaches	3352.000	2114.086	453.000	0.000
Civil Engineering	466.995	127.800	548.788	146.335
Signaling	3352.271	2263.957	6192.637	4108.967
Telecommunications	63.601	0.000	61.528	44.656
Total	**7834.867**	**4914.113**	**7855.953**	**4709.914**

The total revised Capital Cost Estimates are as follows:-

(In Million Rs)

Local		3146.039
Foreign Exchange	4709.914	
Total		7855.953

REASON FOR VARIATION IN COST

a) LOCOMOTIVES

There is no change in the total cost for rehabilitation of locomotives.

b)PASSENGER COACHES

As pointed out above procurement of 52 new coaches has been deleted from the scope of work of this PC-1. Only Rs 453.00 million have been kept for repair/rehabilitation of 87 damaged coaches. The cost of this component has accordingly been reduced from Rs. 3352.00 million to Rs.453.00 million. The original cost for this portion was Rs 447.594 million and there is minor increase of Rs5.406 million.

c) CIVIL ENGINEERING WORKS

The cost of these works has been increased from Rs. 466.995 million to Rs. 548.788 million i.e. by Rs 81.793 million (17.51%) due to following reasons:-

i) Rs 9.300 million in foreign portion i.e. from Rs 120.000 million to Rs 129.500 million increased due to devaluation of Rs with respect to US dollar.

ii) Rs 2.5 million increased due to increase in price of local parts of track machines.

iii) Rs 29.867 million have been saved from repair of burnt stations as it was done with available resources and Track tools (Rail cutting/drilling machines) and welding equipment costing Rs 29867 million has been included as these essential items were omitted originally

iv) Rs 15.000 million increased due to increase in freight, custom duty, sakes tax etc.

v) Remaining Rs 34.793 million increased due to 13% escalation in the year 2009-10.

d) SIGNALING

The cost of the PC-1 increased from Rs 3352.270 million to Rs 6192.637 million (Appendix-B) i.e. by 84.73% as detailed below:-

(i) 41.07% increase in cost due to devaluation of Rupee. The cost of revised PC-1 would have increased to Rs 4815.810 million only i.e. by 43.66% as shown in Appendix J had the conversion rate of US$ remained same as provide in the original PC-1 i.e.1 US$ = Rs 60 (Appendix-B1)

(ii) 19.67% increase in cost due to higher cost of materials as quoted by the successful bidder due to inflation in international market.

(iii) 3.56% increase in System Engineering cost as quoted by the successful bidder.

(iv) 4.76% increase in cost due to higher cost of Installation and commissioning as quoted by the successful bidder due to higher labor cost.

(v) 0.21% decrease in cost due to less charges quoted for Supervision of maintenance by the successful bidder.

(vi) 0.12% decrease in cost due to less charges for Training which staff be imparted locally only.

(vii) 0.40% increase in cost die to increase in custom duty due to increased cost of equipment (item in above).

(viii) 2.10% increase in cost due to increased cost of Buildings. The covered area increased from 35704 Sq.ft to 82952 Sq.ft due to enhanced covered area for equipment rooms as per requirement of the successful bidder. The residences for staff have also been included due to essential requirement for the maintenance staff. The cost per Sq.ft also increased from Rs 1200 to Rs 1400 due to higher market rates.

(x) 2.13% increase in cost due to higher Establishment charges due to wage increases and provision for Project allowance.

(xi) 1.19% increase in cost due to increased Logistics prices in the market.

(xii) 4.18% increase in cost due to provision of Contingencies which were not provided in the original PC-1 and have been included now @ 3%.

e) TELECOMMUNICATIONS

The cost of telecommunications component reduced from Rs 63.00 million to Rs 61.528 million.

8. ANNUAL OPERATING AND MAINTENANCE COST AFTER COMPLETION OF THE PROJECT

Annual recurring cost on operation and maintenance shall only be applicable for the new signaling system and id as under:-

(In Million Rs)

Item	Local	FEC	Total
Pay and allowance	2.735	0.000	2.735
Spare parts	-	12.000	12.000
Fuel and power	8.000	-	8.000
Total	**10.735**	**12.000**	**22.735**

9. DEMAND AND SUPPLY ANALYSIS

NOT APPLICABLE

10. FINANCIAL PLAN AND MODE OF FINANCING

FEDERAL GOVERNMENT RESOURCES

The department/asset wise distribution of the financial requirement is given as under:-

(a) LOCOMOTIVE

(Rupees in Million)

Year of Phasing	Financial Requirement		
	Local	Foreign exchange	Total
2008-09	8.050	323.950	332.000
2009-10	181.994	86.006	268.000
Total	190.044	409.956	600.000

(b) PASSENGER COACHES

(Rupees in Million)

Year of Phasing	Financial Requirement		
	Local	Foreign exchange	Total
2008-09	312.007	0.000	106.500
2009-10	140.993	0.000	442.288
Total	453.000	0.000	548.788

(c) CIVIL ENGINEERING

(Rupees in Million)

Year of Phasing	Financial Requirement		
	Local	Foreign exchange	Total
2008-09	106.500	0.000	106.500
2009-10	295.953	146.335	442.288
Total	402.453	146.335	548.788

(d) SIGNALING

(Rupees in Million)

Year of Phasing	Financial Requirement		
	Local	Foreign exchange	Total
2007-08	24.040	0.000	24.040
2008-09	110.000	616.345	726.345
2009-10	848.780	1531.915	2380.695
2010-11	1100.850	1960.707	3061.557
Total	2083.670	4108.967	6192.637

(e) TELECOMMUNICATIONS

(Rupees in Million)

Year of Phasing	Financial Requirement		
	Local	Foreign exchange	Total
2008-09	0.000	0.000	0.000
2009-10	0.000	0.000	0.000
2010-11	16.872	44.656	61.528
Total	16.872	44.656	61.528

TOTAL FOR ALL COMPONENTS

(Rupees in Million)

Year of Phasing	Capital Cost		
	Local	Foreign exchange	Total
2007-08	24.040	0.000	24.040
2008-09	536.557	940.295	1476.852
2009-10	1467.720	1764.256	3231.976
2010-11	1117.722	2005.363	3123.085
Total	3146.039	4709.914	7855.953

11. PROJECT BENEFITS AND ANALYSIS

- FINANCIAL

It is not possible to quantify the financial benefits in monetary terms as the investment is needed to rehabilitate and renew the assets burnt/damaged during the riots of 27th and 28th December 2007. However the economic and social benefits would be as under:-

- ECONOMIC

The economy is likely to benefit because of:-

i) Increase in the transportation capacity of Pakistan Railways.

ii) Better utilization, improved return on available Railway assets.

iii) Improved financial health of Railway.

- SOCIAL

The social benefits include:-

i) Improvement in quality of services to be rendered to public/customers

ii) Improvement in efficiency

iii) Goodwill of Public through punctual running of trains.

iv) Railway has an edge over the roads as for the haulage of one metric tonne over a distance of one kilometer by road, 18000 BTUs are consumed. However for movement by rail only 3000 BTUs are consumed for the same distance and, thus pollution generating ratio between road and rail haulage is approximately 6:1.

12. IMPLEMANTATION SCHEDULE

(Rupees in Million)

Year of Phasing	Physical Work(%)	Financial Requirement		
		Local	Foreign exchange	Total
2007-08	0.00	24.040	0.000	24.040
2008-09	15.00	536.557	940.295	1476.852
2009-10	40.00	1467.720	1764.256	3231.976
2010-11	45.00	1117.722	2005.363	3123.085
Total	**100%**	**3146.039**	**4709.914**	**7855.953**

13. MANAGEMENT STRUCTURE AND MANPOWER REQUIREMENTS

(a) Give detailed list of Manpower required by gender for implementation of project

See Appendix-D

(b)Likely shortage of manpower by occupation

NOT APPLICABLE

(c) Steps to be taken to assure availability of manpower

NOT APPLICABLE

(d) Approximate number of persons required to be trained per year (locally and abroad) and the kind of skills to be learnt

About 50 persons shall be trained locally for the signaling systems.

(e) Give total capital outlay and the capital cost of mobilizing one worker for one shift

NOT APPLICABLE

(f) Detailed analysis of estimation of the likely employment

NOT APPLICABLE

14. ADDITIONAL PROJECTS/DECISIONS REQUIRED

Indicate additional project/decisions required to optimize the investment being undertaken project

NOT APPLICABLE

INDICES

SUMMARY COST OF THE PROJECT

In Millions Rs

S.No	Item	Total Cost		
		Local	FEC	Total
1	Repair of Locomotives (For details see Annexures Ⅰ-Ⅳ)	190.044	409.956	600.000
2	Repair of Coaches (For details see Annexures Ⅰ-Ⅳ)	453.000	0.000	453.000
3	Civil Engineering works (For details see Annexures 1-7)	402.453	146.335	548.788
4	Signalling systems restoration (For details see Appendices A-J)	2083.67	4108.967	6192.637
5	Telecommunications (For details see Annexures Ⅰ)	16.872	44.656	61.528
	Total	3146.039	4709.914	7855.953

FINANCIAL PHASING

In Millions Rs

S.No	Item	Total Cost			2008-09			2009-10			2010-11		
		Local	FEC	Total	Local	FEC	Total	Local	FEC	Total	Local	FEC	Total
2	Repair of Locomotives	190.044	409.956	600.000	8.050	323.950	332.000	181.994	86.006	268.000	0.000	0.000	0.000
3	Repair of Coaches	453.000	0.000	453.000	312.007	0.000	312.007	140.993	0.000	140.993	0.000	0.000	0.000
4	Civil Engineering works	402.453	146.335	548.788	106.500	0.000	106.500	295.953	146.335	442.288	0.000	0.000	0.000
5	Signalling systems restoration	2083.670	4108.967	6192.637	134.040	616.345	750.385	848.780	1531.915	2380.695	1100.851	1960.707	3061.558
6	Telecommunications	16.872	44.656	61.528	0.000	0.000	0.000	0.000	0.000	0.000	16.872	44.656	61.528
	Total	3146.039	4709.914	7855.953	560.597	940.295	1500.892	1467.720	1764.256	3231.976	1117.723	2005.363	3123.086

LOCOMOTIVES

(Annexure I-IV)

Annexure – I

REPAIR OF LOCOMOTIVES SUMMERY OF COST

In Million Rs

S.No	ITEM OF WORK	LOCAL	F.E.C	TOTAL
1	L.C.OPENING CHARGES FOR DIESEL SPARES REQUIRED FOR SPECIAL REPAIR OF DIESEL ELECTRIC LOCOMOTIVES.	2.000	0.000	2.000
2	F.O.B COST OF SPARE PARTS FOR SPECIAL REPAIR OF 9 LOCOMOTIVES 3000 H.P.	0.000	281.79	281.790
3	F.O.B COST OF SPARE PARTS FOR SPECIAL REPAIR OF SIX LOCOMOTIVES 2000 H.P.	0.000	128.166	128.166
4	CUSTOM DUTY, SALES TAX, FREIGHT, INSURANCE AND CLEARANCE CHARGES FOR 9 LOCOMOTIVES 3000 HP.	121.441	0.000	121.441
5	CUSTOM DUTY, SALES TAX, FREIGHT, INSURANCE AND CLEARANCE CHARGES FOR 6 LOCOMOTIVES 2000 HP.	54.508	0.000	54.508
6	CONTIGENCIES @ 2%.	12.095	0.000	12.095
	TOTAL	190.044	409.956	600.000

Annexure – II

YEAR WISE PHASING OF COST

In Million Rs

YEAR	ITEM OF WORK	LOCAL	F.E.C	TOTAL
2008-09				
1	L.C.OPENING CHARGES FOR DIESEL SPARES REQUIRED FOR SPECIAL REPAIR OF DIESEL ELECTRIC LOCOMOTIVES.	2.000	0.000	2.000
2	F.O.B COST OF SPARE PARTS FOR SPECIAL REPAIR OF 9 LOCOMOTIVES 3000 H.P.	0.000	281.790	281.790
3	F.O.B COST OF SPARE PARTS FOR SPECIAL REPAIR OF TWO LOCOMOTIVES 2000 H.P.	0.000	42.160	42.160
4	CONTIGENCIES L.S	6.050	0.000	6.050
	SUB TOTAL:- (2008-2009)	8.050	323.950	332.000
2009-10				
1	F.O.B COST OF SPARE PARTS FOR SPECIAL REPAIR OF 4 LOCOMOTIVES 2000 H.P.	0.000	86.006	86.006
2	CUSTOM DUTY, SALES TAX, FREIGHT, INSURANCE AND CLEARANCE CHARGES FOR 9 LOCOMOTIVES 3000 HP.	121.441	0.000	121.441
3	CUSTOM DUTY, SALES TAX, FREIGHT, INSURANCE AND CLEARANCE CHARGES FOR 6 LOCOMOTIVES 2000 HP.	54.508	0.000	54.508
4	CONTIGENCIES L.S	6.045	0.000	6.045
	SUB TOTAL:- (2009-2010)	181.994	86.006	268.000
	TOTAL PROJECT COST	190.044	409.956	600.000

Annexure – IV

UNIT COST CALCULATIONS FOR SPECIAL REPAIR OF 4000 HP LOCOMOTIVE

2008 – 2009

In Rs Million

S.No	ITEM	Local	F.E.C	TOTAL
1	F.O.R. COST OF SPARE PARTS SET @Rs. 52.00=1 US$	31.315	0.000	31.315
2	FREIGHT CHARGES @5%	1.561	0.000	1.561
3	C.A.F VALUE(1+2)	32.876	0.000	32.876
4	INSURANCE @1%OF C&F VALUE	0.328	0.000	0.328
5	INSURANCE PAID VALUE (3+4)	33.204	0.000	33.204
6	CUSTOM DUTY @ 15% OF INSURANCE PAID VALUE.	4.981	0.000	4.981
7	DUTY PAID VALUE (5+6)	38.185	0.000	38.185
8	SALES TAX @15% OF DUTY PAID VALUE	5.728	0.000	5.728
9	TAX PAID VALUE (7+8)	43.913	0.000	43.913
10	LANDING CHARGES @1% OF FOB VALUE	0.313	0.000	0.313
11	BANK CHARGES AND LOCAL AGENT'S COMMISSION PAID IN PAK Rs. @ OF 1% OF F.O.B VALUE	0.313	0.000	0.313
	TOTAL:-	44.539	0.000	44.539

	F.O.B. COST	CD/ST	TOTAL
2008-2009	31.310	13.229	44.539
2009-2010	31.936	13.493	45.43
2010-2011	32.562	13.758	46.32
2011-2012	33.188	14.023	47.211

Annexure – IV

UNIT COST CALCULATION FOR SPECIAL REPAIR OF 2000 HP LOCOMOTIVES

2008 – 2009

In Rs Million

S.No		Local	F.E.C	TOTAL
1	F.O.B. COST OF SPARE PARTS	21.08	0	21.08
2	FREIGHT CHARGES @5%	1.05	0	1.05
3	C&F VALUE (1+2)	22.14	0	22.14
4	INSURANCE @1% SF C&f VALUE	0.22	0	0.22
5	INSURANCE PAID VALUE (3+4)	22.36	0	22.36
6	CUSTOM DUTY @ 15% OF INSURANCE PAID VALUE.	3.35	0	3.35
7	DUTY PAID VALUE (5+6)	25.708	0	25.71
8	SALES TAX @15% OF DUTY PAID VALUE	3.856	0	3.86
9	TAX PAID VALUE (7+8)	29.564	0	29.56
10	LANDING CHARGES @1% OF FOB VALUE	0.211	0	0.21
11	BANK CHARGES AND LOCAL AGENT'S COMMISSION PAID IN PAK Rs. @ OF 1% OF F.O.B VALUE	0.211	0	0.21
	TOTAL:-	29.986	0	29.99

	F.O.B. COST	CD/ST	TOTAL
2008-2009	21.080	8.907	29.987
2009-2010	21.502	9.065	30.567
2010-2011	21.923	9.263	31.186
2011-2012	22.345	9.441	31.786

PASSENGER COACHES

(ANNEXURE I-IV)

Annexure-I

REHABILITATION OF 87 BURNT COACHES.
BREAK-UP THE PROJECT COST

Rs In Million

S.No	ITEM OF WORK	LOCAL	FEC	TOTAL
1	PROCUREMENT OF MATERIAL FOR REHABILITATION OF 50 ECONOMY CLASS PASSENGER COACHS.	146.701	0.000	146.701
2	PROCUREMENT OF MATERIAL FOR REHABILITATION OF 37 AIR CONDITIONED BUSINESS CLASS COACHES.	128.624	0.000	128.624
3	LABOUR CHARGES FOR REHABILITATION OF 50 ECONOMY CLASS COACHES.	81.560	0.000	81.560
4	LABOUR CHARGES FOR REHABILITATION OF 37 Nos. AIR CONDITIONED BUISINESS CLASS COACHES	82.859	0.000	82.859
5	CONTINGENCIES @ 3%	13.256	0.000	13.256
	TOTAL	453.000	0.000	453.000

See Annesure-II for year wise cost break-up.

See Annesure-III for unit cost calculations.

Annexure-II

YEAR WISE PHASING OF COST

Rs In Millions

S.No	ITEM OF WORK	QTY	Unit Rate	LOCAL	FEC	TOTAL
2008-2009						
1	REHABILITATION OF 41 ECONOMY CLASS PASSENGER COACHES.	41	2.9	118.9	0	118.9
2	OF 31 AIR CONDITIONED BUSINESS CLASS COACHES.	31	3.44	106.64	0	106.64
3	LABOUR CHARGES FOR REHABILITATION OF 35 ECONOMY CLASS COACHES	35	1.6	56	0	56
4	LABOUR CHARGES FOR REHABILITATION OF 10 Nos. AIR CONDITIONING BUSINESS CLASS COACHES	10	2.138	21.38	0	21.38
5	CONTINGENCIES @3%			9.088	0	9.088
	SUB TOTAL FOR 2008-2009			312.008	0	312.008
2009-2010						
1	REHABILITATION OF 9 ECONOMY CLASS PASSENGER COACHES.	9	3.089	27.801	0	27.801
2	PROCUREMENT OF MATERIAL FOR REHABILITATION OF 6 AIR CONDITIONED BUSINESS CLASS	6	3.664	21.984	0	21.984
3	LABOUR CHARGES FOR REHABILITATION OF 15 ECONOMY CLASS COACHES	15	1.704	25.56	0	25.56
4	LABOUR CHARGES FOR REHABILITATION OF 27 Nos. AIR CONDITIONING BUSINESS CLASS COACHES	27	2.277	61.479	0	61.479
5	CONTINGENCIES @3%			4.169	0	4.169
	SUB TOTAL FOR 2009-2010			140.993	0	140.993
	GRAND TOTAL			453	0	453

Annexure-III

UNIT COST CALCULATIONS FOR REHABILITATION OF ECONOMY CLASS PASSENGER COACHE INCLUDING BRAKE & LUGGAGE VANs 2008-2009

Rs In Millions

S.No	Description	Local	FEC	Total
1	FERROUS MATERIAL	0.270	0.000	0.270
2	STAINLESS STEEL MATERIAL	0.130	0.000	0.130
3	UPHOLSTERY (REXIN,FOAM ETC)	0.100	0.000	0.100
4	INTERIOR PANELLING INCLUDING ROOF AND LAV	0.250	0.000	0.250
5	FLOORONG (MARINE ETC PLYWOOD PVC FLOORING BITUMEN AND CORCK)	0.125	0.000	0.125
6	ALUMINIUM MOULDING	0.030	0.000	0.030
7	PLUMBING ITEMS	0.030	0.000	0.030
8	WINDOW COMPLETE	0.200	0.000	0.200
9	WOOD (SOFT AND HARD)	0.075	0.000	0.075
10	HARDWARE ITEMS	0.030	0.000	0.030
11	BREAK FITTING ETC	0.010	0.000	0.010
12	WELDING MATERIAL	0.120	0.000	0.120
13	SEAT FRAMING ETC	0.125	0.000	0.125
14	INSULATION (STONE WOOL +RKE PACKING)	0.125	0.000	0.125
15	PAINT AND CHEMICALS	0.130	0.000	0.130
16	TOOLING	0.020	0.000	0.020
17	ELECTRICAL EQUIPMENTS/FITTINGS (INCLUDING D.G.SET/TRANSFORMER)	0.460	0.000	0.460
18	SHOCK ABSORBERS BOGIE FITTINGS AND ROLLER BEARINGS ETC	0.180	0.000	0.180
19	LOCKS,HANDLES,RUBBER BULDGES AND RUBBER PROFILES	0.040	0.000	0.040
20	MISC.ITEMS	0.450	0.000	0.450
	SUBTOTAL:-	2.900	0.000	2.900
21	LABOUR CHARGES	1.600	0.000	1.600
	TOTAL:-	4.500	0.000	4.500

YEAR	MAT.COST	LABOUR CHARGES	TOTAL
2008-2009	2.9	1.6	4.5
2009-2010	3.089	1.704	4.793
2010-2011	3.277	1.808	5.085

Annexure-IV

UNIT COST CALCULATIONS FOR SPECIAL REPAIR OF AIR CONDITIONED BUSINESS CLASS AND DINNING CAR PASSENGER COACH 2008-2009

Rs In Millions

S.No	Description	Cost	FEC	Total
1	FERROUS MATERIAL	0.270	0.000	0.270
2	STAINLESS STEEL MATERIAL	0.130	0.000	0.130
3	UPHOLSTERY (REXIN,FOAM ETC)	0.100	0.000	0.100
4	INTERIOR PANELLING INCLUDING ROOF AND LAV	0.250	0.000	0.250
5	FLOORONG (MARINE ETC PLYWOOD PVC FLOORING + BITUMEN AND CORCK)	0.125	0.000	0.125
6	ALUMINIUM MOULDING	0.030	0.000	0.030
7	PLUMBING ITEMS	0.030	0.000	0.030
8	WINDOW COMPLETE	0.200	0.000	0.200
9	WOOD (SOFT AND HARD)	0.075	0.000	0.075
10	HARDWARE ITEMS	0.030	0.000	0.030
11	BREAK FITTING ETC	0.010	0.000	0.010
12	WELDING MATERIAL	0.120	0.000	0.120
13	SEAT FRAMING ETC	0.125	0.000	0.125
14	INSULATION (STONE WOOL +RKE PACKING)	0.125	0.000	0.125
15	PAINT AND CHEMICALS	0.130	0.000	0.130
16	TOOLING	0.020	0.000	0.020
17	ELECTRICAL EQUIPMENTS/FITTINGS	1.000	0.000	1.000
18	SHOCK ABSORBERS BOGIE FITTINGS AND ROLLER BEARINGS ETC	0.180	0.000	0.180
19	LOCKS,HANDLES,RUBBER BULDGES AND RUBBER PROFILES	0.040	0.000	0.040
20	MISC.ITEMS	0.450	0.000	0.450
	SUBTOTAL:-	3.440	0.000	3.440
21	LABOUR CHARGES	2.138	0.000	2.138
	TOTAL:-	5.578	0.000	5.578

YEAR	MAT. COST	LABOUR CHARGES	TOTAL
2008-2009	3.440	2.138	5.578
2009-2010	3.664	2.277	5.941
2010-2011	3.887	2.416	6.303

CIVIL ENGINEERING

(Annexure 1-8)

Annexure-1

DAMAGES TO CIVIL ENGINEERING ASSETS

▼Station building burnt	62
To be completely rebuilt	24
To be partially rebuilt/rehabilitated	38
▼L-xings damages	27
▼Track Machines/Cranes	6
Tamping machines burnt	Two machines(DU-2589 & DU-3082)
Bridge Crane(No.2228)	Partially burnt
Burro Crane(No.5565) P&H Crawler Clane(No.4622) & Hitachi Crane(No.1202)	Partially damaged
▼Stores of Permanent Way Inspectors set on fire.	7
▼Bridges partially damaged	36

Annexure-2

ABSTRACT OF ESTIMATED COST OF CIVIL ENGINEERING WORKS

Rupees in Million

S.No	Description	Local	FEC	Total
1	Rehabilitation/reconstruction of station buildings and other structures in Karachi Division. (Annexure-4)	86.650	0.000	86.650
2	Rehabilitation/reconstruction of station buildings and other structures in Sukkur Division. (Annexure-5)	78.888	0.000	78.888
3	Electrical portion of Station Buildings(L.S)	2.000	0.000	2.000
4	Track & Bridges (Store items of track & bridges) Annexure-6	109.867	0.000	109.867
5	Track Machines and Cranes (Annexure-7)	84.500	129.500	214.000
	Total	361.905	129.500	491.405
6	Escalation @6.5% & 13% for the year 2008-09 & 2009-10	40.548	16.835	57.383
	Grand Total	402.453	146.335	548.788

Annexure-3

PHASING OF COST

(Rupees in Million)

S.No	Description	Year 2008-09			Year 2009-10			Grand Total		
		LOCAL	FEC	TOTAL	LOCAL	FEC	TOTAL	LOCAL	FEC	TOTAL
1	Rehabilitation/reconstruction of station buildings and other structures in Karachi & Sukkur Divisions	60	0	60	105.538	0	105.538	165.538	0	165.538
2	Electrical portion of Store buildings	0	0	0	2	0	2	2	0	2
3	Track & Bridges (Store items of track & bridge)	40	0	40	69.867	0	69.867	109.867	0	109.867
4	Track Machines and Cranes	0	0	0	84.5	129.5	214	84.5	129.5	214
	Total	100	0	100	261.905	129.5	391.405	361.905	129.5	491.405
5	Escalation @6.5% & 13% for the year 2008-09 & 2009-10	6.5	0	6.5	34.0477	16.835	50.8827	40.548	16.835	57.383
	Grand Total	106.5	0	106.5	295.953	146.335	442.288	402.453	146.335	548.788

Annexure-4

COST OF REPAIRS TO DAMAGED STATIONS ON KARACHI DIVISION
(Karachi - Kotri - Tando Adam Section)

(Rupees in Million)

S.N	Station	Description of damages	Estimated Cost for repair / rebuilding
KYC-KOTRI SECTION			
1	Bin Qasim	Rebuilding of the damaged burnt station building including SM/ASM rooms, booking/ goods office, and equipment/ generator room.	3.000
		Special Repairs to other service buildings and structures.	0.500
2	Gadar	Special Repairs to damaged / burnt portion of the station building, roof and verandah.	1.218
3	Dhabeji	Special Repairs to damaged / burnt portion of the station building, roof, waiting hall, verandah and AWI store with their doors & windows.	3.979
4	Jhang Shahi	Special Repair & rebuilding of the damaged / cracked portion of the station building, SM/ASM offices, four rooms, verandah, generator/equipment room, BLI office, booking & parcel offices and other repairs to structure.	3.999
5	Jhampir	Special Repair and partial rebuilding of the damaged station building including SM/ASM, generator room, verandah and other repairs to structure.	3.493
6	Kotri	a- Hospital	1.500
		b- Drivers Running Room	1.300
		c- Guards Running Room	0.667
		d- LFO office	0.280
		e- Parcel & Booking Office	1.200
		f- Main Station Building	4.000
7	Detha	Special Repair to damaged station building including SM office, generator room, store, verandah and other repairs to structure.	1.300
8	Khatian Road	Special Repairs to damaged portion of station building including SM/ASM offices, passenger hall, lamp room, record room, verandah, doors and windows.	1.700
9	Allahdino Sand	Reconstruction of the damaged burnt station building including equipment room, relay room, lamp room and other repairs to station building and verandah.	2.200
10	Oderolal	Special Repair to damaged / burnt & collapsed roof of SM/ASM office and verandah, and other repairs to structure.	2.000
11	Wahab Shah	Reconstruction of the damaged / burnt station building including SM/ASM office and verandah.	2.500
12	Tando Adem	Special Repair to damaged / burnt portion of station building including SM/ASM offices, lamp room and store and other structure.	1.700

S.N	Station	Description of damages	Estimated Cost for repair / rebuilding
KOTRI-DADU SECTION			
13	Sindh University	Reconstruction of the completely damaged / burnt station building.	4.000
14	Cadet College Pitaro	Reconstruction of the completely damaged / burnt station building.	0.984
15	Laki Shah Sadar	Special Repair to damaged / burnt portion of station building including SM/ASM office, record room and other repairs to structure.	1.298
16	Bhan Sayedabad	Reconstruction of the damaged / burnt portions of the station building including SM/ASM office, record room and repair to other structure.	1.715
17	Khudadadabad	Reconstruction of the damaged / burnt portions of the station building including SM/ASM office, record room and repair to other structure.	0.700
18	Dadu	a- Special Repairs to damaged / burnt Station Building	13.690
		b- Guard/Driver Running Room	0.767
		c- SMO Residence/Hospital	4.000
		d- Station Master Residence	2.500
		e- Officers Rest House	2.500
		f- PWI Office	2.786
		g- IOW Office	2.000
		h- Parcel Office	0.813
HDR-MPS SECTION			
19	Tando Jam	Special Repairs burnt and damaged portion of the station building, doors & windows.	0.700
20	Tando Allahyah	Special Repairs to the damaged / burnt station building incluging	2.000
21	Sultanabad	Reconstruction of the damaged / burnt station building.	1.500
BADIN SECTION			
22	Khattar	Reconstruction of the damaged / burnt station building.	1.500
23	Tando Muhammad Khan	Special Repairs to the damaged / burnt station building.	1.500
24	Mirpur Khas	Special Repairs to the damaged / burnt station building and office and store of the IOW/MPS.	1.200
25	Miscellaneous Office furniture, equipments(computers, printers, fax machine, air conditioners, water dispensers etc) works and purchase of building material for minor works, Logistic (vihicles), T&P of IOWs(Artisan's equipments) and cash imprest for office stationary and other unforeseen items.		3.996
	Total		86.650

Annexure-5

COST OF REPAIRS TO DAMAGED STATIONS ON SUKKUR DIVISION

(Rupees in Million)

S.N	Station	Description of damages	Estimated Cost for repair/re-building.
1	Shahdadpur	Special Repairs to damaged & burnt station building, Cabins, doors and windows.	0.091
2	Lundo	Special Repairs to damaged & burnt station building, cabins, floor, door and windows.	0.11
3	Sarhari	Special Repair to collapsed roof of station building, and other repairs to structure, floor, doors and windows.	0.784
4	Bucheri	Special Repair to collapsed roof of station building, verandah, cabins and other repairs to structure, floor, doors & windows.	0.927
5	Daur	Special Repair to collapsed roof of station building, verandah, cabins and other repairs to structure, floor, doors and windows.	0.503
6	Bandhi	Special Repair to collapsed roof of station building, verandah, cabins and other repairs to structure, floor, doors and windows.	0.775
7	Kot Laloo	Special Repair to collapsed roof of station building, verandah, cabins and other repairs to structure, floor, doors and windows.	0.768
8	Padidan	Special Repair to damaged station building, doors and windows.	0.128
9	Bhiria Road	Special Repair to collapsed roof of ASM office and other repairs to burnt station building, verandah,cabins, other repairs to structure, floor, doors & windows.	0.713
10	Lakha Road	Special Repair to collapsed roof of ASM office and other repairs to burnt station building, verandah,cabins, other repairs to structure, floor, doors & windows.	0.596
11	Mehrabpur	Special Repair to roof of SM/ASM and other rooms and other repairs to verandah, computerozed reservation office, lamp, equipment rooms and repair to floor, doors and windows etc.	0.769
12	Setharja	Special Repair to collapsed roof of ASM room and other repairs to burnt station building, verandah, other structure, floor, doors & windows.	0.385
13	Ranipur	Special Repair to collapsed roof of ASM room and other repairs to burnt station building, verandah, battery and lamp rooms, other structure, floor, doors & windows.	0.868
14	Gambat	Special Repair to collapsed roof of ASM room and other repairs to burnt station building, verandah, cabins, battery and lamp rooms, floor, doors and windows.	0.737
15	Tando Masti Khan	Special Repair to collapsed roof of ASM room and other repairs to burnt station building, verandah, cabins, battery and lamp rooms and other structures including doors & windows.	0.891
16	Khairpur	Special Repair to partially damaged ASM room, verandah, cabins, battery, lamp room, trolley hut and other structure.	0.562
17	Begmanji	Special Repair to roof of ASM room, other repairs to station building, verandah cabins, battery and lamp rooms and other structure.	0.873
18	Sukkur	Special Repairs to the burnt and damaged office and Store of the Bridge Inspector.	1.238
19	Sangi	Special Repair to station building, verandah, cabins, battery and lamp roomsincluding doors /windows.	1.157
20	Pano Aqil	Special Repair to burnt and damaged station building, verandah, cabins, Waiting Hall, battery /lamp rooms, booking office including doors /windows.	1.009
21	Mahesar	Special Repair to damaged & burnt station building, verandah, cabins, Waiting Hall, battery /lamp rooms, booking office including doors /windows.	0.899

22	Mirpur Mathelo	Rebuilding of damaged and burnt structure of station building with RCC Roof.	2.349
23	-do-	Special Repairs to damaged burnt building of office, residence and store of PWI/Mirpur Mathelo.	1.734
24	Pano Aqil	Special Repairs to damaged and burnt building of Rest House.	1.53
25	Shikarpur	Special Repair to damaged & burnt station building, verandah, cabins, Waiting Hall, battery /lamp rooms, booking office including doors /windows.	4.562
26	Jacobabad	Special Repair to damaged & burnt station building, verandah, cabins, Waiting Hall, battery /lamp rooms, booking office including doors /windows.	14.362
27	-do-	Special Repair to damaged & burnt building of AEN office, boundary wall, including doors /windows.	1.49
28	-do-	Special Repair to damaged & burnt building of power house, boundary wall, including doors /windows.	0.524
29	-do-	Special Repair to Rest House and damaged boundary wall of officers Rest House.	0.78
30	Dera Allah Yah	Special Repair to damaged & burnt station building, veranda and ASM office including doors /windows.	0.857
31	Kashmore Colony	Special Repair to damaged & burnt station building, veranda and ASM office including doors /windows.	0.952
32	Bakhshapur	Special Repair to damaged & burnt station building, veranda and ASM office including doors /windows.	0.95
33	Kandhkot	Special Repair to damaged & burnt station building, veranda and ASM office including doors /windows.	1.67
34	Haibat Shaheed	Special Repair to damaged & burnt station building, veranda and ASM office including doors /windows.	0.952
35	Loco Shed JCD	Special Repair to damaged & burnt station building of the locoshed including doors /windows.	1.738
36	Larkana	Special Repair to damaged burnt building, of AEN office. a- Re-building of damaged burnt Station at Larkana. b- Supply of doors & windows for station building at Latkana.	1.035 8.923
37	Moenjo Daro	Special Repair to damaged & burnt station building, ASM office, waiting hall, veranda and doors /windows.	1.525
38	Badah	Special Repair to damaged & burnt station building, ASM office, waiting hall, veranda and doors /windows.	1.6
39	Bali Shah	Rebuilding of damaged & burnt station building, ASM office, waiting hall, veranda and doors /windows.	3.1
40	Shah Panjo	Special Repair to damaged & burnt station building, ASM office, waiting hall, veranda and doors /windows.	0.17
41	Randhan	Reconstruction of damaged & burnt station building, ASM office, waiting hall. Veranda and doors /windows	4.1
42	Phulji	Reconstruction of damaged & burnt station building, ASM office, waiting hall. Veranda and doors /windows	4.1
43	Miscellaneous Office furniture, equipments(computers, printers, fax machine, air conditioners, water dispensers etc) works and purchase of building material for minor works, Logistic (vihicles), T&P of IOWs(Artisan's equipments) and cash imprest for office stationary and other unforeseen items.		5.104
Total			78.888

Annexure-6

ESTIMATED COST OF TRACK & BRIDGE STORE ITEMS

(Rs in Million)

S.No.	Description	Quantity	Unit rate	Total cost
1	Track tools	L.S	L.S	1.421
2	Bridge & crossind timbers	L.S	L.S	53.622
3	Elastic rail clips, fishplates, loose jaws, keys, fish bolts etc.	L.S	L.S	15.285
4	Rail seat pads	L.S	L.S	7.663
5	Bridge(C&P, T&P, jacks, ropes, survey instrument etc.)	L.S	L.S	2.000
6	Rail cutting machine along with spare parts	10	0.500	5.000
7	Rail drilling machine along with bits and spare parts	10	0.300	3.000
8	Welding equipments	L.S	L.S	21.876
			Total	109.867

COST FOR REPAIR OF TRACK MACHINES AND CRANES

(Rupees in Million)

S.No	Description	Local	FEC	Total
1	FOB cost of spare parts/assemblies US $ 1.613 million @Rs.80.25 = 1 US $	0	129.5	129.5
2	Freight, Custum duty, Sale Tax etc. (54% of FOB value)	70	0	70
3	Local parts and labour charges etc	14.5	0	14.5
	Total:-	84.5	129.5	214

Annexure-8

Burnt & Damaged Wooden Timbers

S.No.	Designation	Description	Size	Total
1	DEN-Ⅲ/KYC	Bridge Timbers	10' x 10" x 10"	23
			10' x 10" x 8"	7
			9' x 10" x 9"	6
			9' x 10" x 8"	70
			9' x 10" x 7"	25
			9' x 10" x 6"	10
		Crossing timbers	12' x 10" x 6"	3
			13' x 10" x 6"	1
			15' x 10" x 6"	2
		Wooden sleepers	9' x 10" x 6"	1486
2	DEN-Ⅱ/KYC	Bridge timbers	10' x 10" x 8"	300
3	DEN-Ⅰ/SUK	Bridge timbers	11' x 10" x 8"	300
4	DEN-Ⅱ/SUK	Bridge timbers	11' x 10" x 8"	250
5	DEN-Ⅲ/SUK	Bridge timbers	11' x 10" x 8"	250
	Total:			2733

SIGNALLING

(Appendix A-J)

Damaged Stations on Main Line

S.No	STATION NAME	Status	Restoration Plan
1	BIN QASIM	Damaged	To be provided with CBI.
	BADAL NALA		
2	GADDAR	Damaged	Existing Relay Interlock to be restored.
3	DABHEJI	Damaged	Existing Relay Interlock to be restored.
	RAN PATHANI		
4	JUNGSHAHI	Damaged	Existing Relay Interlock to be restored.
	BRAUDABAD		
5	JHIMPIR	Damaged	
	METING		
	BHOLARI		
6	KOTRI	Damaged	Repaired.
7	HYDERABAD	Damaged	Repaired.
8	DETHA	Damaged	Track circuits to be restored with released materials.
9	KHATIAN ROAD	Damaged	To be repaired with released materials.
10	ALLAHDINO SAND	Damaged	Track circuits to be restored with released materials.
	PALIJANI		
11	ODERPLAL	Damaged	To be repaired with released materials.
12	WAHAB SHAH	Damaged	To be repaired with released materials.
13	TANDO ADAM	Damaged	Track circuits to be restored with released materials.
	JALAL MARRI		
	SHAHDAD PUR		To be provided with CBI.
	LUNDO		To be provided with CBI.
14	SARHARI	Damaged	To be provided with CBI.
	NAWAB SHAH		To be provided with CBI.
15	BUCHERI	Damaged	To be provided with CBI.
16	DAUR	Damaged	To be provided with CBI.
17	BANDHI	Damaged	To be provided with CBI.
18	KOT LALLOO	Damaged	To be provided with CBI.
19	PADIDAN	Damaged	To be provided with CBI.
20	BHIRIA ROAD	Damaged	To be provided with CBI.
21	LAKHA ROAD	Damaged	To be provided with CBI.
22	MAHRABPUR	Damaged	To be provided with CBI.
23	SETHHARJA	Damaged	To be provided with CBI.
24	RANIPUR RIYASAT	Damaged	To be provided with CBI.
25	GAMBAT	Damaged	To be provided with CBI.
26	TANDO MASTI KHAN	Damaged	To be provided with CBI.
27	KHAIRPUR	Damaged	To be provided with CBI.
28	BEGMANJI	Damaged	To be provided with CBI.
	SOUTH BLOCK HUT		
	ROHRI		
	NORTH BLOCK HUT		
	MANDO DAIRO		
29	SANGI		Track circuits to be restored with released materials.
30	PANO AKIL	Damaged	
31	MAHESAR	Damaged	To be provided with CBI.
32	GHOTKI	Damaged	To be provided with CBI.
	SARHAD		
33	MIRPUR MATHELO	Damaged	To be provided with CBI.
	DAHARKI		

The following Damages stations on Blanch lines have been partially repaired and working repair shall be done with released materials and from Signal shops.

1. Sind University
2. Cadet Colledge
3. Unapur
4. Budapur
5. Sann
6. Khudabad
7. Dadu
8. Tando Jam
9. Tando Allah Yar
10. Sultan Abad
11. Taru Abad
12. Jacob Abad
13. Shakirpur
14. Dera Allah Yar
15. Habit Shaheed
16. Moenjo Daro
17. Bah Shah
18. Shah Nawaz Bhutto
19. Larkana
20. Bakrani Road
21. Badha
22. Phulji

Appendix-B

ABSTRACT ESTIMATE (@1US$ = Rs, 80.25)

(In Million Rs)

S.No	Item	Local	FEC	Total
1	Material (Appendix-C)	165.935	3495.378	3661.313
2	System Engineering (Appendix-C)	0	239.718	239.718
3	Installation and commissioning (Appendix-C)	12.730	356.895	369.624
4	Training (Appendix-C)	0.000	10.540	10.540
5	SOM for 2 years (Appendix-C)	0.000	6.436	6.436
6	Sales Tax and Excise Duty on item 1 (local) @16%	26.550	0.000	26.550
7	Custum duty and other charges @34% on item 1 (FEC)	1188.429	0.000	1188.429
8	Local equipment, cables, works and services (LS)	200.000	0.000	200.000
9	Inland freight (LS)	10.000	0.000	10.000
10	Establishment charges (Appendix-D)	121.477	0.000	121.477
11	Building (Appendix-F)	113.333	0.000	113.333
12	Logistic (Appendix-G)	64.850	0.000	64.850
	Total	1903.302	4108.967	6012.269
13	Contingencies @3%	180.368	0.000	180.368
	G.Total	2083.67	4108.967	6192.637

Note Note Esclation has not been included in the total cost. However if required it shall be applicable as per Government policy i.e 6.5% for first year and 13% for 2nd year as calculated in Appendix-H.

Appendix-B1

ABSTRACT ESTIMATE (@1US$ = Rs 60)

(In Million Rs)

S.No	Item	Local	FEC	Total
1	Material (Appendix-C)	165.935	2613.367	2779.302
2	System Engineering (Appendix-C)	0	179.229	179.229
3	Installation and commissioning (Appendix-C)	12.730	266.837	279.567
4	Training (Appendix-C)	0.000	7.880	7.880
5	SOM for 2 years (Appendix-C)	0.000	4.812	4.812
6	Sales Tax and Excise Duty on item 1 (local) @16%	26.550	0.000	26.550
7	Custum duty and other charges @34% on item 1 (FEC)	888.545	0.000	888.545
8	Local equipment, cables, works and services (LS)	200.000	0.000	200.000
9	Inland freight (LS)	10.000	0.000	10.000
10	Establishment charges (Appendix-D)	121.477	0.000	121.477
11	Building (Appendix-F)	113.333	0.000	113.333
12	Logistic (Appendix-G)	64.850	0.000	64.850
	Total	1603.418	3072.125	4675.543
13	Contingencies @3%	140.266	0.000	140.266
	G.Total	1743.684	3072.125	4815.809

Note Note Esclation has not been included in the total cost. However if required it shall be applicable as per Government policy i.e 6.5% for first year and 13% for 2nd year as calculated in Appendix-H.

LIST OF MATERIAL AND OTHER ITEMS

S.No		Item	Qty	Unit	Unit Rate		TOTAL COST (In millions)				
					FEC	LOCAL	FEC				LOCAL
					(SEK)	(Rs)	In Swedish Krona (SEK) as quated by successful bidder	Equivalent US$ @1$=8.1686SEK (Rate on 27.4.09)	Equivalent Rs.@1$=80.25 Rs. (Rate on 27.4.09)	Equivalent @1$ 60.00Rs. (Rate used in original PC-1)	(Rs)
1	a	Power Supply equipment Generator Sets	22	Sets	146,018.73		3.212	$0.392	31.482	23.538	
	b	Generator Sets	5	Sets		2,199.059					10.995
	c	UPS. Battery and power Control	22	Sets	914.495		20.119	$2.457	197.165	147.413	
	d	UPS. Battery and power Control	5	Sets		8,378.648					41.893
2	a	Interlocking Equipment Interlocking wquipments.,Point Machines, Track circuits, colour light signals, cables, lightening protection etc	23	Stns	12,840.783		295.338	$36.066	2894.304	2163.965	
	b	Restoration of Relay interlocking	4	Stns		10,029.555					40.118
3	a	Block Equipment	26	Blks	793.303		20.626	$2.519	202.133	151.127	
	b	Restoration of Auto Block on Bin Qasim-Hyderabad section	L.S.								51.541
4		Air conditioning	23	Stns		800.000					18.400
5		Motor Trollies	6	pcs	121.093		0.727	$0.089	7.12	5.324	
6		Maintenance center equipment	2	Sets	3,212.18		6.424	$0.785	62.958	47.072	
7		Test diagnistic equipment	1	Lot			1.593	$0.195	15.614	11.674	
8		Spares	1	Lot			7.963	$0.972	78.036	58.345	2.987
9		Freight	1	job			0.67	$0.082	6.566	4.909	
		Sub-Total					356.672	$43.556	3,495.378	2,613.367	165.935
10		System Engineering	1	job			24.461	$2.987	239.718	179.229	
11		Installation and commissioning	1	job			36.418	$4.447	356.895	266.837	12.73
12		Training	1	job			1.076	$0.131	10.540	7.880	
13		SOM for 2 years	1	job			0.657	$0.080	6.436	4.812	
		G.Total					419.284	$51.202	4,108.967	3,072.125	178.664

Appendix-D

Establishment Charges for Implementation of the Project

S.No	Description	BPS	No of posts	Man months	Ave Pay(Rs)	H Rent @45% (Rs)	Ive sat @5%	T.A @50% (Rs)	Pen Cost @33% (Rs)	Allowance @45% (Rs)	Proj. allocation (Rs.)	Total Cost (Million Rs)		
												Cash	Store	Total
Administrative Executive and Managerial														
1	Project Director	20	1	24	33915	15262	1696	16958	11192	15262	50000	3.463	0	3.463
2	Dy. CSE	19	2	48	29380	13221	1469	14690	9695	13221	40000	5.84	0	5.84
3	XEN/Signal	18	3	72	22210	9995	1111	11105	7329	9995	30000	6.606	0	6.606
4	XEN/Civil	18	1	18	22210	9995	1111	11105	7329	9995	30000	1.651	0	1.651
5	Senior Electrical Engineer	18	1	18	22210	9995	1111	11105	7329	9995	30000	1.651	0	1.651
6	Admin Officer/XEN/Sig(G)	18	1	24	22210	9995	1111	11105	7329	9995	30000	2.202	0	2.202
Supervisory and Technical														
7	ASE	17	3	72	17250	7763	863	8625	5693	7763	30000	5.613	0	5.613
8	AEN	17	1	18	17250	7763	863	8625	5693	7763	30000	1.403	0	1.403
9	Signal inspectors	16	6	144	13110	5900	656	6555	4326	5900	15000	7.408	0	7.408
10	IOW	16	1	18	13110	5900	656	6555	4326	5900	15000	0.926	0	0.926
11	PWI	16	1	18	13110	5900	656	6555	4326	5900	15000	0.926	0	0.926
12	EFO	16	1	18	13110	5900	656	6555	4326	5900	15000	0.926	0	0.926
13	Works Accountant	16	1	24	13110	5900	656	1311	4326	5900	15000	1.109	0	1.109
14	T.I	16	1	18	13110	5900	656	6555	4326	5900	15000	0.926	0	0.926
15	OEI	16	1	24	13110	5900	656	6555	4326	5900	15000	1.235	0	1.235
16	SDSKP	16	1	24	13110	5900	656	1311	4326	5900	15000	1.109	0	1.109
17		16	1	24	13110	5900	656	1311	4326	5900	15000	1.109	0	1.109
18	Sub-Engineer/Signals	11	16	384	8245	3710	412	4123	2721	3710	8000	11.874	0	11.874
19	Sub-Engineer/Works	11	2	36	8245	3710	412	4123	2721	3710	8000	1.113	0	1.113
20	Sub-Engineer/Way	11	2	36	8245	3710	412	4123	2721	3710	8000	1.113	0	1.113
21	Sub-Engineer/Signal Diesel	11	2	36	8245	3710	412	4123	2721	3710	8000	1.113	0	1.113
22	Sub-Engineer/Elec	11	2	48	8245	3710	412	4123	2721	3710	8000	1.484	0	1.484
23	Sub-Engineer/AC	11	2	36	8245	3710	412	4123	2721	3710	8000	1.113	0	1.113
24	Draftsman	11	2	48	8245	3710	412	825	2721	3710	8000	1.326	0	1.326
25		16	1	24	13110	5900	656	1311	4326	5900	15000	1.109	0	1.109
26	Clerk/Sr. Computer Optr.	14	4	96	10620	4779	0	1062	0	4779	8000	2.807	0	2.807
27	Jr. Computer Optr.	9	4	96	7270	3272	0	727	0	3272	4000	1.78	0	1.78

S.No	Description	BPS	No of posts	Man months	Ave Pay(Rs)	H Rent @45% (Rs)	Ive sat @5%	T.A @50% (Rs)	Pen Cost @33% (Rs)	Allowance @45% (Rs)	Proj. allocation (Rs.)	Total Cost (Million Rs)		
												Cash	Store	Total
Skilled														
28	Signal Maintainer	8	16	384	6815	3067	341	3408	2249	3067	4000	8.811	0	8.811
29	Signal Maintainer/Diesel	8	2	36	6815	3067	341	3408	2249	3067	4000	0.826	0	0.826
30	Signal Maintainer/D.Elec	8	2	48	6815	3067	341	3408	2249	3067	4000	1.101	0	1.101
31	Signal Maintainer/AC	8	2	36	6815	3067	341	3408	2249	3067	4000	0.826	0	0.826
32	Work Mistry	8	4	72	6815	3067	341	3408	2249	3067	4000	1.652	0	1.652
33	P-Way Mistry	8	4	72	6815	3067	341	3408	2249	3067	4000	1.652	0	1.652
34	Fitter Diesel	5	4	72	5740	2583	0	2870	0	2583	4000	1.28	0	1.28
35	Carpenter	5	1	24	5740	2583	0	2870	0	2583	4000	0.427	0	0.427
36	Black Smith	5	2	48	5740	2583	0	2870	0	2583	4000	0.853	0	0.853
37	Haminer Man	3	2	48	4940	2223	0	2470	0	2223	2000	0.665	0	0.665
38	Driver	5	12	288	5740	2583	0	2870	0	2583	4000	5.119	0	5.119
39	Tracer	5	2	48	5740	2583	0	574	0	2583	4000	0.743	0	0.743
40	Store issuer	5	2	48	5740	2583	0	574	0	2583	4000	0.743	0	0.743
Un Skilled														
41	Muawan	1	40	960	4320	1944	0	2160	0	1944	2000	11.873	0	11.873
42	N/Qasim	1	16	384	4320	1944	0	2160	0	1944	2000	4.749	0	4.749
43	Chowkidars	1	8	192	4320	1944	0	0	0	1944	2000	1.96	0	1.96
Accounts Staff														
1	SA&FO/Pruj	18	1	24	22210	9995	1111	0	7329	9995	30000	1.935	0	1.935
2	Accounts officer	17	1	24	17250	7763	863	0	5693	7763	30000	1.664	0	1.664
3	AAO	16	2	48	13110	5900	656	0	4326	5900	15000	2.155	0	2.155
4	Senior Auditor	11	2	48	8245	3710	412	0	2721	3710	8000	1.286	0	1.286
5	Junior Auditor	7	2	48	6380	2871	319	0	2105	2871	8000	1.082	0	1.082
7	N/Quasim	1	4	96	4320	1944	216	0	1426	1944	2000	1.138	0	1.438
	Total											121.477	0	121.477

Establishment Charges for Maintenance

S. No	Description	BS	No of post	Average	Total (in million Rs)
Administrative Executive and Managerial					
1	XEN/Signal	18	1	22210	0.267
Supervisory and Technical.					
1	ASE	17	2	17250	0.414
2	Signal Inspector	16	3	13110	0.472
2	Signal Inspector/Power Supply	16	2	13110	0.315
2	Signal Inspector/A.C	16	2	13110	0.315
3	Sub Engineer Signal	11	24	8245	2.375
4	Sub Engineer Diesel	11	4	8245	0.396
5	Sub Engineer Diesel Electric	11	4	8245	0.396
6	Sub Engineer/AC	11	4	8245	0.396
Clerical					
1	Head Clerk	14	1	10620	0.127
2	UDC/Jr Computer Operator	9	1	7270	0.087
3	LDC typist	7	1	6380	0.077
Skilled					
1	Signal Maintainer	8	24	6815	1.963
2	Signal Maintainer/Diesel	8	4	6815	0.327
3	Signal Maintainer/D. Elect	8	4	6815	0.327
4	Signal Maintainer/AC	8	4	6815	0.327
6	Mason	5	2	5740	0.138
7	Painter	5	2	5740	0.138
8	Black Smith	5	2	5740	0.138
9	Hamerman	3	2	4940	0.119
10	Driver	5	6	5740	0.413
11	Store Issuer	5	3	5740	0.207
Unskilled					
1	Muawans	1	24	4320	1.244
2	Chowkidar	1	8	4320	0.415
3	Naib Qasid	1	6	4320	0.311
	Total				11.701
	TA 40% of total				4.68
	House Rent 45%				5.265
	Allowances 70%				8.19
	Sub-Total				29.837
	Staff saving				
1	Cabin man	8	127	6815	-10.386
2	Pointsman	5	18	5740	-1.24
3	Lamp man	1	18	4535	-0.98
	Sub-Total				-12.605
	House Rent 45%				-5.672
	Allowances 70%				-8.824
	Net saving				-27.102
	G Total				2.735
	Total Annual recurring cost		Local	FEC	Total
	Pay and allowances		2.735	0	2.735
	Spare Parts		0	12	12
	Fuel and power		8	0	8
	Total		10.735	12	22.735

Appendix-F

Buildings

(In Million Rs)

S.No	Description	Qty	Unit	Covered area		Cost per Sq: Ft	Cash	Store	Total
				Per unit Sq: Ft	Total Sq: Ft				
1	Equipment rooms	23	Each	1800	41400	1400	57.96	0	57.96
2	Level Crossing huts (stations)	48	Each	48	2304	1400	3.226	0	3.226
3	Maintenance Center	2	Each	1600	3200	1400	4.48	0	4.48
4	Residence Officers	2	Each	3000	6000	1400	8.4	0	8.4
5	Residence Inspectors	2	Each	1600	3200	1400	4.48	0	4.48
6	Residence of Sub: Engineer	4	Each	1000	4000	1400	5.6	0	5.6
7	Residence of Signal maintainers	4	Each	606	2424	1400	3.394	0	3.394
8	Residence of Muawans	4	Each	606	2424	1400	3.394	0	3.394
9	Office buildings				16000	1400	22.4	0	22.4
	Total				80952		113.333	0	113.333

Appendix-G

LOGISTIC

(In Million Rs)

S.No	Item	Quantity		Unit rate	Cash	Store	Total
1	Track	2	Nos	2.800	5.600	0.000	5.600
2	Hiace	1	Nos	2.800	2.800	0.000	2.800
3	Hilux Double cab	4	Nos	3.300	13.200	0.000	13.200
4	Car 1300 cc	1	Nos	1.400	1.400	0.000	1.400
5	Car 1000 cc	2	Nos	0.750	1.500	0.000	1.500
6	Fork Lifter	2	Nos	0.600	1.200	0.000	1.200
7	Motor Cycle	10	Nos	0.080	0.800	0.000	0.800
8	Cycle	10	Nos	0.005	0.050	0.000	0.050
9	Furniture & furnishing	1	LS	3.000	3.000	0.000	3.000
10	Fuel and maintenance	1	LS	10.000	10.000	0.000	10.000
11	Telephone charges	1	LS	2.500	2.500	0.000	2.500
12	Electric charges	1	LS	5.000	5.000	0.000	5.000
13	Office equipment	1	LS	2.500	2.500	0.000	2.500
14	Computers	12	Nos	0.150	1.800	0.000	1.800
15	Plotter	2	LS	0.750	1.500	0.000	1.500
16	Drawing Office Equipment	1	LS	2.000	2.000	0.000	2.000
17	Misc: and unforeseen Items	1	LS	10.000	10.000	0.000	10.000
	Total				64.850	0.000	64.850

FINANCIAL PHASING

In Million Rs

S.No	Item	Total Cost			2007-08			2008-09			2009-10			2010-11		
		Local	FEC	Total	Local	FEC	Total	Local	FEC	Total	Local	FEC	Total	Local	FEC	Total
1	Advance payment at rate of 15%	24.04	616.345	640.385	24	0	24	0	616.345	616.345	0	0	0	0	0	0
2	System Engg	0	203.761	203.761	0	0	0	0	0	0	0	203.761	203.761	0	0	0
3	Equipment	143.805	2971.071	3114.876	0	0	0	$1	0	1	62.805	1200	1262.805	0	1771.071	1771.071
4	Installation	10.82	303.361	314.181	0	0	0	0	0	0	10.82	120	130.82	0	183.361	183.361
5	Training	0	8.959	8.959	0	0	0	0	0	0	0	8.154	8.154	0	0.805	0.805
6	Supervision of maintenance	0	5.47	5.47	0	0	0	0	0	0	0	0	0	0	5.47	5.47
7	Custom dutied and sales tax	1214.978	0	1214.978	0	0	0	12.96	0	12.96	491.822	0	491.822	710.196	0	710.196
8	Establishment	121.477	0	121.477	0	0	0	1	0	1	50	0	50	70.477	0	70.477
9	Buildings	113.333	0	113.333	0	0	0	0	0	0	113.333	0	113.333	0	0	0
10	Logistics	64.85	0	64.85	0	0	0	15.04	0	15.04	25	0	25	24.81	0	24.81
11	Local items, works, services	210	0	210	0	0	0	0	0	0	75	0	75	135	0	135
12	Contingencies	180.368	0	180.368	0	0	0	0	0	0	20	0	20	160.368	0	160.368
	Total	2083.67	4108.967	6192.637	24	0	24	110	616.345	110	848.78	1531.915	2380.695	1100.851	1960.707	3061.553
	Esclation (if applicable)	198.281	354.466	552.748	0	0	0	0	0	0	55.171	99.574	154.745	143.111	254.892	398.000

Note Escalationha not been included in the total cost. However if required it shall be applicable as per Government policy i.e. 6.5% for first year and 13% for 2nd year.

SUMMARY

2007-2008	24.04	0	24.04
2008-2009	110	616.345	726.345
2009-2010	848.78	1531.915	2380.695

BAR CHART

S.No	Item	2007-2008		2008-2009				2009-10				2010-11			
1	Tendering and award of contract						■								
2	System Engineering							■	■	■					
3	equipment								■	■	■	■	■	■	
4	Buildings							■	■	■					
5	Installation									■	■	■	■	■	■
6	Testing and commissioning											■	■	■	■

Appendix-4: Revised PC-1 Proforma Rehabilitation of Railwat Assets Damaged during the Riots of 27th and 28th December 2007 (May 2009)

Revised PC-I Proforma -2005

GOVERNMENT OF PAKISTAN
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

PLANNING COMMISSION

UP GRADATION OF SIGNALING & TELECOMMUNICATION BY PROVIDING COMPUTER BASED INTERLOCKING WITH CENTRALIZED TRAFFIC CONTROL SYSTEM (CTC) & AUTO BLOCK SIGNALLING ON

LODHRAN (EXCL) - KOTRI SECTION

PLAN PERIOD

2014-15 TO 2017-18
(04 YEARS)

&

PROVIDING CENTRALIZED TRAFFIC CONTROL SYSTEM (CTC) AT MULTAN (LODHRAN-SAHIWAL) & LAHORE (SAHIWAL (EXCL)-SHAHDRA BAGH) MAIN LINE SECTION OF PAKISTAN RAILWAYS

PLAN PERIOD

(Eighteen Months)

June – 2014

GOVERNMENT OF PAKISTAN
PLANNING COMMISSION
PC-I FORM
(INFRASTRUCTURE SECTOR)

1.	**NAME OF PROJECT**	Up gradation of Signaling & Telecommunication System by Provision of Computer Based Interlocking, Auto Block Signalling & Centralized Traffic Control System, Optic fiber cable based on VoIP technology to replace the existing Old and Obsolete Signalling & Telecommunication System on Lodhran (Excl) - Kotri Section & providing Centralized Traffic Control System (CTC) at Multan (Lodhran-Sahiwal) & Lahore (Sahiwal (Excl)-Shahdra Bagh) Main Line Section of Pakistan Railways.
2.	**LOCATION**	This Project is spread over 670 & 433 Km length between Lodhran (Excl) – Kotri & Lodhran- Multan-Khanewal-Shahdra Bagh section falling within territorial limits of Lahore, Kasur, Okara, Sahiwal, Khanewal, Multan, Lodhran, Bhawalpur, Rahim Yar Khan, Sukkur, Khairpur, Nawab Shah and Hyderabad Districts of Punjab & Sindh Provinces.
3.	**AUTHORITIES RESPONSIBLE FOR:**	
	(i) Sponsoring	Ministry of Railways
	(ii) Execution	Pakistan Railways
	(iii) Operation & Maintenance	Pakistan Railways
	(iv) Concerned Federal Ministry	Ministry of Railways

4. (a) PLAN PROVISION

- **If the project is included in the medium term/five years plan, specify actual allocation.**

  This project is not included in medium term development framework (MTDF)/ five year plan.

- **If the project is proposed to be financed out of block provision, indicate.**
  This project will be financed out of block provision for transport section.

(Rs. In Million)

Total block provision	Amount already committed	Amount proposed for this project	Balance available
—	—	**41749.972**	—

(iv) List of works for which amount is already committed through PC-Is.

- Rs.3678.500 million for Doubling of Track on Lodhran-Khanewal section via (Multan Cantt:)
- Rs.12617.400 million for Doubling of Track on Khanewal – Raiwind section.
- Rs.9405.000 million for rehabilitation of track on Landhi-Khanpur section
- Rs.9648.365 million for rehabilitation of track on Khanpur-Lodhran section.
- Rs.10720.381 million for Provision of Modern signalling arrangements on Shahdara – Lodhran section.
- Rs.6192.637 million for Rehabilitation of Railway Assets damaged during riots of 27/28 December, 2007 from Mirpur Mathelo-Shahdadpur section.

(b) Provision in the current year PSDP/ADP

NIL

5. PROJECT OBJECTIVES

The existing signalling systems installed on Lodhran (excl) – Kotri section are old, obsolete and of antiqued design by modern standards. The mechanical signalling at Samasata, Khanpur, Rohri, Tando Adam, Hyderabad and Kotri was provided before independence while the same at Bhawalpur, Mubarikpur, Dera Nawab Sahib, Rahimyar Khan, Sangi, Oderolal, Allahdino Sand and Detha was provided during 1970,1975-1980 & 1990 to1992. All relay interlocking at Chani goth, Liaqatpur, Feroza, Jetha Bhutta, Kot Semaba, Sadikabad, Machigoth, Walhar, Reti & Daharki stations was provided in 1963. Block Signalling between stations was provided in 1954. These systems have outlived their useful life and does not guarantee safety of train operation, as such there is a dire need of immediate replacement of this outdated system. The replacement of the entire system has become overdue and is envisaged to be done through this project.

Signalling system on Lodhran-Multan- Khanewal-Shahdra Bagh section are old and obsolete and is being replaced with modern Computer Based Interlocking (CBI) and Automatic Block Signalling with Automatic Train Protection (ATP) under an ongoing project. This system has the capacity to control and monitor the trains from a central point provided the same is linked with Centralized Traffic Control (CTC) System. As a matter of fact the CTC should have been integral part of the project which was omitted at the time of preparation of the PC-I either through ignorance or a costly neglect.

The government of Punjab, in line with the policies of Federal Government Intends to install at least six coal fired power plants of 2x660 MW capacity each, requiring about 40 million tonnes of coal to be transported from port to up-country. There are also

compelling demands of similar plants at Jamshoro, Lakhra, Faisalaabad and Lalpir. The movement of such huge quantity of coal, even with 4000-4500 HP locomotives and 60 tonne capacity (pay load) high capacity wagons would not be possible with the existing infrastructure constraints. The number of trains worked out to about 50 each way requiring augmentation of line capacity which is limited due to mechanical signaling system between Lodhran and Kotri. As such, the existing signalling system on Lodhran-Kotri section is to be replaced with computer based interlocking excluding 22 stations of on going rehabilitation project and auto block signaling system on whole the section of 670 KM to increase capacity to meet with the future requirements.

The main objectives of the project are as under:

i) Increase in Line capacity by installing auto block system between block sections.

ii) Replacement of old, obsolete and over aged existing signalling systems to bring it at par with the contemporary railways of the world.

iii) Providing new signalling system with advance safety features and improved performance parameters.

iv) To improve safety paradigm of the train operations.

v) To improve efficiency and credibility of the train operating system.

vi) To minimize human error by station operating staff and train drivers by installing CBI & ATP systems.

vii) To provide Centralized Traffic Control (CTC) for efficient management of train operations.

viii) To provide passenger information system including internal information for rail staff.

ix) Authority management.

x) Traffic control support functions such as Train Describer System (TDS).

xi) Voice switching system connecting phone calls to way side stations and other train operation points.

xii) Maintenance and diagnostic functions, including event statistics, reporting and play back.

xiii) Advanced tools for extension, maintenance and simulation.

xiv) To provide secure, reliable and independent communication facilities to the department through optic fiber cable based on VoIP technology.

xv) To provide modern train and radio control.

xvi) To provide infrastructure for the provision of internet, and video conferencing facilities.

Following are the goals envisaged in the PC-1 for achieving the above said objectives.

- Power supply equipment (DG sets shall be provided as standby source of supply).
- UPS battery and power control system.
- Interlocking equipment (fail-safe design) non trail-able Point Machines, AC immunized track circuits, multiple aspect colour light signals, signal cable, earthing and lightening protection devices etc.
- Advanced road warning system at all manned level crossings.

- Road warning signals at all unmanned level crossings.
- Automatic block system with colour light signals, cables and track circuits.
- Automatic Train protection (ATP) and cab signalling in 35 locomotives.
- Optic switches, routers, VoIP gateways and drop equipment.
- Replacement of existing points and crossings with UIC-54 in station yard.

Details of Signalling, Telecommunication and P-way works to be carried out are described in Appendix-C while the cost of the project is shown in abstract placed at Appendix-B.

The total estimated cost of the project including escalation charges, worked out as Rs. 41749.972 million including Rs. 27992.452 million for signalling, Rs 31831.278 million for telecom Rs.3217.256 million, for P-way portion Rs. 4642.202 & CTC Rs.2059.237 million. Lodhran (excl) –Kotri project is proposed to be completed within four years (2014-15 to 2017-18) & CTC at Multan & Lahore is proposed to be completed within eighteen month.

Relationship with other Projects

This project has strong relationship with other projects included in current portfolio specially "replacement of old and obsolete signaling gear on Lodhran-Shahdra Bagh section" providing modern and compatible signaling right from Lahore to Karachi main line route which carries almost 80% of railway traffic, hence ensuring uninterrupted ire less operations. The project will greatly and synergise the benefits to be achieved from other projects as detailed below:-

a) Doubling of track from Lodhran – Multan – Khanewal – Sahiwal – Okara & Bhoe Asal – Raiwind section has been completed and rest of the section upto Bhoe Asal is in progress. Track rehabilitation from Landhi to Khanpur & Khanpur to Lodhran is also being done to run the trains at 120 KMH and higher speed as per directives of the President of Pakistan.

b) In the freight sector, 1300 High Capacity wagons have been introduced and another 540 high capacity wagons are being planned for procurement to increase average speed, gross tonne kilometers (GTKM) and turn around of locomotives as well as of freight wagons. The tonne kilometers are projected to increase from 5.81 billion in 2006-2007 to 20.088 billion in 2015-2016.

c) 175 passenger carriages have since been procured and other 220 new passenger carriages are being added to increase passenger kilometers from 26.68 billion in 2006-2007 to 43.35 billion in 2015-2016.

d) 75 more locomotives are under procurement including 55 high traction (4000-4500 HP) locomotives.

e) Doubling of Track on Shahdara Bagh – Lalamusa section has been initiated and work is in progress.

f) Rehabilitation of Railway Assets damaged during riots of 27/28 December, 2007 from Mirpur Mathelo-Shahdadpur section has been initiated and work is in progress.

g) Replacement of old & obsolete signalling gear on Lodhran-Shahdara Bagh section has been initialed & work is in progress.

6. DESCRIPTION & JUSTIFICATION OF PROJECT (ENCLOSE FEASIBILITY STUDY FOR PROJECTS COSTING RS. 300 MILLION AND ABOVE)

6.1 Describe the project and indicate existing facilities in the area and justify the establishment of the project.

6.1.1 DESCRIPTION

GENERAL (SIGNAL)

(i) Signalling systems play an important role in smooth, safe and efficient train operation and are used to protect trains from accidents, operate trains safely, enhance transportation efficiency, increase speed and line capacity.

(ii) The existing signaling system is completely outdated and does not have advance features like Automatic Train Protection (ATP) which is considered essential to improve safety paradigm. After serious accident at Sarhad station on 13.7.2005, the Federal Government Inspector of Railways having statuary role to over see the safety of railway operations, underlined the urgency and importance of provision of these safety features, which are already being provided on Shahdara Bagh – Khanewal-Multan-Lodhran main line section under an approved project. This project envisages provision of similar features on Lodhran (excl) –Kotri section.

(iii) Doubling of Track project has been completed on Lodhran-Multan-Sahiwal-Okara and Bhoe Asal-Raiwind section. Work on rest of the section, up to Bhoe Asal is in progress. The existing signalling and block system cannot cater for the requirements for double track in the future. The new signalling system needs to be urgently provided in replacement of the existing system.

(iv) Existing systems on the entire network is old and obsolete and has been planned to replaced with modern contemporary systems. At present computer based interlocking is being provided at 31 stations on Shahdara Bagh–Khanewal - Lodhran (via Multan) sections, alongwith auto block and automatic train protection system under an approved project. 23 stations damaged during riots of December 2007 on main line from Mirpur Mathelo-Shahdadpur section and Bin Qasim station, are also being provided with Computer Based Interlocking System (CBIs) under another approved project.

(v) A PC-I for Shahdara Bagh (excl) – Lalamusa section for provision of Computer Based Interlocking including Remote Control Operation, Auto Block, Automatic Train Protection, Advance Warning System at Manned Level Crossings & Road Warning system at unmanned level crossing has been approved by the Secretary / Chairman Railways at a cost of Rs.9159.264 million including FEC of Rs.6569.706 million and submitted to Planning Commission for sanction by ECNEC.

(vi) A PC-I for Shahdara Bagh (excl) – Faisalabad section for provision of Computer Based Interlocking, Auto Block, Automatic Train Protection, Advance Warning System at Manned Level Crossings & Road Warning system at unmanned level crossings has been approved by the Secretary/Chairman Railways at a cost of Rs.11527.898 million including of FEC Rs.7992.488 million for Signalling, Telecommunication and P-way portion and submitted to Planning Commission for sanction by ECNEC.

(vii) The Telecommunication system is old, obsolete and based on analog radios. In order to provide latest, secure, reliable and independent communication facilities to the department through optic fiber cable based on VoIP technology it is entirely necessary to install the new telecom system.

(viii) The telecom system on this section will be patched to the similar system on Lodhran-Shahdara project of signaling.

(ix) It will replace old, obsolete and radio control with latest train and radio control.

(x) It will provide infrastructure for the provision of internet, intranet, and video conferencing facilities.

6.1.2 Seminar regarding Up-gradation of Signalling systems on Pakistan Railways

A seminar was held in Railway Headquarters, Lahore on 4th May 2006 as per direction of the Planning Commission. The delegates from Planning Commission, GHQ, Ministries of IT and Railways, National Institute of Electronics, NUST, GIKI, UET- Lahore, COMSAT and companies from private sector attended the seminar and read papers about various aspects of signalling systems.

Following were conclusions of the Seminar: -

i. Old signalling systems on Pakistan Railways must be replaced with modern systems such as Computer Based Interlocking at stations, Auto Block System with Automatic Train Protection (ATP) on double line sections and Tokenless Block with Axle Counters (Semi Automatic Block) on Single line sections for the safety of traveling public and improving the operational efficiency. ATP must be included in the Signalling development projects.

ii. Indigenization is desirable but may take long time to be achieved for sophisticated equipment like signalling. This also depends on demand in the market. Railways may however, start the process with local engineering and design, installation and production of some items, as far as practicable.

iii. The communication system should be upgraded with latest systems consisting of Fiber Optic Cable etc. for which Pakistan Railways could make available its Right of Way.

iv. Track Rehabilitation and improvement must continue as per prescribed standards so as to ensure that track circuits work properly which are the base for any safety system.

v. Special attention should be given to the development of human resources for proper maintenance of modern equipment and incentives should be provided to the Electrical / Electronics Engineers, so that they prefer to stay in Railways as a choice.

6.1.3 Over-view of on going/proposed signalling projects on Pakistan Railways. On going/proposed projects are shown in phases.

Phase-I

(a) On going projects

i) The scheme of modern signalling on Lodhran-Khanewal-Multan-Shahdara Bagh (433 Km) section at a cost of Rs.10.720 billion have already been approved. The contract has been awarded to the Consortium of BT/CRSC of Sweden & China

and the work is in progress. Doubling of track work has been completed from Lodhran-Multan-Sahiwal-Okara, Bhoe Asal - Raiwind section and work onward up to Bhoe Asal is under execution. The provision of modified signalling system is essential due to doubling of track, otherwise train operations will suffer badly. The optic fiber cable installed for the signalling gear will also be used for telecom facilities.

ii) The project of "Rehabilitation of Railway assets damaged during riots of 27th/28th December, 2007 upon the assassination of Motharma Benazir Bhutto" has been approved at a cost of Rs.7.855 billion. The signalling portion of the work for providing Computer Based Interlocking at Bin Qasim station, Shahdadpur-Begmanji section, Pano Akil, Mahesar, Ghotki and Mirpur Mathelo stations is estimated to cost Rs 6.192 billion. Gaddar, Dhabeji, Jungshahi and Jhimpir stations shall be restored with similar equipment by replacing burnt items. The work has been awarded to the Consortium of BT/CRSC of Sweden & China. Restoration work at the above stations alongwith auto block on Bin Qasim-Jhimpir section has since been completed except Bin Qasim-Juma Goth while rest of the work is in progress. The optic fiber cable installed for the signalling system will also be used for telecom facilities.

(b) <u>Proposed projects</u>

i) The PC-I Lodhran (excl) – Kotri including CTC at Multan (Lodhran-Sahiwal) and Lahore (Sahiwal excl-Shahdara Bagh) at a cost of Rs. 41749.972 million with FEC of Rs.27992.452 million has been planned to be provided with Computer Based Interlocking, CTC, Automatic Block on 670 Kms double line section, up-gradation of Telecommunication system, replacement of existing points & crossings with UIC-54 in station yard alongwith Automatic Train Protection system in 35 locomotives, advance warning system at manned level crossings and road warning system at unmanned level crossings, under this project. The estimated cost has been prepared excluding cost of the signalling portion covered under Signal Rehabilitation Project form Mirpur Mathelo to Shahdadpur station.

ii) A PC-I for Shahdara Bagh (Excl) – Lalamusa section, at a cost of Rs.8760.735 million with FEC Rs.6341.346 for signalling, and Rs 398.529 million with FEC of Rs. 228.360 million for Telecom has been approved by the Secretary / Chairman Railways and submitted to Planning Commission for sanction by ECNEC.

iii) A PC-I for Shahdara Bagh (Excl) – Faisalabad section at a cost of Rs.10603.613 million with FEC of Rs.7637.367 for signalling portion, Rs.489.479 million with FEC Rs.268.360 million for Telecom portion and Rs.434.806 million with FEC of Rs.86.761 million for P-way portion has been approved by Secretary/Chairman Railways and submitted to Planning Commission for sanction by ECNEC.

Estimated costs of other projects on the system, are shown phase wise in the following tables

S No	Section	Distance (In Km)	Total Cost (Rs in million)	FEC (Rs in million)
iv	Lalamusa (excl)-Golra Sharif	170	19520.506	14419.622
v	Faisalabad-Khanewal	170	5568.62	3953.66
vi	Khanewal (via chord)- Lodhran (excl.)	91	3053.563	2173.474
vii	Kotri-Karachi	174	10138.91	7177.92

Phase-II

S No	Section	Distance (In Km)	Total Cost (Rs in million)	FEC (Rs in million)
i	Golra Sharif-Peshawar	176	4370.82	3847.74
ii	Lodhran-Pakpattan-Raiwind	407	5812.85	5035.48
iii	Kotri-Dadu-Habibkot	381	5747.50	5035.48
iv	Rohri-Jacobabad-Sibi-Quetta	423	6201.74	5203.71
v	Shahdara Bagh-Narowal_Wazirabad	193	4071.17	3521.45
vi	Jacobabad-Kot Adu	470	4408.13	3678.38
vii	Sher Shah–Kot Adu–Kundian –Attock City	546	9871.95	8568.22
viii	Hyderabad-Mirpur Khas-Zero Point	220	2707.72	2343.87

Phase-III

S No	Section	Distance (In Km)	Total Cost (Rs in million)	FEC (Rs in million)
i	Lala Musa-Sargodha-Chak Jhumra	257	4422.14	3857.90
ii	Shaheenabad-Shorkot Section	163	2319.93	2007.42
iii	Qila Sheikhupura-Jaranwala-Shorkot	242	2363.58	2007.42
iv	Quetta-Chaman section	156	1789.77	1502.74
v	Sargodha – Kundian section	144	1559.29	1670.97
vi	Spezand-Taftan section	669	3041.04	2343.87

The project shown in phase I need to be taken in hand with target completion period of 5-7 years.

6.1.4 Existing Signalling System

i). There are 59 stations on Lodhran (excl)-Kotri section in which 22 stations on Mirpur Mathelo-Shahdadpur section have been included in the project of Rehabilitation of Railway Assets damaged during riots of 27/28 December, 2007. Out of remaining 37 stations 22 are equipped with Standard-III Mechanical Interlocking and 15 stations with all relay interlocking. The mechanical gear is more than 50, 35 & 25 years old and its operation is very slow and time consuming fraught with various safety hazards. Due to aging of equipment, the possibility of its malfunctioning cannot be ruled out which may result in some serious mishap. It is not possible to increase the speed of trains and improve turn around unless the existing old & obsolete signalling system is replaced with contemporary modern signalling system.

ii) Tyre's Double Line Block Instruments are also being used for giving and taking line clear from/to adjacent stations. These instruments are over 46 years old and are not functioning properly. No spares are available and there are frequent failures causing detention to trains, hence their further continuation is not viable.

iii) Signalling system on Lodhran-Multan- Khanewal-Shahdra Bagh section are old and obsolete and is being replaced with modern Computer Based Interlocking (CBI) and Automatic Block Signalling with Automatic Train Protection (ATP) under an ongoing project. This system has the capacity to control and monitor the trains from a central point provided the same is linked with Centralized Traffic Control (CTC) System. As a matter of fact the CTC should have been integral part of the project which was omitted at the time of preparation of the PC-I either through ignorance or a costly neglect.

iv) Pakistan Telecommunication Corporation Limited (PTCL) overhead wires, over which these instruments operate, have also outlived their useful life and are quite unreliable for operation of safety circuits. There is frequent malicious cutting of these wires which also causing hindrance in smooth train operations.

v) Accordingly, it is planned to provide Computer Based Interlocking, alongwith CTC at 26 stations (after closing 11 stations) on this section and Auto Block system on the double line section of 670 Km alongwith Automatic Train Protection system in 35 locomotives, Advance Warning System at Manned Level Crossings, Road Warning Signal system on unmanned level crossings on Lodhran (excl) – Kotri section. Due to provision of auto block system it will be possible to close 11 stations which are not commercially viable, resulting in considerable saving in operational cost. Detail of stations is given at Appendix-A.

vi) Telecommunication Systems consists of MW/UHF/VHF Radios and EPABXs systems installed in 1980-81. It provides telecommunication facilities between Headquarters office, Ministry, Divisions, Stations, official residences Station masters, Drivers and Guards. Block and train control circuits are working on overhead wires, which have been discarded by the PTCL and now being maintained by Pakistan Railways since 31st May, 2006.

6.1.5 JUSTIFICATION (Signalling)

(i) The signaling system plays an important role in smooth, safe and efficient train operation. These systems are used to protect trains from accidents, operate trains safely, enhance transportation efficiency, increase speed and line capacity. Pakistan Railways installed CTC and Auto Block systems in 1962 from Karachi Cantt: to Landhi and 1993 from Landhi to Kotri. However, most of the existing systems are very old and obsolete and need replacement in future in a well thought out phased manner.

(ii) The operation of cabin interlocked mechanical signaling is very slow and time consuming. At Junctions and big stations, mechanical operation of signal gear is very cumbersome and much time consuming causing delays, especially in the case of crossing of trains, thus affecting punctuality of trains. Similarly impaired visibility of kerosene lit semaphore signals during night compels drivers to check speed adding to time loss. The signalling gear is more than 50 years old and needs replacement. Due to aging of the equipment, the possibility of its malfunctioning can not be ruled out which may result in some serious mishap. It is therefore essential to replace the old equipment for the safety of traveling public and efficient train operations.

(iii) After the accident between three trains at Sarhad station on 13.7.2005, in which 139 people died and 250 injured, Federal Government Inspector of Railways has also recommended to replace the old and obsolete signalling systems on the entire network. It has accordingly been proposed to replace the existing outdated equipment on Lodhran (excl) – Kotri section with modern system i.e Computer Based Interlocking, CTC with control offices at Sukkur, Karachis & CTC on LON-SDR section with control office at Multan (Lodhran-Sahiwal) & Lahore (Sahiwal excl- Shahdara Bagh) to monitor and control the train operations which will enhance safety, increase average speeds, improve punctuality and efficiency. This will reduce the chances of human mistakes. The decision making for efficient train operations will become quick and accurate as the entire information of real time position of trains on the section will be available in the control center (on wall display screen).

It will also be possible with this system to reduce the operational staff at the wayside stations by controlling the signalling system from the central control office. With provision of additional terminals to the maintenance and operational officials the efficiency will be enhanced by giving prompt directives to the maintenance and operating staff. The activities of train operations (SMs), system alarms and event logging of all operators can be stored for subsequent analysis to find out the actual cause of any mishap.

(iv) Modern systems such as Electronic Interlocking, Auto Block Signalling, Centralized Traffic Control (CTC), Automatic Train Protection (ATP) and Cab signaling etc are being extensively used by all modern Railways of the world. It is planned to provide Electronic Interlocking, Electric Point Machines, Colour Light Signals, Track Circuits at Railway stations, fiber optic cable for Computer Based Interlocking & Telecommunication system and Auto Block Signalling on double line sections between stations. With the provision of these systems, the safety of train operation will increase manifold, even at higher speeds, restoring the confidence of travelling public in the safety of Railway system. By providing auto block system on double line, the line capacity will increase manifold which can cater for the increasing future demand. Due to provision of Automatic Train Protection system the accidents would be avoided as the train will automatically stop in case driver does not observe red signal.

(v) The work of Rehabilitation of Track Infrastructure on Landhi – Khanpur & Khanpur-Lodhran section is in progress which covers the required parameters for the provision of CBI system because required benefits cannot be achieved without provision of modern signalling system on the said section.

JUSTIFICATION (Telecom)

Due to obsolete technology and lack of spares, it is inevitable to replace the old telecom system with new optical fiber cable based on VoIP telecom system. A modern, secure, independent and reliable telecom system is considered as a necessity in any Railway system of the world. It is proposed to provide the latest and cost effective fiber optical cable, VoIP technology along with digital transmission system and other related equipment on various sections of Pakistan Railways. All the existing voice and data communication requirements of Pakistan Railways shall be met from the proposed telecommunication system and provision shall be kept for future requirements also. The communication systems shall be properly integrated with the train management and Railway signalling system to get maximum benefits besides improvement in the safety standards of the train operations. The fiber optic cable and digital transmission systems will provide better quality and reliability with minimum maintenance cost and safe train operations. Therefore, it is proposed that the existing analogue radio system should be replaced with fiber optic cable and digital transmission system comprising 10/2.5 G.bits/s and 622/155 M.bits/s transmission system, VoIP telephone gateways and train control etc.

Cost of the project showing internal and external portion is given at Appendix-B. Total estimated cost of the project including FEC is Rs. 31831.278 million for signals portion, Rs.3217.256 million for Telecom portion, Rs.4642.202 million for P-Way portion & CTC Rs. 2059.237 million. Lodhran (excl) –Kotri project is proposed to be completed within four years (2014-15 to 2017-18) & CTC at Multan & Lahore is proposed to be completed within eighteen month.

The year wise financial requirement of the project will be as under:

A. Signal Portion

(Rs. In Million)

Year of Phasing	Foreign Exchange	Total Cost	CD/ST & Project Activities	Net Cost
2014-15	4973.475	5904.817	649.181	5255.636
2015-16	7282.290	10417.018	2185.026	8231.992
2016-17	6301.981	9014.725	1890.887	7123.838
2017-18	3921.233	5609.161	1176.552	4432.609
Total:	22478.979	30945.721	5901.646	25044.075

B. Telecom Portion

(Rs. In Million)

Year of Phasing	Foreign Exchange	Total Cost	CD/ST & Project Activities	Net Cost
2014-15	455.030	606.724	43.536	563.188
2015-16	501.480	1030.202	142.481	887.721
2016-17	487.550	1032.959	138.523	894.436
2017-18	250.740	547.371	71.240	476.131
Total:	**1694.800**	**3217.256**	**395.780**	**2821.476**

C. P-way Portion

(Rs. In Million)

Year of Phasing	Foreign Exchange	Total Cost	CD/ST & Project Activities	Net Cost
2014-15	504.404	736.288	63.232	673.056
2015-16	752.656	1533.138	212.829	1320.309
2016-17	651.337	1326.755	184.179	1142.576
2017-18	405.276	825.535	114.600	710.935
Total:	**2313.673**	**4421.716**	**574.840**	**3846.876**

D. CTC Portion

(Rs. In Million)

Year of Phasing	Foreign Exchange	Total Cost	CD/ST & Project Activities	Net Cost
2014-15	1109.938	1494.158	219.814	1274.334
2015-16	395.062	559.727	94.206	465.521
2016-17	-	-	-	-
2017-18	-	-	-	-
Total:	**1505.000**	**2053.885**	**314.020**	**1739.865**

SUMMERY OF YEAR WISE FINANCIAL REQUIREMENT SIGNAL, TELECOM, P-WAY & CTC (A+B+C+D)

(Rs. In Million)

Year of Phasing	Foreign Exchange	Total Cost	CD/ST & Project Activities	Net Cost
2014-15	7042.847	8741.987	975.763	7766.224
2015-16	8931.490	13540.085	2634.552	10905.533
2016-17	7440.868	11374.439	2213.589	9160.850
2017-18	4577.249	6982.067	1362.392	5619.675
Total:	27992.454	40638.578	7186.296	33452.282

6.2 Providing technical parameters i.e. input and output of the project. Also discuss technological aspects of the project.

TECHNICAL PARAMETERS

Design features of CBI & CTC System are as under:-

(a-I) STATION SIGNALLING

i) Installation of Electronic Interlocking at all Stations.

ii) The Interlocking system shall have automated fail-safe design.

iii) AC Track Circuits shall be provided.

iv) Multiple aspect colour light signals having a visibility of not less than 1.2 Kilometer in bright sunshine.

v) Non-trailable point machines with internal locking and detection of individual switch independently.

vi) Signalling cables, shall be provided for track circuits, signals and points machines.

vii) The system shall be entrance and exit type.

viii) The system shall be provided with uninterrupted power supply arrangements including chargers, inverters and batteries.

ix) Diesel generators shall be provided at all stations as standby source of supply.

x) Traffic control support functions such as Train Describer System (TDS).

xi) Passenger information system including internal information for rail staff.

xii) Voice switching system connecting phone calls to way side stations and other train operation points.

xiii) Maintenance and diagnostic functions, including event statistics, reporting and playback.

xiv) Advanced tools for extensions, maintenance and simulation.

xv) Installation of Application server for Telecommunication between central office, wayside stations and other train operation duty points.

xvi) Workstations for Traffic controllers with monitoring and control functions of independent sections.

xvii) Installation of Wall screen showing indications of Signalling gears of the entire section in the real time.

xviii) All manned level crossings in the yards and block sections shall be interlocked with signals.

xix) All unmanned level crossings shall be provided with Road Warning Signals.

xx) Air Conditioning shall be provided in equipment rooms for proper functioning of the system.

(a-II) <u>WAY SIDE STATIONS</u>

i) Interfacing arrangements shall be provided at each way side station on the entire section to communicate with the application server of CTC Center.

ii) Big / Junction station shall be equipped with passenger information display and address system.

(b) BLOCK SIGNALLING

i) Automatic Block System shall be provided on the entire double line section.

ii) Frequency shift and AC Track circuits shall be provided.

iii) Automatic Train Protection (ATP) and Cab Signalling system shall be provided in the Cab of Locomotive so that the driver can see the signals in cab in advance. The train shall stop automatically in case the driver does not apply brakes approaching the danger signal.

(c) TRANSFER OF TECHNOLOGY

Signalling equipment is not manufactured in Pakistan being specialized equipment. The successful bidder shall be encouraged to locally manufacture as many items as possible and to carry out system design and installation with maximum local participation.

(d) FEASIBILITY STUDY

An in-house feasibility study for improvement of the existing Signalling & Telecom Systems on Pakistan Railways was carried out in 2005 and submitted to the Ministry of Railways and Planning Commission. The updated copy is attached as **Appendix-M**.

TECHNICAL PARAMETERS (Telecom)

The scope of work based on technical/design features shall be as under:-

a) Installation of 10/2.5 G.bits/s system as a back bone for long distance circuits and to provide alternate route in case of failure of the prime route at 14 stations (Appendix-A).

b) Installation of 622/155 M.bits/s system at all Stations for station to station communication at 57 stations (Appendix-A).

c) Installation of related drop equipment at each station.

d) Dual un-interrupted power supply with single stand by Diesel Generators at all stations.

e) VoIP gateway at Sukkur, Khanpur, Rohri, Nawab Shah, Hyderabad & Kotri for providing direct dialing facilities to the administration, operational staff and wayside stations.

f) VHF Radio Base Stations at 19 stations for communication between the train drivers and train controller in addition to the ASMs (Appendix-A).

g) VHF Radio Sets on 35 locomotives for communication with the control offices.

h) Train control, Dy: Train Control & VHF Control Consoles including displays for trains shall be installed as monitoring equipment for efficient train operations.

i) Optic Fiber Cable shall be provided throughout the length to cater for immediate and long term needs of Railway Telecommunication, Signaling, IT, Management Information System and other telecommunication controlled devices, data speed between the stations and divisional headquarters shall be 2 M.bits/s. whereas between Divisional Headquarters and Headquarters office Lahore, it will be 8M.bits/s.

j) Hotlines between Central control office, Divisional Control officers and important station.

6.3 Provide details of signalling and telecom works, equipment, machinery and other physical facilities required for the project.

Project Requirements

Manpower

The detail of manpower needed for execution of the project and for its operation after completion is given in Appendix-D & E and is summarized as under:-

Signalling

S.No.	Description	For Execution (man months) (Appendix-D)	For Operation (No. of Jobs) (Appendix-E)
1.	Administrative, Executive and Managerial	432	2
2.	Supervisory and Technical Staff	2880	34
3.	Clerical	720	10
4.	Skilled	3072	50
5.	Un-skilled	6336	88
6.	Others	4416	-
	Total	12948	184

Telecom

S.No.	Description	For Execution (man months) (Appendix-D)	For Operation (No. of Jobs) (Appendix-E)
1.	Administrative, Executive and Managerial	336	7
2.	Supervisory and Technical Staff	816	17
3.	Clerical	240	5
4.	Skilled	624	13
5.	Un-skilled	1296	27
6.	Others	-	-
	Total	3312	69

P-way

S.No.	Description	For Execution (man months) (Appendix-D)	For Operation (No. of Jobs) (Appendix-E)
1.	Administrative, Executive and Managerial	3	-
2.	Supervisory and Technical Staff	12	-
3.	Clerical	10	-
4.	Skilled	14	-
5.	Un-skilled	39	-
6.	Others	-	-
	Total	76	-

C.T.C

S.No.	Description	For Execution (man months) (Appendix-D)	For Operation (No. of Jobs) (Appendix-E)
1.	Administrative, Executive and Managerial	72	2
2.	Supervisory and Technical Staff	306	18
3.	Clerical	90	6
4.	Skilled	198	20
5.	Un-skilled	360	35
6.	Others	126	16
	Total	1152	97

Material

In order to meet with the requirements of project, the imported material such as power supply, interlocking, level crossing (manned and unmanned), auto block, cab signalling equipment, drop equipment & VoIP gateways will be procured through approved agencies while all the indigenious material will be manufactured in Railway's Signal Shops or arranged through open tenders.

The detail of imported, local equipment and machinery is given in Appendix-C, F & G.

6.4 Indicate governance issues of the sector relevant to the project and strategy to resolve them.

Not applicable

7. CAPITAL COST ESTIMATES

The cost of the project is based on the tender rates received in the year 2008 and have been updated incorporating escalation of rates due to market in fluctuation and currency exchange variation with a total financial outlay of Rs.31831.278 million including Foreign Exchange Component of Rs. 22478.979 million for signalling, Rs. 3217.256 million including foreign exchange component of Rs.1694.800 for telecom, Rs.4642.202 million including foreign exchange component of Rs 2313.673 million for P-way portion & Rs.2059.237 million including foreign exchange component of Rs1505.000 million for CTC at Multan and Lahore.

Year-wise/component wise physical activities.

S No	Description	Qty:	1st year	2nd year	3rd Year	4th Year
1	Provision of power supply equipment	26 stations	4	9	9	4
2	Interlocking equipment	26 stations	4	9	9	4
3	Level crossing equipment with advanced road warning system.	155 Nos	30	50	50	25
4	CTC equipment	2 Set	-	1 Set	1 Set	-
5	Road warning system at unmanned level crossings.	140 Nos	25	50	50	15
6	Auto Block equipment	670 Kms	125	225	225	95
7	ATP & Cab signaling	35 Loco	4	12	12	7

Year-wise/component-wise financial phasing

(Rs. In million)

S #o	Items	1st Year			2nd Year			3rd Year			4th Tear			Total		
A	External	Total	Local	FEC	Total	Local	FEC	Total	Local	FEC	Total	Local	FEC	Total	Local	FEC
1	Provision of power supply equipment	68.108	0.000	68108	229.239	0.000	229.239	198.380	0.000	198.38	123.437	0.000	123.437	619.164	0.000	619.164
2	Interlocking equipment	878.976	0.000	878.976	2115.308	0.000	2115.308	1830.555	0.000	1830.555	1139.013	0.000	1139.013	5713.344	0.000	5713.344
3	Level crossing equipment with advanced road warning system.	105.113	0.000	105.113	353.792	0.000	353.792	306.166	0.000	306.166	190.503	0.000	190.503	955.574	0.000	955.574
4	CTC equipment	0.000	0.000	0.000	349.112	0.000	349.112	302.116	0.000	302.116	187.983	0.000	187.983	942.934	0.000	942.934
5	Road warning system at unmanned level crossings.	15.223	0.000	15.223	52.248	0.000	52.248	45.215	0.000	45.215	28.134	0.000	28.134	141.120	0.000	141.120
6	Auto Block equipment	663.300	0.000	663.300	2232.547	0.000	2232.547	1932.012	0.000	1932.012	1202.141	0.000	1202.141	6030.000	0.000	6030.000
7	Cab signaling	53.973	0.000	53.973	181.664	0.000	181.664	157.209	0.000	157.209	97.190	0.000	97.190	490.665	0.000	490.665
8	Other imported items (Item 9 to 16 of Appendix-C)	271.148	0.000	271.148	912.634	0.000	912.634	789.780	0.000	789.780	491.419	0.000	491.419	2464.981	0.000	2464.981
9	Training, system Engg, installation and commissioning, SOM for 2 years (Item 17 to 20 of Appendix-C)	563.332	0.000	563.332	1896.072	0.000	1896.072	1640.831	0.000	1640.831	1020.962	0.000	1020.962	5121.196	0.000	5121.196
	Total (A)	2619.173	0.000	2619.173	8322.616	0.000	8322.616	7202.264	0.000	7202.264	4480.782	0.000	4480.782	22478.978	0.000	22478.978
B	**Internal**															
10	Cost of local material, services, CD and other charges and inland freight (Item-6 to 8 & 12 to 13 of Appendix-B)	695.271	695.271	0.000	2340.156	2340.156	0.000	2025.135	2025.135	0.000	1260.084	1260.084	0.000	6320.646	6320.646	0.000
11	Cost of building (Appendix-F)	45.264	45.264	0.000	152.350	152.350	0.000	131.841	131.841	0.000	82.034	82.034	0.000	411.489	411.489	0.000
12	Establishment charges (Appendix-D)	82.159	82.159	0.000	276.533	276.533	0.000	239.307	239.307	0.000	148.902	148.902	0.000	746.901	746.901	0.000
13	Logistic (Appendix-G)	25.667	25.667	0.000	86.390	86.390	0.000	74.760	74.760	0.000	46.517	46.517	0.000	233.334	233.334	0.000
	Total (B)	848.361	848.361	0.000	2855.429	2855.429	0.000	2471.043	2471.043	0.000	1537.537	1537.537	0.000	7712.370	7712.370	0.000
	Total (A+B)	3467.534	848.361	2619.173	11178.045	2855.429	8322.616	9673.307	2471.043	7202.264	6018.319	1537.537	4480.782	30191.348	7712.370	22478.978
	Contingencies @ 3%	82.732	82.732	0.000	278.459	278.459	0.000	240.974	240.974	0.000	149.140	149.14	0.000	752.105	752.105	0.000
	Total(A+B+3%)	3550.266	931.093	2619.173	11456.504	3133.888	8322.616	9914.281	2712.017	7202.264	6167.459	1686.677	4480.782	30943.453	8464.475	22478.978
14	Escalation charges @ 6.5% for 2nd year,13% for 3rd year & 19.5% for 4th year	0.000	0.000	0.000	203.703	203.703	0.000	352.622	352.622	0.000	329.058	329.058	0.000	885.383	885.383	0.000
	G. Total	6738.978	2583.761	4155.217	11660.207	3337.591	8322.616	10266.903	3064.639	7202.264	6496.517	2015.735	4480.782	31828.836	9349.858	22478.978

Calculations of Escalation

A) Signal Portion **(Rs. In Million)**

Year	Capital Cost							
	Local	FEC	Total	Escalation charges				G. Total
				%age	Local	FEC	Total	
2014-15	931.342	4973.475	5904.817	-	-	-	0.000	5904.817
2015-16	3134.728	7282.290	10417.018	6.5	203.757	0.000	203.757	10620.775
2016-17	2712.744	6301.981	9014.725	13	352.654	0.000	352.654	9367.379
2017-18	1687.928	3921.233	5609.161	19.5	329.146	0.000	329.146	5938.307
Total	8466.742	22478.979	30945.721		885.557		885.557	31831.278

B) Telecom Portion **(Rs. In Million)**

Year	Capital Cost							
	Local	FEC	Total	Escalation charges				G. Total
				%age	Local	FEC	Total	
2014-15	151.694	455.030	606.724	-	-	-	-	606.724
2015-16	496.453	501.480	997.933	6.5%	32.269	-	32.269	1030.202
2016-17	482.663	487.550	970.213	13%	62.746	-	62.746	1032.959
2017-18	248.226	250.740	498.966	19.5%	48.404		48.404	547.371
Total	1379.036	1694.800	3073.836		143.420	-	143.420	3217.256

C) P-way Portion **(Rs. In Million)**

Year	Capital Cost							
	Local	FEC	Total	Escalation charges				G. Total
				%age	Local	FEC	Total	
2014-15	231.884	504.404	736.288	-	-	-	-	736.288
2015-16	780.482	752.656	1533.138	6.5	50.731	-	50.731	1583.869
2016-17	675.418	651.337	1326.755	13	87.804	-	87.804	1414.559
2017-18	420.259	405.276	825.535	19.5	81.951	-	81.951	907.486
Total	2108.043	2313.673	4421.716		220.486	-	220.486	4642.202

D) C.T.C Portion **(Rs. In Million)**

Year	Capital Cost							
	Local	FEC	Total	Escalation charges				G. Total
				%age	Local	FEC	Total	
2014-15	384.220	1109.938	1494.158	-	-	-	-	1494.158
2015-16	164.665	395.062	559.727	3.25	5.352	-	5.352	565.079
Total	548.885	1505.000	2053.885		5.352	-	5.352	2059.237

SUMMERY OF ESCALATION SIGNAL, TELECOM, P-WAY & CTC PORTION (A+B+C+D)

(Rs. In Million)

Year	Capital Cost							
	Local	FEC	Total	Escalation charges				G. Total
				%age	Local	FEC	Total	
2014-15	1699.140	7042.847	8741.987	-	-	-	-	8741.987
2015-16	4576.328	8931.488	13507.816	6.5/ 3.25	292.109	-	292.109	13799.925
2016-17	3870.825	7440.868	11311.693	13	503.204	-	503.204	11814.897
2017-18	2356.413	4577.249	6933.662	19.5	459.501	-	459.501	7393.163
Total	12502.706	27992.452	40495.158		1254.814	-	1254.814	41749.972

B) Year wise Estimation of Physical Activities

A) Signal Portion

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	11	931.342	4973.475	5904.817
2015-16	36	3134.728	7282.290	10417.018
2016-17	35	2712.744	6301.981	9014.725
2017-18	18	1687.928	3921.233	5609.161
Total:	100	8466.742	22478.979	30945.721

B) Telecom Portion

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	11 %	151.694	455.030	606.724
2015-16	36 %	528.722	501.480	1030.202
2016-17	35 %	545.409	487.550	1032.959
2017-18	18 %	296.631	250.740	547.371
Total:	100	**1522.456**	**1694.800**	**3217.256**

C) P-way Portion

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	11 %	231.884	504.404	736.288
2015-16	36 %	780.482	752.656	1533.138
2016-17	35 %	675.418	651.337	1126.755
2017-18	18 %	405.259	405.276	825.535
Total:	100	2093.043	2313.673	4221.716

SUMMERY OF PHYSICAL ACTIVITIES SIGNAL, TELECOM & P-WAY (A+B+C)

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	11 %	1314.920	5932.909	7247.829
2015-16	36 %	4411.663	8536.426	12948.089
2016-17	35 %	3870..825	7440.868	11311.693
2017-18	18 %	2356.413	4577.249	6933.662
Total:	100	11953.821	26487.452	38441.273

D) CTC Portion

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	70 %	384.220	1109.938	1494.158
2015-16	30 %	164.665	395.062	559.727
Total:	100	548.885	1505.000	2053.885

Capital Cost Estimates

The cost of project and other related facilities, included in the PC-I proforma has been calculated as under: (See Appendix-B for the abstract estimated cost)

A) Signal Portion

Rs. In Million

Description	Cost
Local	9352.298
Foreign Exchange Component	22478.980
Total	**31831.278**

B) Telecom Portion

Rs. In Million

Description	Cost
Local	1522.456
Foreign Exchange Component	1694.800
Total	**3217.256**

C) P-way Portion

Rs. In Million

Description	Cost
Local	2328.529
Foreign Exchange Component	2313.673
Total	**4642.202**

D) CTC Portion

Rs. In Million

Description	Cost
Local	554.237
Foreign Exchange Component	1505.000
Total	**2059.237**

Summery of Capital Cost Signal, Telecom , P-way & CTC (A+B+C+D)

Rs. In Million

Description	Cost
Local	12502.706
Foreign Exchange Component	27992.452
Total	**40495.158**

Say (FEC) Rs.27992.452 million = 279.925 million US$ @ 1 US$ = Rs.100/-

8. ANNUAL OPERATING COST AND MAINTENANCE COST AFTER COMPLETION OF PROJECT. (See Appendix-E)

(Rs. In Million)

Description	Signal	Telecom	CTC	Total
Local	80.301	24.924	52.243	155.468
Foreign Exchange Component	70.500	5.000	5.000	80.500
Total	**150.801**	**29.924**	**57.243**	**237.968**

Break up of Recurring/Operating Cost

(Rs. In Million)

Description	Signal	Telecom	CTC	Total
Pay of Officers & Staff	73.067	22.924	49.243	145.234
Staff saving due to closing of stations	-34.766	-	-	-34.766
Spares parts	70.500	5.000	5.000	80.500
Fuel and Power	42.000	2.000	3.000	47.000
Total	**150.801**	**29.924**	**57.243**	**237.968**

9 DEMAND AND SUPPLY ANALYSIS

The signalling & telecom system, on Lodhran (excl) – Kotri, section is old and obsolete. The mechanical signalling at Samasata, Khanpur, Rohri, Tando Adam, Hyderabad, Kotri, was provided before independence while the same at Bhawalpur, Mubarikpur, Dera Nawab Sahib, Rahimyar Khan, Sangi, Oderolal, Allahdino Sand, Detha, was provided during 1970, 1975-1980 and 1990-1992. All relay interlocking at Channi goth, Liaqatpur, Feroza, Jetha Bhutta, Kot Semaba, Sadikabad, Machigoth, Walhar, Reti, Daharki stations was provided in 1963. Block Signalling between stations was provided in 1954. The telecom system was installed in 1980-81. The signalling & telecom systems have outlived its useful life and there is a dire need of immediate replacement.

Signalling system on Lodhran-Multan- Khanewal-Shahdra Bagh section are old and obsolete and is being replaced with modern Computer Based Interlocking (CBI) and Automatic Block Signalling with Automatic Train Protection (ATP) under an ongoing project. This system has the capacity to control and monitor the trains from a central point provided the same is linked with Centralized Traffic Control (CTC) System. As a matter of fact the CTC should have been integral part of the project which was omitted at the time of preparation of the PC-I either through ignorance or a costly neglect.

The Government of Punjab, in line with the policies of Federal Government intends to install at least six coal fired power plants of 2x660 MW capacity each, requiring about 40 million tonnes of coal to be transported from port to up-country. There are also compelling demands of similar plants at Jamshoro, Lakhra, Faisalabad and Lalpir. The movement of such huge quantity of coal, even with 4000-4500 HP locomotives and 60 tonne capacity (pay load) high capacity wagons would not be possible within existing infrastructure constraints. The number of trains works out to about 50 each way requiring augmentation of line capacity which is limited due to mechanical signaling system between Lodhran and Kotri. As such, the existing signaling system on Lodhran-Kotri section is to be replaced with computer based interlocking and auto block signaling system to increase capacity to meet with future requirements.

10. FINANCIAL PLAN

Source of Financing

(a) Equity

This project will be financed by the Government of Pakistan. The financial phasing is at **Appendix-I.**

(b) Debt

Not Applicable

(c) Grants along with sources

Not Applicable

(d) Weighted cost of capital

Not Applicable

11. PROJECT BENEFITS AND ANALYSIS

I) FINANCIAL

This is essentially a safety related project requiring replacement of old signalling, telecom & p-way gear to ensure safety of traveling public and improve efficiency of train operations and as such does not necessitate of financial analysis.

However the same has been carried out at an interest rate of 12%, the N.P.V after 20 years is Rs.24032 millions. The internal rate of return after 20 years is 12.82%. The project is thus financially viable. The project benefit & summary is shown at Appendix-K/II, K/III. Financial & Economic analysis has been shown at Appendix-K & K/I.

II) ECONOMIC

a) Increase the transportation capacity.
b) Reducing the chances of accidents considerably.
c). Efficient and punctual train services.
d). Quick and easy operation
e) Enhance safety and speed of trains.
f) Saving in fuel cost.
g) Overall good financial impact.

III) SOCIAL BENEFITS WITH INDICATORS

– Enhanced safety for the traveling public.
– Restoration of confidence of clients on Railway services.
– Goodwill of Public through efficient and punctual train services.

– Reducing the environmental pollution as reliance on road traffic will be reduced.
– Passenger information system including internal information for staff.
– Protection of manned level crossings.
– Road Warning Signals at unmanned level crossings.

IV) EMPLOYMENT GENERATION (DIRECT AND INDIRECT)

Implementation and execution

i.	For Signal	329 Nos (Appendix- D)
ii.	For Telecom	69 Nos (Appendix- D)
iii.	For P-Way	76 Nos (Appendix-D)
iv.	For CTC	64 Nos. (Appendix-D)

(There will be an opportunity of considerable requirement of staff and labour for execution of the work creating indirect employment).

ii) Operation of Project (Appendix-E)

Signal Portion

Addition	184 Nos.
Reduction	109 Nos.
Net	75 Nos.

Telecom Portion

Addition	60 Nos.
Reduction	-
Net	60 Nos

CTC Portion

Addition	95 Nos.
Reduction	-
Net	95 Nos

V) ENVIRONMENTAL IMPACT

It is an established fact that Railway is a preferred mode of transport as compared to road from environmental point of view. Therefore by diverting more traffic from road to rail, it will help in reducing both air as well as noise pollution and is considered most economical for mass transit.

VI) IMPACT OF DELAYS ON PROJECT COST AND VIABILITY

Cost of the project may increase with passage of time according to the inflation in the market. Safety of the traveling public shall be at risk with the delay in execution of the project.

12. A. IMPLEMENTATION SCHEDULE

The Project shall be completed within 48 months, as indicated below provided required funds are made available. Bar chart is attached as “Appendix-J”.

a) Signal Portion

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	11	931.342	4973.475	5904.817
2015-16	36	3134.728	7282.290	10417.018
2016-17	35	2712.744	6301.981	9014.725
2017-18	18	1687.928	3921.233	5609.161
Total:	100	8466.742	22478.979	30945.721

b) Telecom Portion

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	11 %	151.694	455.030	606.724
2015-16	36 %	528.722	501.480	1030.202
2016-17	35 %	545.409	487.550	1032.959
2017-18	18 %	296.631	250.740	547.371
Total:	100	**1522.456**	**1694.800**	**3217.256**

c) P-way Portion

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	11 %	231.884	504.404	736.288
2015-16	36 %	780.482	752.656	1533.138
2016-17	35 %	675.418	651.337	1126.755
2017-18	18 %	405.259	405.276	825.535
Total:	100	2093.043	2313.673	4221.716

SUMMERY OF PHYSICAL ACTIVITIES SIGNAL, TELECOM & P-WAY (a+b+c)

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	11 %	1314.920	5932.909	7247.829
2015-16	36 %	4411.663	8536.426	12948.089
2016-17	35 %	3870..825	7440.868	11311.693
2017-18	18 %	2356.413	4577.249	6933.662
Total:	100	11953.821	26487.452	38441.273

d) CTC Portion

(Rs. in million)

Year of Phasing	Physical Work (%)	Financial Requirement		
		Local	F.E.C	Total
2014-15	70 %	384.220	1109.938	1494.158
2015-16	30 %	164.665	395.062	559.727
Total:	100	548.885	1505.000	2053.885

B. RESULT BASED MONITORING (RBM) INDICATORS (SIGNAL)

S. No.	Input	Output	Outcome		Targeted Impact
			Base line indicator	Targets after completion of project	
1	Power Supply Equipment DG/Set, UPS, Batteries, Power Control	Complete installation according to parameters of CBI system.	High Operational, maintenance & fuel cost and heavy wear & tear due to old system.	Reduce the operational, maintenance & fuel cost.	It will increase the transportation capacity, enhance safety, reduce operational staff, store the activities of operators, speed of train. There will be saving in fuel cost, reduction in the chances of accident due to efficient and punctual train service. It will enhance the safety of public / road users at manned and un-manned level crossing, resultantly overall good financial impact of Railway and good will of public.
2	Interlocking Equipment Interlocking equipment, point machines, track circuits, color light signals, cables, lightening protection etc.	Complete replacement with modern signalling system (CBI)	Speed 96/100KMH, Slow operation, safety in hands of men, time consuming, manual operation, less line capacity, all gears in open yard, and prone to interference & tress passers.	Speed 120/160KMH, quick & easy operation, enhance the safety, increase in line capacity, efficient & punctual train services, improve the visibility of signals, free from interfering and tress passer chances.	
3	CTC equipment	Complete section will be provided with CTC	It does not exist	Reduce the operational staff, operator activities which can be stored to find out actual reason of any mishap.	
4	Level Crossing Equipment at manned level crossing	All manned level crossing will be provided with advance warning signalling system.	Only important level crossing in yard and block section have been provided with signaling system.	Enhance the safety of public/road users.	
5	Road warning system at un-manned level crossing	All un-manned level crossing will be provided with road warning	No signalling warning system exists.	Enhance the safety of public / road user.	

		signalling system.			
6	Auto Block Equipment Color light signals, cables, track circuits	Complete section will be provided with Auto Block equipment.	It does not exist	Enhancement of the Speed & increase in Line Capacity.	
7	Cab Signalling	35 locos will be provided with cab signalling.	It does not exist	Train will automatically stop in case driver does not apply brakes approaching to red signals.	

RESULT BASED MONITORING (RBM) INDICATORS (TELECOM)

S. No.	Input	Output	Outcome		Targeted Impact
			Base line indicator	Targets after completion of project	
1	Line Equipment 10 G.B.	Will provide optimized and latest optic fiber cable based on VoIP technology.	Ensuring reliability, security and increased data rate.	Provision of Internet, Intranet, video conference and reliable communication facilities.	To increase the number of voice channels to carry the increased load of the users. Increase in data rates ensuring faster communication. Internet, Intranet, video conference facilities at headquarters office, ministry, divisions, stations and official residences. Station to Station, locomotive driver, guard, station master and controller's safe and reliable communication for safe train
2	Line Equipment 622/155 M.B.	Will provide optimized and latest optic fiber cable based on VoIP technology.	Ensuring reliability, security and increased data rate.	Provision of Internet, Intranet, video conference and reliable communication facilities.	
3	Train Control Console	Secure, latest mode of communication between ASM and section controller	Security and reliability of train operation.	Enhanced and improved security and reliability of train operation.	
4	VHF Console	Secure, latest mode of communication between ASM, drive and section controller.	Security and reliability of train operation.	Enhanced and improved security and reliability of train operation.	
5	Telephone gateway (VOIP gateway)	Will provide optimized and latest optic fiber cable based on VoIP	Ensuring reliability, security and increased data	Provision of Internet, Intranet, video conference and	

		technology.	rate and trunk circuits.	reliable communication facilities.	operations

13. MANAGEMENT STRUCTURE AND MAN POWER REQUIREMENTS INCLUDING SPECIALIZED SKILLS DURING CONSTRUCTION AND OPERATIONAL PHASES

(a) Give detailed list of manpower required by gender for implementation of the project.

Signal

S.No.	Description	For Execution (man months) (Appendix-D)	For Operation (No. of Jobs) (Appendix-E)
1.	Administrative Executive and Managerial	432	2
2.	Supervisory and Technical Staff	2880	34
3.	Clerical	720	10
4.	Skilled	3072	50
5.	Un-skilled	6336	88
6.	Others	4416	-
	Total	12948	184

Telecom

S.No.	Description	For Execution (man months) (Appendix-D)	For Operation (No. of Jobs) (Appendix-E)
1.	Administrative Executive and Managerial	336	7
2.	Supervisory and Technical Staff	816	17
3.	Clerical	240	5
4.	Skilled	624	13
5.	Un-skilled	1296	27
6.	Others	-	-
	Total	3312	69

P-way

S.No.	Description	For Execution (man months) (Appendix-D)	For Operation (No. of Jobs) (Appendix-E)
1.	Administrative Executive and Managerial	3	-
2.	Supervisory and Technical Staff	12	-
3.	Clerical	10	-
4.	Skilled	14	-
5.	Un-skilled	39	-
6.	Others	-	-
	Total	76	-

C.T.C

S.No.	Description	For Execution (man months) (Appendix-D)	For Operation (No. of Jobs) (Appendix-E)
1.	Administrative, Executive and Managerial	72	2
2.	Supervisory and Technical Staff	306	18
3.	Clerical	90	6
4.	Skilled	198	20
5.	Un-skilled	360	35
6.	Others	126	16
	Total	1152	97

(b) Likely shortage of manpower by occupation.

Not Applicable

(c) Steps to be taken to assure availability of manpower.

Not Applicable

(d) Approximate number of persons required to be trained per year (locally and abroad) and the kind of skills to be learnt.

About 16 persons shall be trained through abroad training and 50 persons shall be trained locally.

(e) Give total capital outlay, give the capital cost of mobilizing one worker for one shift.

Not Applicable

(f) Detailed analysis of estimation of the likely employment.

Not Applicable

14. ADDITIONAL PROJECTS/DECISIONS REQUIRED TO MAXIMIZE SOCIOECONOMIC BENEFITS FROM THE PROPOSED PROJECT

Old and obsolete signalling and telecom systems need to be replaced for achieving maximum benefits on the entire railways network as proposed in Para 6.1.3 and recommended to be given due priority.

NOTE:-

(INTEGRATION OF DISASTER RISK REDUCTION INTO DEVELOPMENT PROCESS)

Charges for Disaster Risk Reduction (DDR) has been included in PC-I (See Appendix-B).

Check list for Disaster Risk Reduction (DRR), Infrastructure Sector circulated vide No.5 (7) Misc/PP&H/PD/10 on 23 November 2010 as part of PC1 & PC2 is attached at Appendix-L.

15. CERTIFIED THAT THE PROJECT PROPOSAL HAS BEEN PREPARED ON THE BASIS OF INSTRUCTIONS PROVIDED BY THE PLANNING COMMISSION FOR THE PREPARATION OF PC-I FOR INFRASTRUCTURE SECTOR PROJECTS.

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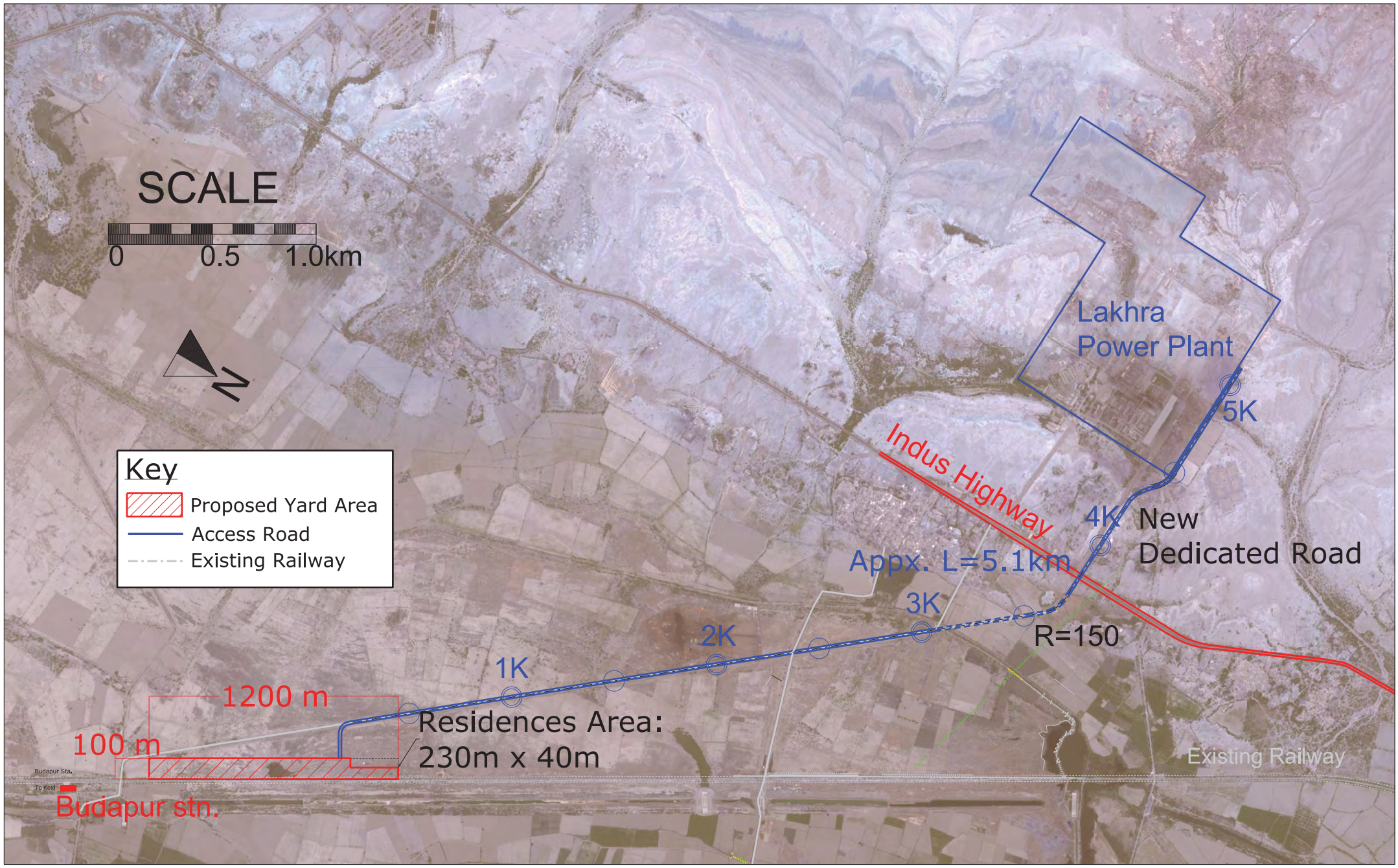
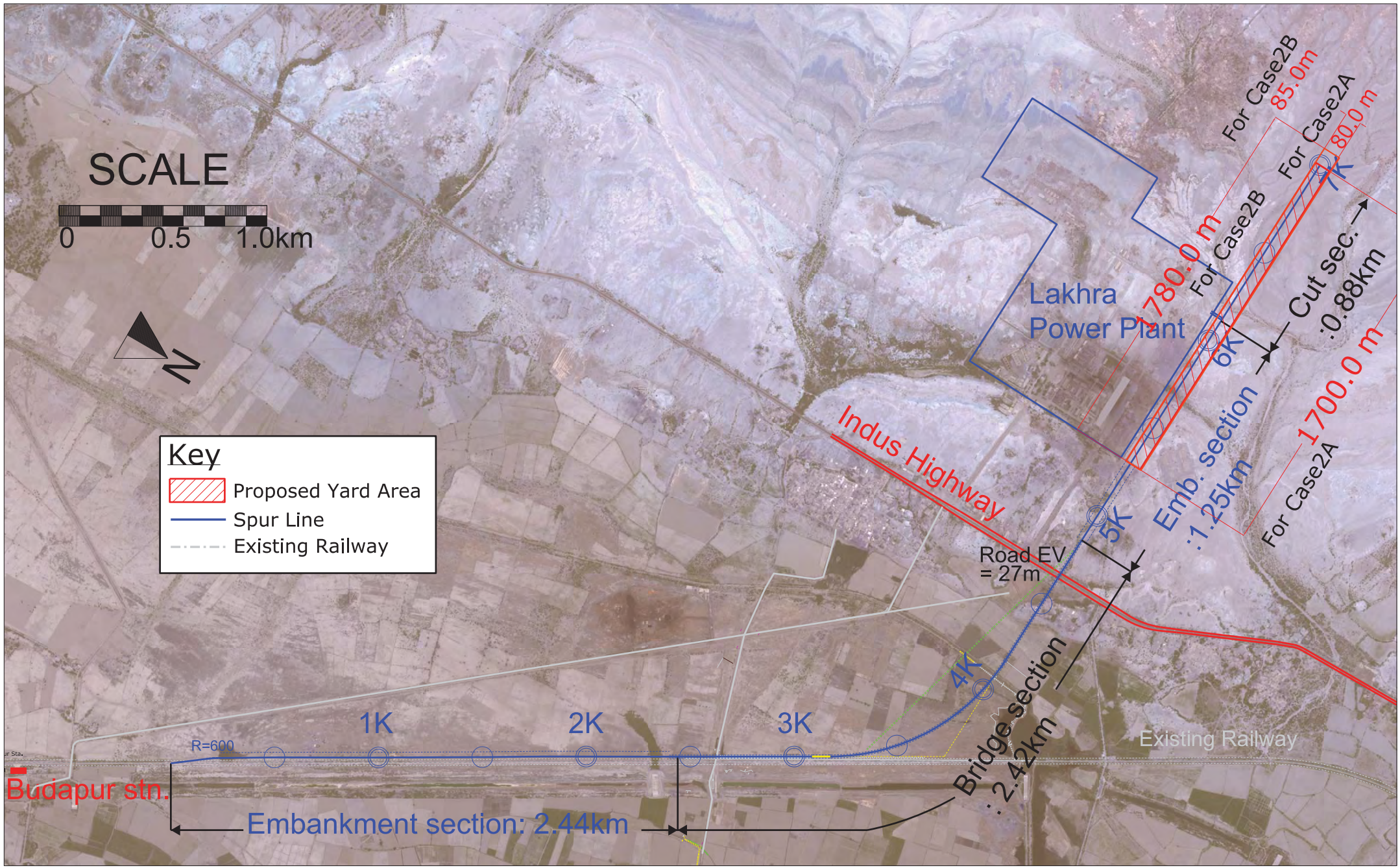
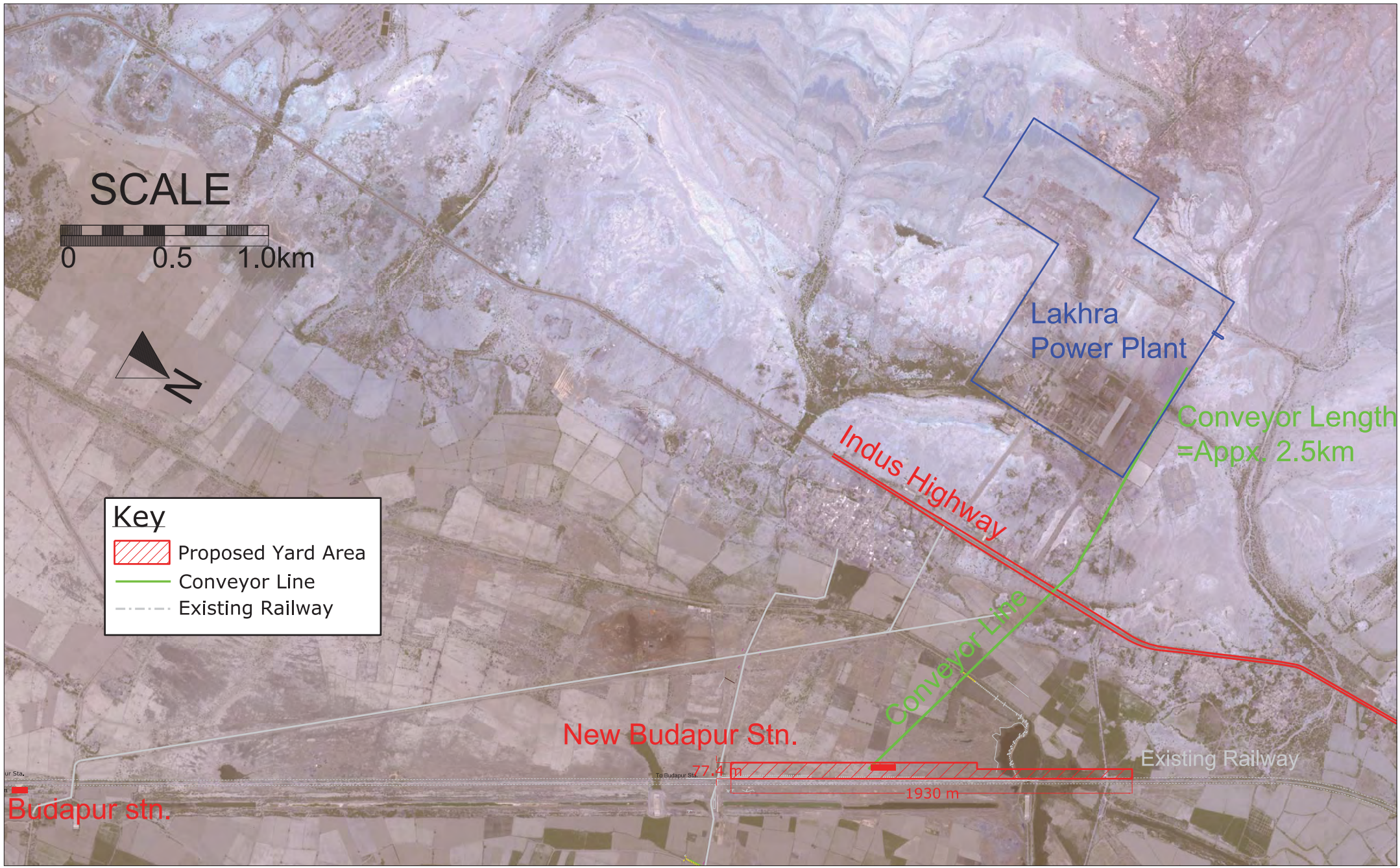
Appendix-5: Drawings



JAPAN INTERNATIONAL COOPERATION AGENCY	NIPPON KOEI CO., LTD. MITSUI CONSULTANTS CO., LTD.	OBSERVATIONS:	Preparatory Survey on Lakhra Coal Fired Thermal Power Plant Construction Project in Pakistan CONTENTS: Access Plan of Case-1 to Lakhra Power Plant (Dump Track Case)	PAGE: 1 OF 3 DATE: April 2015 DRAWN BY:



JAPAN INTERNATIONAL COOPERATION AGENCY	NIPPON KOEI CO., LTD. MITSUI CONSULTANTS CO., LTD.	OBSERVATIONS:	Preparatory Survey on Lakhra Coal Fired Thermal Power Plant Construction Project in Pakistan CONTENTS: Access Plan of Case-2A and 2B to Lakhra Power Plant (Railway Spur Line Case)	PAGE: 2 OF 3 DATE: April 2015 DRAWN BY:



JAPAN INTERNATIONAL COOPERATION AGENCY	NIPPON KOEI CO., LTD. MITSUI CONSULTANTS CO., LTD.	OBSERVATIONS:	Preparatory Survey on Lakhra Coal Fired Thermal Power Plant Construction Project in Pakistan CONTENTS: Access Plan of Case-3 to Lakhra Power Plant (Conveyor Belt Case)	PAGE: 3 OF 3 DATE: April 2015 DRAWN BY:

Appendix 6 PR Owned locomotives

Appendix 6.1 Key feature of Rolling Stock of Pakistan Railways

- ✧ No. of Pakistan Railways registered locomotives = 442 Nos.
- ✧ Present availability for passengers = 100 Nos. (Approximate)
- ✧ Present availability for freight = 50 Nos. (Approximate)
- ✧ Age condition = 50% fleet over aged (Approximate)
- ✧ Present usage rate of (locomotives) = 50% (Approximate)

- ✧ KC to KOT 3000 H.P. =2300 tons payload (Approximate)
- ✧ KOT to KNOT 2000 H.P. =1700 tons payload (Approximate)

Appendix 6.2 Key feature of diesel electric locomotives

S. No	Group of DE Locomotives	Class of DE Locomotives	Axle Load in tone/ tonnes	Type of Bogie Truck	Horse Power	DE Loco Model	Traction Motor Type/Horse Power
1	Group-I (23.3,22.86 & 19.3 tonnes engine axle load) DPU-30, HGMU-30, HGMU-30,AGE-30,RGE-24, ARU-20, DPU-20 & HAU-10	DPU-30	23.30	CO-CO	3550	CDK-9	ZD109BP 7/710
2		HGMU-30	20.00	CO-CO	3300	TV-6125-A	GM-D-77/637
3		GMU-30	19.16	CO-CO	3000	GT-26CW2	GM-D-77/637
4		AGE-30	22.76	CO-CO	3300	DE-DC-33CA	GE752AH-24/30/912
5		RGE-24	18.84	CO-CO	2400	C-24-71	GE752-AH/30/750
6		ARU-20	19.20	AIA-AIA	2000	DL-212	GE-752-C1,E-1,AF8/560
7		DPU-20	19.30	AIA-AIA	2460	CKD8D	ZD109BP/710
8		HAU-10	20.00	CO-CO	1050	HF-10A	Hitachi-HS-366-BR/121
9	Group-II (17.78 tonnes engine axle load)	-	-	-	-	-	-
10	Group-III (17.27 tonnes engine axle load) ARPW-20, HAU-20, HBU-20,PHA-20, GRU-20, GEU-20 & RGE-20	ARPW-20	19.20	AIA-AIA	2150	DL-500-C/FPD-7	GE,5GE-761-PA14/A19/450
11		HAU-20	17.26	CO-CO	2200	HFA-22A	Hitachi-HS-25141-O/R/281
12		HBU-20	17.50	CO-CO	2268	HFA-22B	Hitachi-HS-25141-O/R/395
13		PHA-20	17.50	CO-CO	2268	HFA-22B	Hitachi-HS-25141-O/R/395
14		GRU-20	17.50	CO-CO	2268	C-70-C	GES-5GE-761-A23/550
15		GEU-20	16.00	CO-CO	2150	U-20-C	GES-5GE-761-A23/500
16		RGE-20	16.70	CO-CO	2000	C20-71	GES-5GE-761-A23/550
17	Group-IV (16.76 tonnes engine axle load) GMU/GMCU-15 & GEU-15	GMU-15	14.24	CO-CO	1550	GL-22-C	GM's/D-29
18		GMCU-15	14.48	CO-CO	1650	G-22-CU	GM's/D-29
19		GEU-15	16.76	CO-CO	1650	U-15-C	GE's/5GE761-A19
20	Group-V (13.21 tonnes engine axle load) ALU-95 & ALU-12	ALU-95	12.80	CO-CO	950	DL-531	GE's/5GE761-A-10
21		ALU-12	12.80	CO-CO	1200	DL-535	GE's/5GE761-A-10

Appendix 6.3 Salient feature of High Capacity Goods Stock on the system

S.No	Code	Description	Dlag. No.	Total on system			Tare weight	Carr. Cap.	Load per Axle	Cubicle contents (inside)						Flexible Wheel Base		Rigid Wheel Base		Buffer to Buffer		Type of Trolley
										Length		Width		Height								
				PB	RB	Total	(Tonnes)			mm	0'-0"	mm	0'-0"	mm	0'-0"	mm	0'-0"	mm	0'-0"	mm	0'-0"	
1	ZBC	Covered Bogie	269	0	470	470	24.0	60.0	21	15500	50.9	2760	9.1	2605	8.5	11700	38.4	1850	6.1	16438	53.9	Ride Control
2	ZBFC	Bogie Wagon for Contalner	268	0	280	280	24.0	60.0	21	18600	61.0	2750	9.0		0.0	14600	47.9	1850	6.1	19538	64.1	
3	ZBFC (s)	Small Bogie Wagon for Contalner	273	0	156	156	19.2	61	21	12500	41.0	2750	9.0	1310	4.3	9100	29.9	1850	6.1	13847	4504	
4	ZBKC	High sided Open Top Wagon	271	0	814	814	22.6	60.0	20.65	13000	42.7	3080	10.1	2230	7.3	9700	31.8	1850	6.1	14438	47.4	
5	ZNRV	Brake Van	270	0	110	110	32.0	21.0	13.25	15000	49.2	3118	10.2	2780	9.1	10400	34.1	1850	6.1	16347	53.6	
Total				0	1830	1830																

Appendix 6.4 Salient feature of High Capacity Goods Stock 4 wheeled on the system

S.No	Code	Description	Total on system			Tare weight	Carrying capacity	Gross Weigh	Load per Axle	Cubicle contents (inside)						Wheel Base		Buffer to Buffer	
										Length		Width		Height					
			PB	RB	Total	(Tonnes)				mm	0'-0"	mm	0'-0"	mm	0'-0"	mm	0'-0"	mm	0'-0"
1	C	Covered Goods wagon	902	2867	3769	10.9	22	32.9	16.45	7163	23.5	2946.4	9.7	2445	8.0	4572	15.0	8433	27.7
2	CWA	Covered for cement	41	0	41	10.8	22	32.8	16.4	7163	23.5	2946.4	9.7	2454	8.1	4572	15.0	8433	27.7
3	CA	Covered for live stock	115	0	115	11.3	21	32.3	16.5	7163	23.5	2946.4	9.7	2394	7.9	4572	15.0	8433	27.7
4	KC	High sided open truck	322	1950	2272	10	22	32	16	7001	23.0	2845.0	9.3	1524	5.0	4572	15.0	8280	27.2
5	KCW	High sided wagon	8	0	8	9	20	29	14.5	7226	23.7	2857.5	9.4	1321	4.3	4572	15.0	8585	28.2
6	KCA	High sided truck fitted with angle	2	0	2	10.14	21	31.14	15.57	7163	23.5	2844.8	9.3	1676	5.5	4572	15.0	8433	27.7
7	**KCC**	**High sided wagon for coal**	**86**	**6**	**92**	**10.2**	**22.4**	**32.6**	**16.3**	**5944**	**19.5**	**2844.8**	**9.3**	**1600**	**5.3**	**3505**	**11.5**	**7213**	**23.7**
8	KK	Sugar cane wagon	12	0	12	8.6	15.2	23.8	11.9	5893	19.3	**2844.8**	9.3	2235	7.3	3658	12.0	7213	23.7
9	**KF**	**Low sided open truck**	**556**	**341**	**897**	**10.1**	**22**	**32.1**	**16.05**	**8382**	**27.5**	**2844.8**	**9.3**	**632**	**2.1**	**4877**	**16.0**	**9652**	**31.7**
10	KW	Ballast truck	122	0	122	10.18	21.3	31.48	15.74	6604	21.7	2997.2	9.8	1727	5.7	3505	11.5	7874	25.8
11	**V**	**Brake Van**	**21**	**237**	**258**	**11.3**	**-**	**11.3**	**16.3**	**2616**	**8.6**	**2743.2**	**9.0**	**2667**	**8.8**	**3505**	**11.5**	**8585**	**28.2**
12	FRC	Flat for container loading	14	662	676	7.5	24.5	32	16	5867	19.3	2946.4	9.7	177.8	0.6	3505	11.5	7213	23.7
13	**TO**	**Tank Wagon**	**102**	**2478**	**2580**	**12.13**	**19.7**	**31.83**	**15.92**	**7081**	**23.2**	**2168.5**	**-**		**0.0**	**4572**	**15.0**	**8432**	**27.7**
14	FD		36	3	39	10.1	22	32.1	16.05	8382	27.5	2844.8	9.3	632	2.1	4877	16.0	9652	31.7
15	**X**		**4**	**4**	**4**	**10.9**	**22**	**32.9**	**16.45**	**7163**	**23.5**	**2946.4**	**9.7**	**2445**	**8.0**	**4572**	**15.0**	**8433**	**27.7**
Total			2343	8544	10887														

Maximum permissible speed of Vacuum Braked Goods Stock is 45 MPH(i.e 72.405 KMPH) as per ref: SR-507 of Operating Manual.

Appendix 6.5 Salient feature of High Capacity Goods Stock 8 wheeled on the system

S. No	Code	Description	Total on system			Tare weight	Carrying capacity	Load per Axle	Cubicle contents (inside)						Flexible Wheel Base		Rigid Wheel Base		Buffer to Buffer		Type of Trolley
									Length		Width		Height								
			PB	RB	Total	(Tonnes)			mm	0'-0"	mm	0'-0"	mm	0'-0"	mm	0'-0"	mm	0'-0"	mm	0'-0"	
1	BC	Covered	2	134	136	21.7	43.7	16.35	12192	40.0	2845	9.3	2438	8.0	8535	28.0	1830	6.0	13462	44.2	Ride Control
2	BKC	High Sided Open Truck	45	204	249	20.6	44.7	16.33	12192	40.0	2845	9.3	1524	2.0	8535	28.0	1830	6.0	13462	44.2	Diamond
3	BKF	Bogie low side wagon	46	110	156	20.5	44.7	16.3	13716	45.0	2845	9.3	775	2.5	10058	33.0	1830	6.0	14986	49.2	Diamond
4	BKFC	Modified bogie low side wagon	0	208	208	20.11	43	15.78	14996	49.2	2896	9.5	762	2.5		0.0	1830	6.0	14986	49.2	Diamond
5	ZBKFC	Modified bogie low side wagon	0	62	62	20.11	43	15.78	14996	49.2	2896	9.5	762	2.5		0.0	1830	6.0	14986	49.2	Diamond
6	BFC	Container	0	114	114	19.05	43.5	15.75	13716	45.0	2835	9.3		0.0	10058	33.0	1830	6.0	14986	49.2	Diamond
7	BFR/C	Modified flat truck with twist locks	**154**	**91**	**245**	**19.3**	**44.7**	**15.75**	**13716**	**45.0**	**2235**	**7.3**		**0.0**	**10058**	**33.0**	**1830**	**6.0**	**14986**	**49.2**	Diamond
8	BFR	Flat truck	97	1	98	19.4	45.7	16.28	13716	45.0	**2845**	**9.3**		0.0	10058	33.0	1830	6.0	14986	49.2	Diamond
9	MBFR	Flat truck for Militry	**0**	**328**	**328**	**31.5**	**66**	**16.25**	**13716**	**45.0**	**3048**	**10.0**		**0.0**	**8535**	**28.0**	**1524**	**5.0**	**14986**	**49.2**	Diamond
10	BFU	Crocodile truck	12	7	19	30.8	60.6	20.85	17374	57.0	2743	9.0		0.0	13716	45.0	1830	6.0	18644	61.2	Diamond
11	MBFU	**Crocodile truck for Miltry**	**45**	**18**	**63**	**24.9**	**40.1**	**22.48**	**14326**	**47.0**	**2743**	**9.0**		**0.0**	**10668**	**35.0**	**1830**	**6.0**	**15595**	**51.2**	Diamond
12	BKW	Truck for Ballast	476	27	503	22.3	42.7	16.25	10668	35.0	2540	8.3	1765	5.8	7163	23.5	1830	6.0	11938	39.2	Diamond
13	**BFD**	**Dummy Truck for crain jib**	**4**	**15**	**19**	**20.5**	**44.7**	**16.3**	**13716**	**45.0**	**2845**		**775**	**2.5**	**10058**	**33.0**	**1830**	**6.0**	**14986**	**49.2**	Diamond
14	BKL	Low sided wagon	1	0	1									0.0		0.0		0.0		0.0	
15	ZBTO	Bogie tank wagon (Air Brake)	**0**	**525**	**525**	**26.9**	**37.6**	**15.79**	**12680**	**41.6**				**0.0**	**8535**	**28.0**	**1830**	**6.0**	**14224**	**46.7**	Ride Control
16	BTO	Bogie tank wagon	**0**	**705**	**705**	**26.9**	**37.6**	**15.79**	**12954**	**42.5**				**0.0**	**8535**	**28.0**	**1830**	**6.0**	**14224**	**46.7**	Ride Control
17	ZRRV	Bogie Brake Van	**0**	**6**	**6**	**36.6**	**45**	**20.4**		**0.0**				**0.0**		**0.0**		**0.0**		**0.0**	
18	URRV	Bogie Brake Van	**0**	**12**	**12**	**36.6**	**45**	**20.4**		**0.0**				**0.0**		**0.0**		**0.0**		**0.0**	
		Total	882	2567	3449																

Maximum permissible speed of Vacuum Braked Goods Stock is 45 MPH (i.e 72.405 KMPH) as per ref: SR-507 of Operating Manual.

Appendix 6.6 Turnout of DE locomotives in last five years after major schedule

LOCOMOTIVES TURNED OUT IN LAST FIVE YEARS AFTER MAJOR SCHEDULES

YEARS	2008-09	2009-10	2010-11	2011-12	2012-13	TOTAL
KC	29	20	8	12	10	79
CDL/W	94	96	89	73	51	403
MGPR	24	21	17	14	12	88
TOTAL	147	137	114	99	73	570

Appendix 6.7 Procurement Plan of Rolling Stock

S.No.	Projects	Estimated Cost (Rs. In Million) As Per PC-1	Expenditures (Rs. In Million)	Remarks
1	Pilot Project for Manufacture of 05 (3000 H.P) Locomotives	955.00		Under execution.
2	Procurement/ Manufacture of 75 Nos new DE Locomotives	45,430.951		Revised PC-1 has been put to CME/Loco for necessary correction.
3	Procurement of 150 Diesel Electric Locomotives.	55,488.00		Case is in the court, wating of court decision.
4	Procurement/Manufacture of 800 High Capacity Hopper Wagons.	9,500.00		PC-1 has been submitted to Ministry of Railways on 01-07-2014.
5	Rehabilitation of 300 Nos. Traction Motors.	1,650.00		PC-1 submitted to Ministry of Railways on 16-05-2014.

Appendix 6.8 Out Turn Target of Base Workshops

BACK SHOPS	CLASS OF LOCOMOTIVES OVERHAULED	OUT TURN TARGET / MONTH
Central Diesel Locomotives Workshops Rawalpindi	AGE-30,DPU-20/30,RGE-20,RGE-24,HBU-20,PHA-20,HAU-20, GMU-15,GMCU-15&GEU-15	08 Nos.
Diesel Shops Karachi	GMU-30 & HGMU-30	02 Nos.
Loco Shops Moghalpura	GRU-20, ALU-12 & ALU-95	02 Nos.

Appendix 7 : Data list of PR mainline; Karachi City station– Kotri junction and branch line; Kotri junction– Budapur station

Appendix 7.1 List of stations

S.No.	Station	Code	KM	Distance Between	Remarks
Karachi to Landhi					
1	Karachi Cantt.	KC	8.62		Double Line
2	Departure Yard	DPY	14.24	5.62	Double Line
3	Drigh Road	DID	18.62	4.38	Double Line
4	Drigh Colony	DCL	20.53	1.91	Double Line
5	Malir Colony	MLCL	23.54	3.01	Double Line
6	Malir	MXB	25.29	1.75	Double Line
7	Landhi	LND	28.96	3.67	Double Line
Landhi to Jhimpir					
1	Landhi	LND	28.96	-	Double Line
2	Jumma Goth	JMTH	34.98	6.02	Double Line
3	Bin Qasim	BQM	42.06	7.08	Double Line
4	Badal Nala	BDNL	45	2.94	Double Line
5	Gaddar	GDR	50.94	5.94	Double Line
6	Dhabeji	DBJ	60.19	9.25	Double Line
7	Ranpathani	RPN	78.6	18.41	Double Line
8	Jungshahi	JGS	90.52	11.92	Double Line
9	Braudabad	BKB	107.13	16.61	Double Line
10	Jhimpir	JHP	123.33	16.2	Double Line
JHIMPIR TO KOTRI					
1	Jhimpir	JHP	123.45	-	Double line
2	Meeting	MTG	143	19.63	Double line
3	Bholari	BOL	163.9	20.51	Double line
4	Kotri	KOT	173.74	9.86	Double line
KOTRI TO BUDHAPUR					
1	Kotri	KOT	0	-	Single Line
2	Sindh University	SDUT	7.68	7.68	Single Line
3	Cadet College Petaro	CCQ	20.35	12.67	Single Line
4	Unar Pur	UNR	32.13	11.78	Single Line
5	Buda Pur	BDP	40.31	8.18	Single Line

Appendix 7.2 List of rails

S.No	Kilometer		Length	Type of Rail	Rail Length	Jointed/ CWR/ LWR	Manufacturing year	Year Laid	Condition of Rails (USED, Wheel burnt, worm out etc with numbers and location)
	From	To	(Km)						
Karachi to Landhi									
UP LINE									
1	7.84	9.42	1.58	90R	42'	Jointed		1970	
2	9.42	9.49	0.07	100RE	42'	Jointed		1982-83	
3	9.49	9.63	0.14	90R	42'	Jointed		1970	Points & crossing
4	9.63	10.28	0.65	100RE	42'	Jointed		1982-83	
5	10.28	10.35	0.07	90R	42'	Jointed		1970	Points & crossing
6	10.35	10.56	0.21	100RE	42'	Jointed		1982-83	
7	10.56	10.7	0.14	90R	42'	Jointed		1971	Points & crossing
8	10.7	11.84	1.14	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
9	11.84	11.98	0.14	100RE	42'	Jointed		1970	L-Xing No.5
10	11.98	13.98	2	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
11	13.98	14.07	0.09	90R	42'	Jointed		1970	Point No. 3a DPY
12	14.07	14.77	0.7	UIC-54	8 Rail panel	Jointed	Jul-06	1982-83	
13	14.77	15	0.23	90R	42'	Jointed		1970	Point No. 5a DPY Point No. 8a DPY
14	15	17.98	2.98	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
15	17.98	18	0.02	100RE	42'	Jointed		1982-83	Old L-xing 7 PAF
16	18	18.21	0.21	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
17	18.21	18.28	0.07	90R	42'	Jointed		1970	Point No.1a DID
18	18.28	18.35	0.07	100RE	42'	Jointed		1982-83	
19	18.35	18.42	0.07	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
20	18.42	18.56	0.14	90R	42'	Jointed		1970	Double Slip Point No 3a
21	18.56	19.28	0.72	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
22	19.28	19.42	0.14	90R	42'	Jointed		1970	Point No. 15a & b
23	19.42	19.7	0.28	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
24	19.7	19.84	0.14	90R	42'	Jointed		1970	Point No.8 & L-xing No.8
25	19.84	21.21	1.37	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
26	21.21	21.42	0.21	100RE	42'	Jointed		1982-83	Colony gate
27	21.42	22.98	1.56	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
28	22.98	23.07	0.09	100RE	42'	Jointed		1982-83	L-xing No.10
29	23.07	23.35	0.28	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
30	23.35	23.63	0.28	90R	42'	Jointed		1970	Points No. 2a & 3a MLCL
31	23.63	24.84	1.21	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
32	24.84	24.91	0.07	90R	42'	Jointed		1970	X-over 2a MXB
33	24.91	25.28	0.37	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
34	25.28	25.35	0.07	90R	42'	Jointed		1970	Point No.3a MXB
35	25.35	25.42	0.07	100RE	42'	Jointed		1982-83	
36	25.42	25.98	0.56	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
37	25.98	26.07	0.09	90R	42'	Jointed		1970	Point No.5a MXB
38	26.07	26.14	0.07	100RE	42'	Jointed		1982-83	
39	26.14	26.42	0.28	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
40	26.42	26.56	0.14	90R	42'	Jointed		1970	Point No. 7a
41	26.56	27.07	0.51	UIC-54	8 Rail panel	Jointed	Jul-06	2008	
42	27.07	27.85	0.78	100RE	42'	Jointed		1982-83	
DN LINE									
1	7.84	9.63	1.79	90R	42' & 39-36	Jointed	-	1970	
2	9.63	10.28	0.65	100RE	42'	Jointed		1982-83	
3	10.28	10.63	0.35	90R	42'	Jointed		1970	
4	10.63	13.98	3.35	100RE	42' & 36"	Jointed		1982-83	
5	13.98	14	0.02	90R	42'	Jointed		1970	
6	14	14.77	0.77	100RE	42'	Jointed		1982-83	
7	14.77	15	0.23	90R	42'	Jointed		1970	
8	15	18.28	3.28	100RE	42'	Jointed		1982-83	
9	18.28	18.49	0.21	90R	42'	Jointed		1970	
10	18.49	19.21	0.72	100RE	42'	Jointed		1982-83	
11	19.21	19.77	0.56	90R	42'	Jointed		1970	
12	19.77	23.35	3.58	100RE	42'	Jointed		1982-83	
13	23.35	23.42	0.07	90R	42'	Jointed		1970	
14	23.42	24.77	1.35	100RE	42'	Jointed		1982-83	
15	24.77	24.91	0.14	90R	42'	Jointed		1970	
16	24.91	25.21	0.3	100RE	42'	Jointed		1982-83	
17	25.21	25.49	0.28	90R	42'	Jointed		1970	
18	25.49	26.14	0.65	100RE	42'	Jointed		1982-83	
19	26.14	26.28	0.14	90R	42'	Jointed		1970	
20	26.28	26.42	0.14	100RE	42'	Jointed		1982-83	
21	26.42	26.56	0.14	90R	42'	Jointed		1970	
22	26.56	27.85	1.29	100RE	42'	Jointed		1982-83	

S.No	Kilometer		Length	Type of Rail	Rail Length	Jointed/ CWR/ LWR	Manufacturing year	Year Laid	Condition of Rails (USED, Wheel burnt, worm out etc with numbers and location)
	From	To	(Km)						
Landhi to Jhimpir									
UP LINE									
1	27.94	29/70	1.76	100RE	42'	Joined	1979/81	1984	
2	29.7	40.75	11.05	UIC-54	84'	LWR	2005	Jun-05	
3	40.75	85.35	44.6	UIC-54	42'	LWR	2006	Jul-06	
DN LINE									
1	27.94	29.7	1.76	100RE	42'	Joined	1978,79,81	1983	
2	29.7	67.4	37.7	UIC-54	42'	LWR	2008	Sep-08	
3	67.4	73.04	5.64	100RE	42'	LWR	1981	1982	
4	73.04	75.6	2.56	UIC-54	42'	LWR	2005	2007	
5	75.6	85.33	9.73	100RE	42'	LWR	2007	2008	
UP LINE									
1	85.35	127.2	41.85	UIC-54	42'+84'	LWR	2005	2006	
DN LINE									
1	85.35	89.7	4.35	100RE	42'	LWR	1980	1981	
2	89.7	92.37	2.67	100RE	42'	LWR	1980	1983	
3	92.37	98.93	6.56	100RE	42'	LWR	1980	1980	
4	98.93	100.35	1.42	100RE	42'	LWR	1982	1982	
5	100.35	105.5	5.15	100RE	42'	LWR	1970	1970	
6	105.5	106.87	1.37	100RE	42'	LWR	1983	1983	
7	106.87	114.7	7.83	100RE	42'	LWR	1982	1982	
8	114.7	116.07	1.37	100RE	42'	LWR	1985	1985	
9	116.07	119.91	3.84	100RE	42'	LWR	1982	1982	
10	119.91	120	0.09	100RE	42'	LWR	1983	1983	
11	120	123	3	UIC-54	42'	LWR	2009	Oct-09	
12	123	124.79	1.79	100RE	42'	LWR	1983	1983	
13	124.79	127.2	2.41	100RE	42'	LWR	1978	1980	
Jhimpir to Kotri									
UP LINE									
1	127.22	171.22	44	UIC-54	42'-0"	LWR	2007	2007	
2	171.22	172.9	1.68	UIC-54	42'-0"	LWR	2008	2008	
3	172.9	174.4	1.6	90-R	39'-0"	LWR	1926	1926-27	
4	174.4	176.25	1.85	100-RE	42'-0"	LWR	1979	1979-80	
DN LINE									
1	127.22	130.62	3.4	UIC-54	42'-0"	LWR	2012	2012	
2	130.62	136	5.38	UIC-54	42'-0"	LWR	Sep-08	2008-09&2012	8 Panel
3	136	138.25	2.25	100-RE	42'-0"	LWR	1974-76	1974-76	
4	138.25	172.88	34.63	UIC-54	42'-0"	LWR	Aug-07	Aug-07	8 Panel
5	172.88	173.08	0.2	100-RE	36'-0"	LWR	1985-86	1985-86	
6	173.08	173.16	0.08	100-RE	42'-0"	LWR	1986	1986	
7	173.16	173.2	0.04	100-RE	42'-0"	LWR	1985-86	1985-86	
8	173.2	174	0.08	100-RE	42'-0"	LWR	1986	1986	
9	174	174.4	0.04	90-R	36'-0"	LWR	1926	1926	
10	174.4	176.25	1.85	90-R	42'-0"	LWR	1957	1957	
Kotri to Budapur									
1	0	1.28	1.28	90-R	42'-0"	Jointed	1988		
2	1.28	25.33	24.05	90-R	42'-0"	Jointed	1957		
3	25.33	19.07	3.74	90-R	36'-0"	Jointed	1957		
4	29.07	40.15	11.08	90-R	42'-0"	Jointed	1988		

Appendix 7.3 List of sleepers

S.No	KILOMETER		Length(Km)	Type of Sleepers	Density	Manufacturing year	Year Laid
	FROM	TO					
Karachi to Landhi							
UP Line							
1	7.84	10.7	2.86	Wooden	N+4	-	1964
2	10.7	17	6.3	PSC	N+7	-	1984
3	17	20.14	3.14	Wooden	N+4	-	1964
4	20.14	27.85	7.71	PSC	N+7	-	1984
DN Line							
1	7.84	9.8	1.96	Wooden	N+4	-	1964
2	9.8	10.07	0.27	Wooden/PSC	N+7	-	1964-84
3	10.07	10.21	0.14	PSC	N+7	-	1984
4	10.21	10.28	0.07	Points & crossing	-		-
5	10.28	10.63	0.35	Wooden/PSC	N+7		1964-84
6	10.63	10.77	0.14	Points & crossing	-		-
7	10.77	13.98	3.21	PSC	N+7		1984
8	13.98	14	0.02	Points & crossing	-		-
9	14	14.77	0.77	PSC	N+7		1984
10	14.77	15.14	0.37	Wooden	N+7		1984
11	15.14	18.28	3.14	PSC	-		1984
12	18.28	18.49	0.21	Points & crossing	-		-
13	18.49	19.21	0.72	PSC	N+7		1984
14	19.21	19.35	0.14	Points & crossing	-		-
15	19.35	19.56	0.21	PSC	N+7		1984
16	19.56	19.84	0.28	Points & crossing	-		-
17	19.84	21.28	1.44	PSC	N+7		1984
18	21.28	21.49	0.21	Wooden/PSC	N+7		1964-84
19	21.49	21.63	0.14	PSC	N+7		1984
20	21.63	21.84	0.21	Wooden/PSC	N+7		1964-84
21	21.84	22.14	0.3	PSC	N+7		1984
22	22.14	22.49	0.35	Wooden/PSC	N+7		1964-84
23	22.49	27.05	4.56	Wooden	N+7		1964
24	27.05	27.5	0.45	Br. No.29	-		-
25	27.5	27.85	0.35	PSC	N+7		1984
Landhi to Jhimpir							
UP Line							
1	27.96	29.7	1.94	PSC	N+7	1984	1984
2	29.7	60	30.3	PSC	N+7	2004	2005
3	60	85.35	25.35	PSC	N+7	2005	2005
DN Line							
1	27.94	30.7	2.76	PSC	N+7	1983	1983
2	30.7	51	20.3	PSC	N+7	2009	2009
3	51	67.25	16.25	PSC	N+7	1979	1979
7	67.25	73.4	6.15	PSC	N+7	1983	1983
8	73.4	75.6	2.2	PSC	N+7	2007	2007
9	75.6	78.05	2.45	PSC	N+7	1984	1984
10	78.05	85.33	7.28	PSC	N+7	1974	1974
UP Line							
1	85.35	127.2	41.85	PSC	N+7	2006	2006
DN Line							
1	85.35	89.8	4.45	PSC	N+7	1981	1981
2	89.8	92.37	2.57	PSC	N+7	1983	1983
3	92.37	98.93	6.56	PSC	N+7	1980	1980
4	98.98	100.35	1.42	PSC	N+7	1982	1982
5	100.35	103.15	2.8	PSC	N+7	1992	1992
6	103.15	105.5	2.85	PSC	N+7	1987	1987
7	105.5	106.87	1.37	PSC	N+7	1983	1983
8	106.87	108.27	1.4	Wooden	N+7	1982	1982
9	108.27	114.7	6.47	PSC	N+7	1982	1982
10	114.7	116.7	1.3	PSC	N+7	1985	1985
11	116.7	119.1	3.21	PSC	N+7	1982	1982
12	119.1	120.4	1.3	PSC	N+7	1983	1983
13	120.4	127.2	6.8	PSC	N+7	2010	2010

S.No	KILOMETER		Length(Km)	Type of Sleepers	Density	Manufacturing year	Year Laid
	FROM	TO					
JHIMPIR TO KOTRI							
UP LINE							
1	127.22	171.22	44	PSC	N+7	2007	2007
2	171.22	172.9	1.68	PSC	N+7	2008	2008
3	172.9	173.31	0.41	RW.DEO	N+7	1980	1980
4	173.31	174	0.69	PSC	N+7	2009	2009
5	174	176.29	2.29	RW.DEO	N+7	1980	1980
DN LINE							
1	127.22	135.62	8.4	PSC	N+7	Oct-09	Oct-09
2	135.62	136	0.38	PSC	N+7	2008	2008
3	136	138.42	2.42	PSC	N+7	2004	2004
4	138.42	172.26	34.34	PSC	N+7	Oct-09	Oct-09
5	172.76	174.4	1.64	Wooden	N+7	1985	1985
6	174.4	175.45	1.05	PSC/RW	N+7	1964,92	1964,92
7	175.45	176	0.55	Bridge Timber		-	-
8	176	176.25	0.25	Wooden	N+7	1969-70	1969-70
KOTRI TO BUDHAPUR							
1	0	1.3	1.3	Wooden	N+7		1964
2	1.3	1.56	1.56	RCC T.B	N+4		1993
3	1.56	1.85	1.85	Wooden	N+3		1964
4	1.85	3.25	3.25	S/trough	N+3		1955
5	3.25	7.67	7.67	S/trough	N+3		1997-98
6	7367	9.73	9.73	S/trough	N+3		1997-98
				RCC T.B	N+4		1983-84
7	9.73	18.73	18.73	S/trough	N+3		1981-82
8	18.73	22.91	22.91	RCC T/B	N+4		1983-84
9	22.91	24.21	24.21	S/trough	N+3		1980-81
10	24.21	27	27	RCC T/B	N+4		1982-83
11	27.28	28	28	S/trough	N+4		1990
12	28	32.56	32.56	RCC T/B	N+4		1982-83
13	32.56	35.75	35.75	S/trough	N+3		1979-80
14	35.75	38.91	38.91	CIP/CTS-9	N+3		1977-78
15	38.91	39.91	39.91	RCC T/B	N+7		2011
16	39.91	40.31	40.31	CIP/CTS-9	N+3		1977-78

Appendix 7.4 List of level crossing

S.No	L-xing No.	Class	Man/Unman	Converted Chainage Km	Engg/ Traff	Width	Check Rail		Interlock or not	Road Surface/ Date of overhauling	No of Gate keepers	Sponsoring Agency/ Remarks
							Length	S/D				
Karachi to Landhi												
1	5	I	Manned	11.87	Engg:	32’	40°	D	Inter Lock	MetalMar-13	6	
2	7	II	Manned	17.87	Traff:	32’	40°	D	Inter Lock	Katcha 8-Oct	3	
3	8	II	Manned	19.73	Traff:	38’-9”	42°	D	Inter Lock	MetalMar-13	3	
4	10	II	Manned	23.00	Traff:	28”	36°	D	Inter Lock	Metal 12-Dec	3	
5	11	II	Manned	25.27	Traff:	32”	40°	D	Inter Lock	Metal 12-Mar	3	
Landhi to Jhimpir												
1	16	I	Manned	34.00	Traffic	32’	36’	S	Interlock	2-2-2009	3	Railways
2	19	II	Manned	91.13	Traffic	33’	36’	S	Interlock	9-4-2008	3	Railways
3	20	II	Manned	105.47	Engg	12’	42’	S	Interlock	19-9-2008	2	Railways
4	21	II	Manned	123.93	Traffic	12’	36’	S	Interlock	7-11-2006	3	Railways
JHIMPIR TO KOTRI												
1	22	III	Unmanned	143.67	Engg:	12’	21’-0”	Double	Not	Katcha	Nil	
2	22/A	II	Manned	158.93	Engg:	12’	42’-0”	Double	Not	Pacca	Three	
3	23	II	Manned	164.00	Traffic	12’	42’-0”	Double	Not	Pacca	Two	
4	24	I	Manned	172.07	Traffic	24’	42’-0”	Double	Not	Pacca	Three	
5	25	II	Manned	174.13	Traffic	24’	42’-0”	Single	Not	Pacca	Three	
KOTRI TO BUDAPUR												
1	1	II	MANNED	1.20	ENGG	N/A	N/A	N/A	N/A	N/A	N/A	
2	1-A	III	UNMANNED	2.40	ENGG	N/A	N/A	N/A	N/A	N/A	N/A	Irrigation
3	3-T	I	MANNED	8.40	TRAFFIC	N/A	N/A	N/A	N/A	N/A	N/A	
4	3/A	III	UNMANNED	13.93	ENGG	N/A	N/A	N/A	N/A	N/A	N/A	
5	4	II	MANNED	21.13	TRAFFIC	N/A	N/A	N/A	N/A	N/A	N/A	
6	5	III	UNMANNED	22.87	ENGG	N/A	N/A	N/A	N/A	N/A	N/A	
7	6	III	UNMANNED	37.60	ENGG	N/A	N/A	N/A	N/A	N/A	N/A	
8	7-T	II	MANNED	40.60	TRAFFIC	N/A	N/A	N/A	N/A	N/A	N/A	

Appendix 7.5 List of bridges

S/No	Bridge No	Converted Chainage	Between Station		Span Length	Type
			From	To		
Karachi to Landhi						
1	9	8.33	KYC	KC	4x8'-6"	Trough
2	10	11.47	KC	DPY	4x20'-0"	Girder
3	11	12.20	KC	DPY	4x10'-0"	RCC Slab
4	12	12.87	KC	DPY	5x20'-0"	Girder
5	12/A	15.53	DPY	DID	1x20'-0"	Girder
6	13	15.73	DPY	DID	1x8'-6"	Trough
7	14	15.87	DPY	DID	1x8'-6"	Trough
8	15	16.20	DPY	DID	3x16'-4"	Arch
9	16	16.53	DPY	DID	1x8'-6"	Trough
10	17	17.73	DPY	DID	1x8'-6"	Trough
11	17/A	18.33	DPY	DID	1x8'-6"	RCC Slab
12	17/B	18.33	DPY	DID	1x9'-6"	RCC Slab
13	18	19.40	DID	DCL	6x8'-6"	Trough
14	19	19.80	DID	DCL	9x8'-6"	Trough
15	20	20.80	DCL YARD		12x7'-6"	RCC Slab
16	21	21.87	DCL	MLCL	6x8'-6"	Trough
17	22	22.07	DCL	MLCL	6x7'-0"	RCC Slab
18	23	22.20	DCL	MLCL	6x3'-0"	Hume Pipe
19	24	22.33	DCL	MLCL	6x4'-0"	Hume Pipe
20	25	22.60	DCL	MLCL	6x8'-6"	RCC Slab
21	25/A	22.80	DCL	MLCL	6x20'-0"	Girder
22	26	23.80	MLCL	MXB	4x33"	Hume Pipe
23	27	24.67	MLCL	MXB	2x13'-0"	RCC Slab
24	28	26.33	MXB	LND	2x12'-0"	Girder
25	29	27.13	MXB	LND	25x60'-0"	Girder
Landhi to Jhimpir						
26	31	32.33	JMTH	BQM	5x9"	Arch Stone
27	32	36.27	JMTH	BQM	2x15'-10"	Brick Masonry
28	33	37.73	JMTH	BQM	2x5'-6"	Steel Trough
29	34	39.40	JMTH	BQM	2x8'-6"	Steel Trough
30	35	40.80	JMTH	BQM	2x20'-0"	Girder Plate
31	36	40.93	JMTH	BQM	5x18'-0"	Girder
32	37	42.33	JMTH	BQM	2x8'-6"	TR/Deck
33	37-A	43.27	BDNL	GDR	10x10'-0"	RCC Slab
34	38	44.87	BQM	BDNL	3X18'-6"	Girder RSJ
35	39	46.73	BDNL	GDR	8x10'-0"	RCC Slab
36	40	48.20	BDNL	GDR	10X2'-6"	Rail Decking
37	42	50.07	BDNL	GDR	3x8'-6"	Steel Trough
38	43	50.33	GDR	DBJ	10x7'-6"	Steel Trough
39	44	50.67	GDR	DBJ	3x8'-6"	Steel Trough
40	45	51.60	GDR	DBJ	8x12'-6"	Arch Stone

S/No	Bridge No	Converted Chainage	Between Station		Span Length	Type
			From	To		
41	46	51.87	GDR	DBJ	6x36'-6"	Girder
42	48	52.33	GDR	DBJ	3x17'-6"	Brick Masonry
43	49	53.20	GDR	DBJ	10x8'-6"	Steel Trough
44	50	54.93	GDR	DBJ	8x17'-6"	Girder
45	51	55.67	GDR	DBJ	13x11'-4"	Girder
46	52	57.07	GDR	DBJ	8x17'-6"	Girder
47	53	58.00	GDR	DBJ	15x26'-0"	Girder
48	54	58.47	GDR	DBJ	2x9'	Arch Stone
49	55	59.60	GDR	DBJ	1x77'-0"& 2x30'-0"	Girder
50	56	60.80	DBJ	RPN	3x9'	Arch Stone
51	57/A	62.60	DBJ	RPN	2x12'	Arch Stone
52	57-B	62.60	DBJ	RPN	2x30'-0"	Girder
53	58	63.07	DBJ	RPN	2x30'-0"	Girder Plate
54	59	63.73	DBJ	RPN	1x8'-6"	Steel Trough
55	60	64.20	DBJ	RPN	4x18'-0"& 2x8'-0"	Arch
56	61	64.73	DBJ	RPN	1x8'-6"	Steel Trough
57	62	65.33	DBJ	RPN	1x8'-6"	Steel Trough
58	63	65.67	DBJ	RPN	1x20'	Girder RSJ
59	64	66.40	DBJ	RPN	8x8'-6	Steel Trough
60	65	67.27	DBJ	RPN	3x20'-0"	Girder
61	66	68.93	DBJ	RPN	3x19'	Brick Masonry
62	67	70.00	DBJ	RPN	3x18'-6"	Brick Masonry
63	68	70.47	DBJ	RPN	2x23'	Girder Plate
64	69	72.20	DBJ	RPN	7x20'-0"	Arch
65	70	72.47	DBJ	RPN	4x40'	Hume Pipe
66	71	72.80	DBJ	RPN	2x8'	Steel Trough
67	72	73.07	DBJ	RPN	2x60'-10"	Steel Trough
68	73	73.47	DBJ	RPN	3x8'-6"	Steel Trough
69	74	73.60	DBJ	RPN	1x8'-0"	SJ.TR.Deck
70	75	73.80	DBJ	RPN	2x2'-6"	Rail Decking
71	77	74.27	DBJ	RPN	3x15'	Girder RSJ
72	78	74.33	DBJ	RPN	1x8'-6"	Steel Trough
73	79	74.93	DBJ	RPN	2x40'-0"	Girder Plate
74	80	76.93	DBJ	RPN	1x12'	Arch Stone
75	81	77.07	DBJ	RPN	2x6'	Brick Masonry
76	82	77.07	DBJ	RPN	1x12'	Arch Stone
77	83	77.40	DBJ	RPN	2x34'	RCC Pipe
78	84	77.73	DBJ	RPN	1x9'-9"	Arch
79	85	78.13	DBJ	RPN	12x36'-0"	Girder
80	87	80.13	RPN	JGS	6x2'-6"	Rail Decking
81	88	82.13	RPN	JGS	8x8'-6"	Trough
82	89	82.80	RPN	JGS	2x8'-6"	Steel Trough
83	90	83.93	RPN	JGS	4x2'-6"	Rail Decking
84	91	83.60	RPN	JGS	2x8'-6"	Steel Trough
85	92	84.20	RPN	JGS	5x8'-6"	Steel Trough

S/No	Bridge No	Converted Chainage	Between Station		Span Length	Type
			From	To		
86	93	84.73	RPN	JGS	3x2'-6"	Rail Decking
87	94	85.47	RPN	JGS	4x2'-6"	Rail Decking
88	95	85.53	RPN	JGS	1x8'-6"	Steel Trough
89	96	86.00	RPN	JGS	4x8'-6"	Steel Trough
90	97	86.47	RPN	JGS	4x2'-6"	Rail Decking
91	98	87.00	RPN	JGS	4x2'-6"	Rail Decking
92	99	87.40	RPN	JGS	4x2'-6"	Rail Decking
93	100	88.73	RPN	JGS	1x8'-6"	Steel Trough
94	101	89.33	RPN	JGS	3x8'-6"	Steel Trough
95	102	90.20	JGS	BKB	15x20-'0"	Girder
96	102/A	90.47	JGS	BKB	1x6'-6"	Steel Trough
97	104	90.67	JGS	BKB	1x8'-6"	Steel Trough
98	105	92.87	JGS	BKB	8x8'-6"	Steel Trough
99	106	93.07	JGS	BKB	5x8'-6"	Steel Trough
100	107	93.20	JGS	BKB	15x8'-6"	Girder
101	108	93.40	JGS	BKB	8x8'-6"	Steel Trough
102	109	93.67	JGS	BKB	4x8'-6"	Steel Trough
103	110	93.93	JGS	BKB	3x8'-6"	Steel Trough
104	111	94.33	JGS	BKB	11x8'-6"	Steel Trough
105	112	95.00	JGS	BKB	11x8'-6"	Steel Trough
106	113	95.60	JGS	BKB	12x8'-6"	Steel Trough
107	114	96.20	JGS	BKB	3x8'-6"	Steel Trough
108	115	97.07	JGS	BKB	2x8'-6"	Steel Trough
109	116	97.33	JGS	BKB	1x8'-6"	Steel Trough
110	117	97.60	JGS	BKB	1x8'-6"	Steel Trough
111	118	97.93	JGS	BKB	6x8'-6"	Steel Trough
112	119	98.93	JGS	BKB	1x8'-6"	Steel Trough
113	120	99.27	JGS	BKB	2x8'-6"	Steel Trough
114	121	99.87	JGS	BKB	2x8'-6"	Steel Trough
115	122	100.87	JGS	BKB	1x8'-6"	Steel Trough
116	123	101.47	JGS	BKB	1x8'-6"	Steel Trough
117	125	102.27	JGS	BKB	2x8'-6"	Steel Trough
118	129	107.73	JGS	BKB	2x8'-6"	Steel Trough
119	130	108.00	JGS	BKB	3x8'-6"	Steel Trough
120	131	108.60	BKB	JHP	3x18'	RCC Pipe
121	132	110.07	BKB	JHP	2x8'-6"	Steel Trough
122	133	110.53	BKB	JHP	1x8'-6"	Steel Trough
123	134	110.73	BKB	JHP	4x2'-6"	Rail Decking
124	135	112.07	BKB	JHP	5x40'-0"	Girder
125	137	112.73	BKB	JHP	3x29'-8"	Girder
126	138	114.20	BKB	JHP	1x8'-6"	Steel Trough
127	139	115.80	BKB	JHP	1x34'	RCC Pipe
128	140	115.93	BKB	JHP	1x34'	RCC Pipe
129	141	116.07	BKB	JHP	1x34'	RCC Pipe
130	142	116.20	BKB	JHP	12x11'-4	Girder

S/No	Bridge No	Converted Chainage	Between Station		Span Length	Type
			From	To		
131	143	117.13	BKB	JHP	1x29'-4	Girder Plate
132	144	117.53	BKB	JHP	3x40'-0"	Girder
133	145	118.60	BKB	JHP	1x19'-6"	Trough
134	145/A	119.40	BKB	JHP	1x20'-0"	Girder Plate
135	146	119.60	BKB	JHP	1x8'-6"	ST.TR
136	147	120.47	BKB	JHP	3x20'-0"	Trough
137	148	121.07	BKB	JHP	3x20'-0"	Trough
138	149	121.67	BKB	JHP	5x20'-0"	Trough
JHIMPIR TO KOTRI						
139	150	123.20	JHP	MTG	1x10'	RCC Slab
140	151	124.27	JHP	MTG	1x2'-6"	Rail Decking
141	152	124.80	JHP	MTG	1x41'-3"	Arch Stone
142	153	125.47	JHP	MTG	1x6'-6"	ST.TR
143	154	126.60	JHP	MTG	6x40'-0"	Girder
144	155	128.87	JHP	MTG	1x8'-6"	Steel Trough
145	156	129.13	JHP	MTG	3x40'-0"	Girder Plate
146	157	130.67	JHP	MTG	9x40'-0" 3x37'-0"	Girder Plate
147	158	131.67	JHP	MTG	2x15'-0"	Arch
148	159	134.07	JHP	MTG	1x8'-6"	Steel Trough
149	160	134.80	JHP	MTG	4x8'-6"	Steel Trough
150	161	135.33	JHP	MTG	1x8'-6"	Steel Trough
151	162	136.80	JHP	MTG	6x6'-6"	Steel Trough
152	163	137.33	JHP	MTG	4x2'-6"	Rail Decking
153	164	137.80	JHP	MTG	3x2'-6"	Rail Decking
154	165	138.67	JHP	MTG	1x8'-0"	Steel Trough
155	166	140.53	JHP	MTG	4x8'-6"	Steel Trough
156	167	141.53	JHP	MTG	4x8'-6"	Steel Trough
157	168	142.27	JHP	MTG	6x8'-6"	Steel Trough
158	169	142.60	MTG	BOL	1x10'	Arch
159	170	143.73	MTG	BOL	4x20'-0"	Girder Plate
160	171	144.53	MTG	BOL	1x11'-3"	RCC Slab
161	172	145.07	MTG	BOL	1x15'	Girder Plate
162	173	145.40	MTG	BOL	4x20'-0"	Girder Plate
163	180	149.67	MTG	BOL	10x8'-6"	Steel Trough
164	181	151.07	MTG	BOL	1x2'-6"	Steel Trough
165	182	151.93	MTG	BOL	1x8'-6"	Steel Trough
166	183	152.33	MTG	BOL	3x8'-6"	Steel Trough
167	184	152.67	MTG	BOL	2x8'-6"	Steel Trough
168	187	153.40	MTG	BOL	2x8'-6"	Steel Trough
169	188	153.53	MTG	BOL	1x8'-6"	Steel Trough
170	189	154.00	MTG	BOL	1x20'	Girder
171	190	154.33	MTG	BOL	2x8'-6"	Steel Trough
172	191	155.60	MTG	BOL	1x20'-6"	Girder
173	193	156.73	MTG	BOL	1x8'-6"	Steel Trough
174	194-A	158.13	MTG	BOL	10x10'-0"	RCC Slab

S/No	Bridge No	Converted Chainage	Between Station		Span Length	Type
			From	To		
175	194-B	158.27	MTG	BOL	10x10'-0"	RCC Slab
176	195	160.60	MTG	BOL	1x8'-6"	Steel Trough
177	196	160.73	MTG	BOL	24x60'-0"	Girder Plate
178	198	163.80	MTG	BOL	2x2'-6"	Rail Decking
179	199	164.00	BOL	KOT	2x2'-6"	Rail Decking
180	201	164.80	BOL	KOT	1x20'	Girder
181	202	165.00	BOL	KOT	2x10'	Girder
182	203	166.20	BOL	KOT	1x8'-6"	Steel Trough
183	204	166.80	BOL	KOT	2x8'-6"	Steel Trough
184	205	167.27	BOL	KOT	3x8'-6"	Steel Trough
185	206	167.60	BOL	KOT	1x8'-6"	Steel Trough
186	207	167.87	BOL	KOT	1x10'-0"	Shallow Type
187	208	168.07	BOL	KOT	1x10'-0"	RCC Slab
188	209	169.07	BOL	KOT	1x10'-0"	RSS Slab
189	210	170.20	BOL	KOT	3x2'-6"	Rail Decking
190	211	172.73	BOL	KOT	2x60'-0"	Girder
KOTRI TO BUDHAPUR						
S/No	Bridge No	CH	From	To	Span Length	Type
1	212	0.60	KOT	SDUT	1x1'-6"	Culvert
2	214	1.13	KOT	SDUT	1x2'-0"	Hume Pipe
3	215	2.27	KOT	SDUT	2x60'-0"	Girder
4	216	2.33	KOT	SDUT	1x4'-0"	Arch
5	218	3.27	KOT	SDUT	2x10'-0"	RCC Slab
6	219	4.07	KOT	SDUT	1x10'-0"	RCC Slab
7	220	4.27	KOT	SDUT	1x3'-3"	RCC Slab
8	221	4.33	KOT	SDUT	1x10'-0"	RCC Slab
9	222	4.73	KOT	SDUT	1x10'-0"	RCC Slab
10	223	4.93	KOT	SDUT	1x10'-0"	RCC Slab
11	224	5.20	KOT	SDUT	1x10'-0"	RCC Slab
12	225	5.27	KOT	SDUT	1x2'-1"	Stone Slab
13	226	5.33	KOT	SDUT	1x6'-0"	RCC Slab
14	227	5.73	KOT	SDUT	1x10'-4"	R.S.J Girder
15	228	6.07	KOT	SDUT	1x3'-6"	RCC Slab
16	229	6.47	KOT	SDUT	1x7'-0"	Stone Arch
17	230	6.60	KOT	SDUT	1x6'-0"	RCC Slab
18	231	6.73	KOT	SDUT	2x7'-0"	RCC Slab
19	232	6.93	KOT	SDUT	1x2'-0"	RCC Slab
20	233	7.07	KOT	SDUT	1x6'-4"	RCC Slab
21	234	7.20	KOT	SDUT	4x9'-6"	Trough & RCC Slab
22	235	7.33	KOT	SDUT	1x2'-0"	Rail Cluster
23	236	7.47	KOT	SDUT	3x6'-6"	RCC Slab
24	237	7.60	KOT	SDUT	3x6'x8"	Rail Cluster
25	238	7.73	SDUT	CCQ	1x2'x0"	Rail Opening
26	239	7.80	SDUT	CCQ	2X7'x0	Arch

S/No	Bridge No	Converted Chainage	Between Station		Span Length	Type
			From	To		
27	240	7.87	SDUT	CCQ	1x6'-6"	RCC Slab
28	241	8.07	SDUT	CCQ	4x5'x0"	Arch
29	242	8.20	SDUT	CCQ	1x3'-3"	RCC Slab
30	243	8.53	SDUT	CCQ	2x7'-0"	Arch
31	244	8.73	SDUT	CCQ	1x5'x3"	RCC Slab
32	245	8.87	SDUT	CCQ	2X7'x0	Arch
33	246	9.07	SDUT	CCQ	1x2'x0	Rail Opening
34	247	9.20	SDUT	CCQ	1x5'x3"	RCC Slab
35	248	9.33	SDUT	CCQ	1x2'x0	Rail Opening
36	249	9.53	SDUT	CCQ	1x10'x0	Arch
37	250	9.67	SDUT	CCQ	3x10'x0"	Arch
38	251	9.87	SDUT	CCQ	1x10'x0"	Arch
39	252	10.00	SDUT	CCQ	1x10'x3"	Arch
40	253	10.60	SDUT	CCQ	8x20'-6"	Arch
41	254	11.53	SDUT	CCQ	1x5'-0"	Arch
42	255	11.87	SDUT	CCQ	5x20'-4"	Plate Girder
43	256	12.73	SDUT	CCQ	15x10'-0"	Arch
44	257	13.47	SDUT	CCQ	3x5'-0"	RCC Slab
45	258	13.67	SDUT	CCQ	1x7'-0"	Plate Girder
46	259	14.33	SDUT	CCQ	5x10'-0"	Girder
47	260	14.87	SDUT	CCQ	1x5'-0"	Arch
48	261	14.93	SDUT	CCQ	1x5'-6"	Girder RSJ
49	263	16.13	SDUT	CCQ	1x10'-0"	RCC Slab
50	264	16.27	SDUT	CCQ	4x20'-0"	RSJ
51	265	16.33	SDUT	CCQ	1x10'-0"	RCC Slab
52	266	17.47	SDUT	CCQ	12x19'-6"	RSJ
53	267	18.07	SDUT	CCQ	2x9'-9"	RSJ
54	268	18.93	SDUT	CCQ	2x6'-6"	RSJ
55	269	19.07	SDUT	CCQ	1x6'-6"	RCC Slab
56	270	19.13	SDUT	CCQ	1x20'-0"	Girder
57	271	20.73	CCQ	UNR	5x1'-6"	Hume Pipe
58	272	21.00	CCQ	UNR	1x10'-0"	RCC Slab
59	273	21.20	CCQ	UNR	2x4'-6"	Hume Pipe
60	274	21.33	CCQ	UNR	1x4'-6"	Hume Pipe
61	275	22.00	CCQ	UNR	2x20'-0"	Arch
62	276	21.87	CCQ	UNR	1x2'-0"	Rail Opening
63	277	23.07	CCQ	UNR	1x2'-0"	Rail Opening
64	278	23.47	CCQ	UNR	1x2'-0"	Rail Opening
65	279	23.73	CCQ	UNR	1x2'-0"	Rail Opening
66	280	24.27	CCQ	UNR	1x20'-0"	Arch
67	281	24.93	CCQ	UNR	1x3'-3"	Rail Cluster
68	282	25.27	CCQ	UNR	1x3'-3"	Rail Cluster
69	283	25.93	CCQ	UNR	1x3'-3"	Rail Cluster
70	284	27.07	CCQ	UNR	1x20'-0"	Arch
71	285	27.40	CCQ	UNR	2x20'-0"	Arch

S/No	Bridge No	Converted Chainage	Between Station		Span Length	Type
			From	To		
72	286	27.67	CCQ	UNR	1x5'-0"	Arch
73	287	27.80	CCQ	UNR	2x5'-0"	Arch
74	288	27.93	CCQ	UNR	1x3'-3"	RCC Slab
75	289	28.00	CCQ	UNR	1x9'-9"	Girder
76	290	28.13	CCQ	UNR	1x4'-6"	Hume Pipe
77	291	28.33	CCQ	UNR	2x9'-9"	RSJ
78	292	28.73	CCQ	UNR	1x10'-0"	RSJ
79	293	29.20	CCQ	UNR	1x10'-0"	RSJ
80	293/A	29.67	CCQ	UNR	3x20'-0"	RSJ
81	294	29.93	CCQ	UNR	1x19'-10"	Plate Girder
82	295	30.27	CCQ	UNR	12x19'-9"	Plate Girder
83	296	30.87	CCQ	UNR	16x19'-6"	Girder RSJ
84	297	31.27	CCQ	UNR	10x40'-0"	Girder
85	298	31.60	CCQ	UNR	14x19'-6"	Girder
86	299	32.87	UNR	BDP	2x19'-6	Girder
87	300	33.33	UNR	BDP	1x10'-6"	Arch
88	301	33.67	UNR	BDP	1x5'-0"	Arch
89	302	34.33	UNR	BDP	14x19'-6"	Girder
90	302/A	34.67	UNR	BDP	5x19'-6"	Girder
91	302/B	35.40	UNR	BDP	3x20'-0"	Girder
92	305	37.27	UNR	BDP	2x20'-0"	Arch
93	306	37.40	UNR	BDP	2x7'-0"	Arch
94	307	38.20	UNR	BDP	1x3'-3"	RCC Slab
95	308	38.53	UNR	BDP	1x2'-10"	RCC Slab
96	311	40.67	UNR	BDP	2x9'-9"	Girder

Appendix 8 Financial Viability of the Preferred Project Case

The purpose of the Financial Analysis is to measure whether or under what conditions the project will achieve acceptable rates of return for its investors. The three most important indicators of the financial worth of a project are the Financial Internal Rate of Return (FIRR), the Return on Equity (ROE) and the Net Present Value (NPV). The FIRR of a capital investment project may be defined as the discount rate which will equate the present values of the project's cash inflows and outflows. The ROE measures the net return to the equity invested in a project, while the NPV is the difference between the stream of cash outflows and inflows over the life of the project discounted back to the present.

The financial viability of the rail coal haulage project was established by a conventional Discounted Cash Flow (DCF) Analysis which compares cash outflows with cash inflows for several project alternatives.

The cash outflows of the project comprise the streams of capital, O&M and financing costs over the life of the project (assumed to be 30 years), while the cash inflows are the revenue, or income, streams over the same period.

FIRR's are calculated after the addition of financing costs to the cash outflows of the project. These rates are then compared with a targeted minimum rate. Usually this minimum rate is the chosen discount rate which itself can be one of a number of different rates. For example it can be:

A rate which reflects the *opportunity cost of capital*, or the interest rate which can be earned in the next best investment;

A rate which reflects the *weighted average cost of capital*, or the average of interest rates applying to loans for the financing of the project, weighted by each loan amount

A *cut-off rate* which is the rate of return on investment which an investor desires to achieve

It should be noted that this study is pre-feasibility study and the estimated cost will be revised in further stage.

8.1 Project FIRR

Project FIRR is calculated based on the discounted cash flow projection expressed in constant price (2014) to evaluate the project's overall feasibility in terms of finance.

FIRR is a discount rate when net present value (NPV) of the discounted cash flow equals to zero and defined in the following formula:

$$NPV = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n} = 0$$

Where: NPV =Net Present Value,
n =Year,
N =Total Number of Years,
C_n =Annual net cash flow in year n and
r =Discount rate=Internal rate of return (IRR)

The FIRR will be evaluated by comparing weighed average cost of capital (WACC) estimated for the project's funding structure.

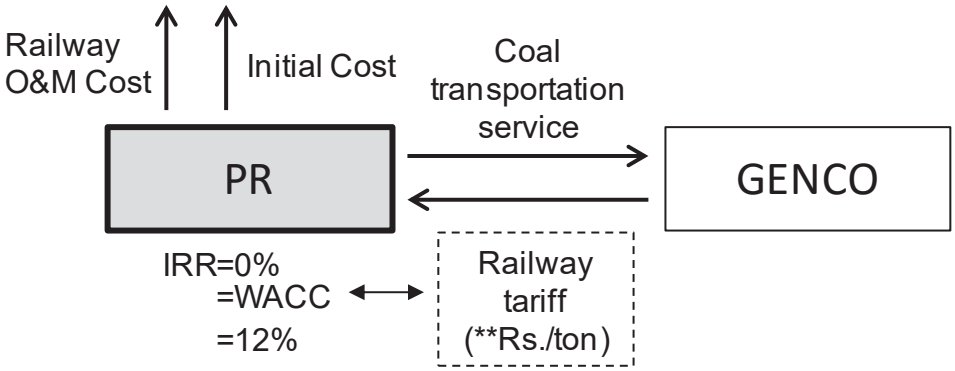
8.2 Railway Tariff

The railway tariff will be added to coal shipping charge. The charge shall cover the initial cost and O&M cost of railway system for coal transportation and it is regarded as benefit in the financial cash flow. As explained in Clause 10.3, official tariff is based on following formula in PR.

- $y = 25.422x^{-0.371}$ where; y: unit revenue per ton-km, x: Rail haul distance (km)

That is however, when estimated official tariff is applied into financial evaluation, FIRR meets negative in all cases. Therefore, it is necessary to propose required tariff to cover the railway transportation project cost. Here, railway tariff rate is set to cover the initial cost and railway O&M cost.

The assumed railway operator is Pakistan Railway and all railway concerned project cost including railway O&M cost will be funded by GENCO through railway tariff. Initial cost and railway O&M cost will be collected as the railway tariff, and IRR is variable accordingly. In this regard, FIRR is not calculated unless the railway tariff is set properly (Figure 8-1).



Source: JICA Study Team

Figure 8-1 Cash Flow Structure in the Railway Project for Coal Transportation

In the economic analysis, railway tariff rate will be calculated in three IRR scenarios in all cases (Case 1, Case 2A/2AR, 2B and Case 3) as follows:

(1) The railway tariff rate equivalent to meet FIRR=0%

(2) The railway tariff rate which meets FIRR equivalent to Weighted Average Cost of Capital (WACC) and

(3) The railway tariff rate equivalent to meet FIRR=12%

For the purpose of the appraisal, it has been assumed that a cut-off rate of 12 per cent will be used both for the purpose of discounting future cash flows back to the present and as a target rate against which the calculated FIRR's may be compared. A project can be said to produce an acceptable return on investment if the FIRR is greater than 12 per cent. Use of a 12 per cent cut-off rate is consistent with the requirements of all international development agencies for financial appraisals.

8.3 Assumptions

The financial evaluation is made based on the following assumptions:

- The useful life of the Project is 30 years from the train operation.
- Salvage value after project life is zero since all infrastructures are made for railway transportation exclusively.
- Constant prices at 2014 level are used in this financial evaluation.
- Locomotives, wagons will have been used for 30 years after Lakhra plant starts operation.

8.4 Financial Cost

8.4.1 Initial Cost

The financial initial costs for Case 1, Case 2A, Case 2B and Case 3 are summarized in Table 8-1, Table 8-2, Table 8-3 and Table 8-5 respectively. Note that all financial cost excludes interest during construction (IDC).

Table 8-1 Financial Initial Cost for Case 1

Case 1	Initial Cost
Consulting Service	***655***
Land Acquisition	***789***
Siding track extension	24
Construction of Budapur Station Yard	1,011
Constructioon of dedicated access road	1,936
Signalling and weighbridge Bib Qasim	180
Sub-total - civil works	***3,151***
Procurement of new 2,400 HP locomotives	3,786
Procurement of new shunting locomotives	379
Procurement of flatbed wagons and brake vans	2,716
Sub-total - rolling stock	***6,881***
Procurement of Open Top Containers	1,049
Procurement of Dump Trucks	78
Procurement of Reach Stacker	265
Sub-total - handling equipment	***1,392***
Sub-total	12,868
Price Escalation	0
Contingency	643
Tax	2,772
Grand Total including tax	***16,283***

Source: JICA Study Team

Table 8-2 Financial Initial Cost for Case 2A

Case 2A	Initial Cost
Consulting Service	***1,657***
Land Acquisition	***2,302***
New line Akhundabad-Budapur	4,971
Siding track Budapur-Lakhra P.S.	185
Earthwork for siding track	176
Bridge construction	12,507
Track and signalling work in yard	718
Coal unloading facilities	161
Sub-total - civil works	***18,718***
Procurement of new 4,000 HP locomotives	2,267
Procurement of new shunting locomotives	1,136
Procurement of hopper wagons and brake vans	2,010
Sub-total - rolling stock	***5,413***
Sub-total	28,090
Price Escalation	0
Contingency	1,404
Tax	5,430
Grand Total including tax	***34,924***

Source: JICA Study Team

Table 8-3 Financial Initial Cost for Case 2AR

Case 2AR	Initial Cost
Consulting Service	***1,511***
Land Acquisition	***1,086***
Track improvement Akhundabad-Budapur	2,206
Siding track Budapur-Lakhra P.S.	185
Earthwork for siding track	176
Bridge construction	12,507
Track and signalling work in yard	718
Coal unloading facilities	161
Sub-total - civil works	***15,953***
Procurement of new 4,000 HP locomotives	2,267
Procurement of new shunting locomotives	1,136
Procurement of hopper wagons and brake vans	2,010
Sub-total - rolling stock	***5,413***
Lakhra Required Revised PC-I Portion	***764***
Sub-total	24,726
Price Escalation	0
Contingency	1,236
Tax	4,836
Grand Total including tax	***30,799***

Source: JICA Study Team

Table 8-4 Financial Initial Cost for Case 2B

Case 2B	Initial Cost
Consulting Service	***1,392***
Land Acquisition	***1,148***
New line Akhundabad-Budapur	49
Siding track Budapur-Lakhra P.S.	185
Earthwork for siding track	176
Bridge construction	12,507
Track and signalling work in yard	797
Coal unloading facilities	161
Sub-total - civil works	***13,876***
Procurement of new 4,000 HP locomotives	3,786
Procurement of new shunting locomotives	1,136
Procurement of hopper wagons and brake vans	2,390
Sub-total - rolling stock	***7,312***
Sub-total	23,727
Price Escalation	0
Contingency	1,186
Tax	4,716
Grand Total including tax	***29,630***

Source: JICA Study Team

Table 8-5 Financial Initial Cost for Case 3

Case 3	Initial Cost
Consulting Service	***1,001***
Land Acquisition	***1,782***
New line Akhundabad-Budapur	5,029
Conveyor Belt construction	3,448
Track and signalling work in yard	903
Coal unloading facilities	161
Sub-total - civil works	***9,541***
Procurement of new 4,000 HP locomotives	2,267
Procurement of new shunting locomotives	1,136
Procurement of hopper wagons and brake vans	2,010
Sub-total - rolling stock	***5,413***
Sub-total	17,737
Price Escalation	0
Contingency	887
Tax	3,726
Grand Total including tax	***22,350***

Source: JICA Study Team

8.4.2 Railway O&M Cost

Initial economic cost in the case of Case 1, 2A, 2AR, 2B and 3 are summarized in Table 8-6.

Table 8-6 Yearly Financial Railway O&M Cost by Case

In Mil. Rs.	Case1	Case2A	Case2AR	Case2B	Case3
O&M Costs (Variable)					
Train crews	31.8	22.6	22.6	29.8	22.3
Fuel/ energy consumption	295.5	270.5	270.5	298.4	266.9
Locomotive maintenance	164.3	63.5	63.5	169.3	62.6
Wagon maintenance	438.7	356.7	356.7	451.8	351.9
Variable track maintenance	220.0	201.4	201.4	222.2	198.7
Sub-total, O&M Costs (variable)	1,150.3	914.8	914.8	1,171.5	902.3
O&M Costs (Fixed)					
Fixed cost of infra. Maintenance	35.2	41.3	34.4	39.2	40.6
Station operating cost	34.9	41.2	34.4	39.1	40.1
Sub-total, O&M Costs (fixed)	70.1	82.5	68.8	78.2	80.7
Overheads	313.0	255.7	252.2	320.5	252.1
GRAND TOTAL	**1,533.4**	**1,253.0**	**1,235.8**	**1,570.2**	**1,235.1**

Source: JICA Study Team

Although railway transportation is outsourced to PR, coal unloading will be operated by Power Plant owner. Therefore, unloading works inside Lakhra Plant area are excluded for financial and economic evaluation.

8.4.3 Container Renewal Cost

It is assumed that Case 1 will renew containers every 5 years after starting operation and the cost is added on railway O&M cost. The following cost is added for railway O&M cost in Case 1:

- 6,200 million Rs: 2.7 million Rs./ container x 456 containers x 5 times for project life

8.5 Result of Financial Evaluation

This sub-section provides the result of financial evaluation including railway tariff rate which meets following three scenarios of FIRR level:

(1) FIRR=0%

(2) FIRR= Weighted Average Cost of Capital (WACC) and

(3) FIRR=12%

According to the interview to Pakistan Railway, Pakistan inflation rate is assumed from 10% to 12%, and FIRR should be bigger than inflation rate. That is why 12% is set as a one of the scenario.

WACC is given in Table 8-7 according to following conditions.

- Maximum amount of debt is 85% of railway project cost.
- Non-eligible portion rate in debt is assumed at 15% and Eligible portion one is Yen Libor plus 450 bps say, 4.63%.
- Ratio of loan and equity (75:25) assumed.

Calculated WACC by cases are given in the table below:

Table 8-7 Nominal Weighed Average Cost of Capital (WACC)

Case	Item	Formula	Loan		Equity	**Total**
			(Yen LIBOR)	(Relending)	Tax, Land	
Common	A. Nominal cost		4.63%	15.00%	12.00%	
	B. Tax rate		35.00%	35.00%	0.00%	
	C. Tax-adjusted nominal cost	Ax(1-B)	3.01%	9.75%	12.00%	
Case1	D. Amount (Mil. Rs.)		9,577	3,367	3,339	16,283
	E. Weighing		58.81%	20.68%	20.51%	100%
	F. Weighted component of WACC	CxE	1.77%	2.02%	2.46%	**6.25%**
Case2A	D. Amount (Mil. Rs.)		8,377	19,501	7,046	34,924
	E. Weighing		23.99%	55.84%	20.17%	100%
	F. Weighted component of WACC	CxE	0.72%	5.44%	2.42%	**8.59%**
Case2AR	D. Amount (Mil. Rs.)		8,510	16,858	5,431	30,799
	E. Weighing		27.63%	54.73%	17.63%	100%
	F. Weighted component of WACC	CxE	0.83%	5.34%	2.12%	**8.28%**
Case2B	D. Amount (Mil. Rs.)		9,689	14,543	5,398	29,630
	E. Weighing		32.70%	49.08%	18.22%	100%
	F. Weighted component of WACC	CxE	0.98%	4.79%	2.19%	**7.96%**
Case3	A. Amount (Mil. Rs.)		11,277	5,966	5,107	22,350
	E. Weighing		50.46%	26.69%	22.85%	100%
	F. Weighted component of WACC	CxE	1.52%	2.60%	2.74%	**6.86%**

Note: All units in million Rs.
Source: JICA Study Team

Net Profit Value also included in the result for reference. In this regard, the Asian Development Bank (ADB) used 10%-12% as the social discount rate for the economic analysis, and such rate is regarded as the social opportunity cost of capital. Therefore, the inflation rate is assumed at 12% in the NPV analysis.

Major indicators for financial evaluation, NPV and FIRR by cases and unit revenue level are summarized in the Table below. Profit stream by cases are shown innext sub clause.

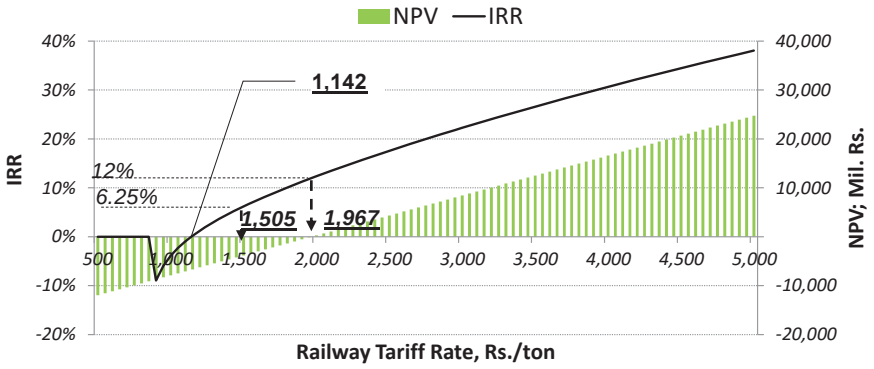
Table 8-8 Results of Tariff Rate by Case and IRR Scenario (0%, WACC and 12%)

	Item	Case 1	Case 2A	Case 2AR	Case 2B	Case 3
Net	Net Initial Financial Cost	**16,283**	**34,924**	**30,799**	**29,630**	**22,350**
Cost	Net Railway O&M Cost (30 years)	52,203	37,589	37,075	47,106	37,053
in mil. Rs.	Financial Cost Total	68,486	72,513	67,874	76,736	59,403
Present	Initial Cost (12%, 30years)	9,023	19,216	16,887	16,218	12,134
Value	Railway O&M Cost (12%, 30years)	7,034	5,113	5,106	6,408	5,040
in mil. Rs.	Present Value Total	16,056	24,329	21,930	22,626	17,174
Railway	(1) IRR=0%	1,142	1,209	1,131	1,279	990
tariff rate	(2) IRR=WACC	1,505	2,363	2,100	2,164	1,540
in Rs./ton	WACC=	6.25%	8.59%	8.28%	7.96%	6.86%
	(3) IRR=12%	1,967	2,980	2,687	2,772	2,104

Source: JICA Study Team

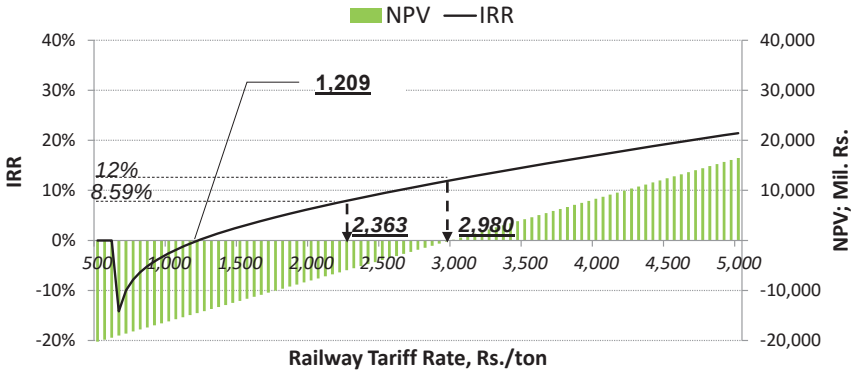
All the cases exceed PR official railway tariff. Railway tariff is affected by discounted present value and assumed IRR level. In the case of IRR=12%, railway tariff sequences are same as the line “Present Value Total” in the Table 8-8. Furthermore, net cost is equivalent to present value with discount rate is 0% thus the railway tariff level is the same sequence of net cost in the scenario of (1) IRR= 0%, the line “Cost Total” in the Table 8-8..

The result of the relation between IRR and railway tariff rate are shown from Figure 8-2 to Figure 8-6, also the figure shows the rate in the scenario (1), (2) and (3) by finding any percent of the left side vertical axis in the graph.



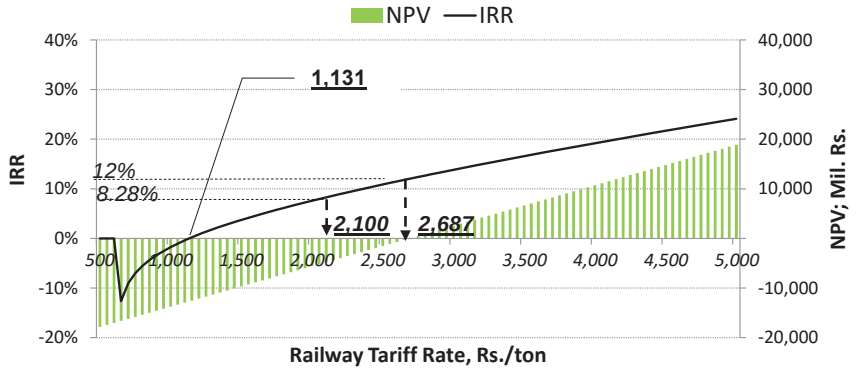
Source: JICA Study Team

Figure 8-2 FIRR and NPV by Railway Tariff Rate on Case 1



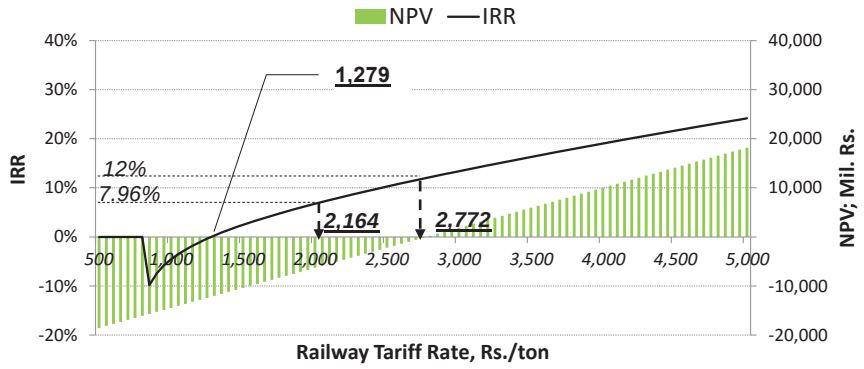
Source: JICA Study Team

Figure 8-3 FIRR and NPV by Railway Tariff Rate on Case 2A



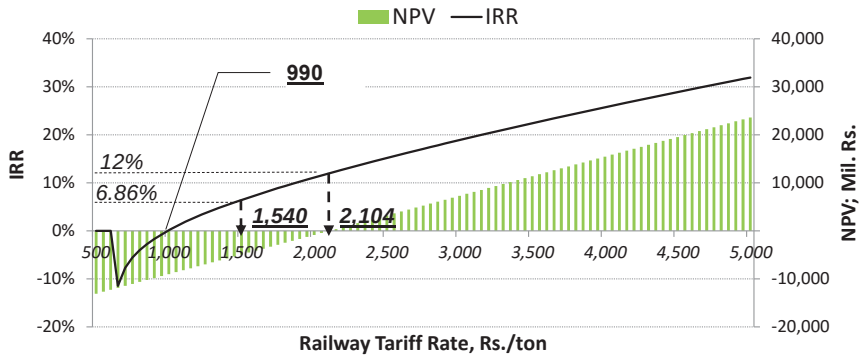
Source: JICA Study Team

Figure 8-4 FIRR and NPV by Railway Tariff Rate on Case 2AR



Source: JICA Study Team

Figure 8-5 FIRR and NPV by Railway Tariff Rate on Case 2B



Source: JICA Study Team

Figure 8-6 FIRR and NPV by Railway Tariff Rate on Case 3

8.6 Financial Cost and Benefit Stream

8.6.1 Scenario 1: Tariff rate in the case of FIRR equivalent to zero

The NPV and FIRR are calculated based on the aforementioned financial costs and benefits. Financial cost and benefit stream for all cases are shown tables below.

Table. 8-9 Financial Cost and Benefit Stream on Case 1 with FIRR equivalent to Zero

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Revenue 1,142 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-104.9	0.0	0.0	-104.9
	-561.1	0.0	0.0	-561.1
	-3,799.3	0.0	0.0	-3,799.3
	-4,598.8	0.0	0.0	-4,598.8
0	-4,605.4	0.0	0.0	-4,605.4
1	-2,614.0	-1,533.4	2,283.0	-1,864.4
2	0.0	-1,533.4	2,283.0	749.6
3	0.0	-1,533.4	2,283.0	749.6
4	0.0	-1,533.4	2,283.0	749.6
5	0.0	-2,773.5	2,283.0	-490.5
6	0.0	-1,533.4	2,283.0	749.6
7	0.0	-1,533.4	2,283.0	749.6
8	0.0	-1,533.4	2,283.0	749.6
9	0.0	-1,533.4	2,283.0	749.6
10	0.0	-2,773.5	2,283.0	-490.5
11	0.0	-1,533.4	2,283.0	749.6
12	0.0	-1,533.4	2,283.0	749.6
13	0.0	-1,533.4	2,283.0	749.6
14	0.0	-1,533.4	2,283.0	749.6
15	0.0	-2,773.5	2,283.0	-490.5
16	0.0	-1,533.4	2,283.0	749.6
17	0.0	-1,533.4	2,283.0	749.6
18	0.0	-1,533.4	2,283.0	749.6
19	0.0	-1,533.4	2,283.0	749.6
20	0.0	-2,773.5	2,283.0	-490.5
21	0.0	-1,533.4	2,283.0	749.6
22	0.0	-1,533.4	2,283.0	749.6
23	0.0	-1,533.4	2,283.0	749.6
24	0.0	-1,533.4	2,283.0	749.6
25	0.0	-2,773.5	2,283.0	-490.5
26	0.0	-1,533.4	2,283.0	749.6
27	0.0	-1,533.4	2,283.0	749.6
28	0.0	-1,533.4	2,283.0	749.6
29	0.0	-1,533.4	2,283.0	749.6
30	0.0	-1,533.4	2,283.0	749.6
Total	-16,283.4	-52,203.4	68,490.0	3.3
NPV (12%)	-9,022.6	-7,033.6	9,316.9	-6,739.3
			IRR=	0.00%
			B/C=	0.58

Unit: Mil. Rs., Source: JICA Study team

Table. 8-10 Financial Cost and Benefit Stream on Case 2A with FIRR equivalent to Zero

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Revenue 1,209 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-265.3	0.0	0.0	-265.3
	-1,576.4	0.0	0.0	-1,576.4
	-6,882.7	0.0	0.0	-6,882.7
	-9,706.8	0.0	0.0	-9,706.8
0	-9,939.9	0.0	0.0	-9,939.9
1	-6,553.2	-1,253.0	2,418.0	-5,388.2
2	0.0	-1,253.0	2,418.0	1,165.0
3	0.0	-1,253.0	2,418.0	1,165.0
4	0.0	-1,253.0	2,418.0	1,165.0
5	0.0	-1,253.0	2,418.0	1,165.0
6	0.0	-1,253.0	2,418.0	1,165.0
7	0.0	-1,253.0	2,418.0	1,165.0
8	0.0	-1,253.0	2,418.0	1,165.0
9	0.0	-1,253.0	2,418.0	1,165.0
10	0.0	-1,253.0	2,418.0	1,165.0
11	0.0	-1,253.0	2,418.0	1,165.0
12	0.0	-1,253.0	2,418.0	1,165.0
13	0.0	-1,253.0	2,418.0	1,165.0
14	0.0	-1,253.0	2,418.0	1,165.0
15	0.0	-1,253.0	2,418.0	1,165.0
16	0.0	-1,253.0	2,418.0	1,165.0
17	0.0	-1,253.0	2,418.0	1,165.0
18	0.0	-1,253.0	2,418.0	1,165.0
19	0.0	-1,253.0	2,418.0	1,165.0
20	0.0	-1,253.0	2,418.0	1,165.0
21	0.0	-1,253.0	2,418.0	1,165.0
22	0.0	-1,253.0	2,418.0	1,165.0
23	0.0	-1,253.0	2,418.0	1,165.0
24	0.0	-1,253.0	2,418.0	1,165.0
25	0.0	-1,253.0	2,418.0	1,165.0
26	0.0	-1,253.0	2,418.0	1,165.0
27	0.0	-1,253.0	2,418.0	1,165.0
28	0.0	-1,253.0	2,418.0	1,165.0
29	0.0	-1,253.0	2,418.0	1,165.0
30	0.0	-1,253.0	2,418.0	1,165.0
Total	-34,924.3	-37,589.5	72,540.0	26.3
NPV	-19,215.7	-5,113.4	9,867.9	-14,461.3
(12%)			IRR=	0.00%
			B/C=	0.41

Unit: Mil. Rs., Source: JICA Study team

Table 8-11 Financial Cost and Benefit Stream on Case 2AR with FIRR equivalent to Zero

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Revenue 1,131Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-241.9	0.0	0.0	-241.9
	-918.8	0.0	0.0	-918.8
	-6,238.8	0.0	0.0	-6,238.8
	-8,799.0	0.0	0.0	-8,799.0
0	-8,804.4	0.0	0.0	-8,804.4
1	-5,796.2	-1,235.8	2,262.0	-4,770.0
2	0.0	-1,235.8	2,262.0	1,026.2
3	0.0	-1,235.8	2,262.0	1,026.2
4	0.0	-1,235.8	2,262.0	1,026.2
5	0.0	-1,235.8	2,262.0	1,026.2
6	0.0	-1,235.8	2,262.0	1,026.2
7	0.0	-1,235.8	2,262.0	1,026.2
8	0.0	-1,235.8	2,262.0	1,026.2
9	0.0	-1,235.8	2,262.0	1,026.2
10	0.0	-1,235.8	2,262.0	1,026.2
11	0.0	-1,235.8	2,262.0	1,026.2
12	0.0	-1,235.8	2,262.0	1,026.2
13	0.0	-1,235.8	2,262.0	1,026.2
14	0.0	-1,235.8	2,262.0	1,026.2
15	0.0	-1,235.8	2,262.0	1,026.2
16	0.0	-1,235.8	2,262.0	1,026.2
17	0.0	-1,235.8	2,262.0	1,026.2
18	0.0	-1,235.8	2,262.0	1,026.2
19	0.0	-1,235.8	2,262.0	1,026.2
20	0.0	-1,235.8	2,262.0	1,026.2
21	0.0	-1,235.8	2,262.0	1,026.2
22	0.0	-1,235.8	2,262.0	1,026.2
23	0.0	-1,235.8	2,262.0	1,026.2
24	0.0	-1,235.8	2,262.0	1,026.2
25	0.0	-1,235.8	2,262.0	1,026.2
26	0.0	-1,235.8	2,262.0	1,026.2
27	0.0	-1,235.8	2,262.0	1,026.2
28	0.0	-1,235.8	2,262.0	1,026.2
29	0.0	-1,235.8	2,262.0	1,026.2
30	0.0	-1,235.8	2,262.0	1,026.2
Total	-30,799.1	-37,074.5	67,860.0	-13.6
NPV	-16,887.0	-5,043.4	9,231.2	-12,699.1
(12%)			IRR=	0.00%
			B/C=	0.42

Table. 8-12 Financial Cost and Benefit Stream on Case 2B with FIRR equivalent to Zero

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Revenue 1,279 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-222.9	0.0	0.0	-222.9
	-921.8	0.0	0.0	-921.8
	-5,808.9	0.0	0.0	-5,808.9
	-8,386.6	0.0	0.0	-8,386.6
0	-8,652.7	0.0	0.0	-8,652.7
1	-5,637.1	-1,570.2	2,558.0	-4,649.3
2	0.0	-1,570.2	2,558.0	987.8
3	0.0	-1,570.2	2,558.0	987.8
4	0.0	-1,570.2	2,558.0	987.8
5	0.0	-1,570.2	2,558.0	987.8
6	0.0	-1,570.2	2,558.0	987.8
7	0.0	-1,570.2	2,558.0	987.8
8	0.0	-1,570.2	2,558.0	987.8
9	0.0	-1,570.2	2,558.0	987.8
10	0.0	-1,570.2	2,558.0	987.8
11	0.0	-1,570.2	2,558.0	987.8
12	0.0	-1,570.2	2,558.0	987.8
13	0.0	-1,570.2	2,558.0	987.8
14	0.0	-1,570.2	2,558.0	987.8
15	0.0	-1,570.2	2,558.0	987.8
16	0.0	-1,570.2	2,558.0	987.8
17	0.0	-1,570.2	2,558.0	987.8
18	0.0	-1,570.2	2,558.0	987.8
19	0.0	-1,570.2	2,558.0	987.8
20	0.0	-1,570.2	2,558.0	987.8
21	0.0	-1,570.2	2,558.0	987.8
22	0.0	-1,570.2	2,558.0	987.8
23	0.0	-1,570.2	2,558.0	987.8
24	0.0	-1,570.2	2,558.0	987.8
25	0.0	-1,570.2	2,558.0	987.8
26	0.0	-1,570.2	2,558.0	987.8
27	0.0	-1,570.2	2,558.0	987.8
28	0.0	-1,570.2	2,558.0	987.8
29	0.0	-1,570.2	2,558.0	987.8
30	0.0	-1,570.2	2,558.0	987.8
Total	-29,630.1	-47,105.9	76,740.0	4.0
NPV	-16,218.0	-6,408.0	10,439.2	-12,186.7
(12%)			IRR=	0.00%
			B/C=	0.46

Unit: Mil. Rs., Source: JICA Study team

Table. 8-13 Financial Cost and Benefit Stream on Case 3 with FIRR equivalent to Zero

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 990Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-160.3	0.0	0.0	-160.3
	-1,152.8	0.0	0.0	-1,152.8
	-4,171.8	0.0	0.0	-4,171.8
	-4,419.5	0.0	0.0	-4,419.5
0	-7,315.0	0.0	0.0	-7,315.0
1	-5,130.4	-1,235.1	1,980.0	-4,385.5
2	0.0	-1,235.1	1,980.0	744.9
3	0.0	-1,235.1	1,980.0	744.9
4	0.0	-1,235.1	1,980.0	744.9
5	0.0	-1,235.1	1,980.0	744.9
6	0.0	-1,235.1	1,980.0	744.9
7	0.0	-1,235.1	1,980.0	744.9
8	0.0	-1,235.1	1,980.0	744.9
9	0.0	-1,235.1	1,980.0	744.9
10	0.0	-1,235.1	1,980.0	744.9
11	0.0	-1,235.1	1,980.0	744.9
12	0.0	-1,235.1	1,980.0	744.9
13	0.0	-1,235.1	1,980.0	744.9
14	0.0	-1,235.1	1,980.0	744.9
15	0.0	-1,235.1	1,980.0	744.9
16	0.0	-1,235.1	1,980.0	744.9
17	0.0	-1,235.1	1,980.0	744.9
18	0.0	-1,235.1	1,980.0	744.9
19	0.0	-1,235.1	1,980.0	744.9
20	0.0	-1,235.1	1,980.0	744.9
21	0.0	-1,235.1	1,980.0	744.9
22	0.0	-1,235.1	1,980.0	744.9
23	0.0	-1,235.1	1,980.0	744.9
24	0.0	-1,235.1	1,980.0	744.9
25	0.0	-1,235.1	1,980.0	744.9
26	0.0	-1,235.1	1,980.0	744.9
27	0.0	-1,235.1	1,980.0	744.9
28	0.0	-1,235.1	1,980.0	744.9
29	0.0	-1,235.1	1,980.0	744.9
30	0.0	-1,235.1	1,980.0	744.9
Total	-22,349.7	-37,053.3	59,400.0	-2.9
NPV	-12,134.0	-5,040.5	8,080.4	-9,094.1
(12%)			IRR=	0.00%
			B/C=	0.47

Unit: Mil. Rs., Source: JICA Study team

8.6.2 Scenario 2: Tariff Rate which improve FIRR equivalent to WACC

Financial cost and benefit stream by cases are given from the following Table. 8-14 to Table. 8-18.

Table. 8-14 Financial Cost and Benefit Stream on Case 1 with FIRR meets WACC=6.25%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 1,505 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-104.9	0.0	0.0	-104.9
	-561.1	0.0	0.0	-561.1
	-3,799.3	0.0	0.0	-3,799.3
	-4,598.8	0.0	0.0	-4,598.8
0	-4,605.4	0.0	0.0	-4,605.4
1	-2,614.0	-1,533.4	3,009.0	-1,138.4
2	0.0	-1,533.4	3,009.0	1,475.6
3	0.0	-1,533.4	3,009.0	1,475.6
4	0.0	-1,533.4	3,009.0	1,475.6
5	0.0	-2,773.5	3,009.0	235.5
6	0.0	-1,533.4	3,009.0	1,475.6
7	0.0	-1,533.4	3,009.0	1,475.6
8	0.0	-1,533.4	3,009.0	1,475.6
9	0.0	-1,533.4	3,009.0	1,475.6
10	0.0	-2,773.5	3,009.0	235.5
11	0.0	-1,533.4	3,009.0	1,475.6
12	0.0	-1,533.4	3,009.0	1,475.6
13	0.0	-1,533.4	3,009.0	1,475.6
14	0.0	-1,533.4	3,009.0	1,475.6
15	0.0	-2,773.5	3,009.0	235.5
16	0.0	-1,533.4	3,009.0	1,475.6
17	0.0	-1,533.4	3,009.0	1,475.6
18	0.0	-1,533.4	3,009.0	1,475.6
19	0.0	-1,533.4	3,009.0	1,475.6
20	0.0	-2,773.5	3,009.0	235.5
21	0.0	-1,533.4	3,009.0	1,475.6
22	0.0	-1,533.4	3,009.0	1,475.6
23	0.0	-1,533.4	3,009.0	1,475.6
24	0.0	-1,533.4	3,009.0	1,475.6
25	0.0	-2,773.5	3,009.0	235.5
26	0.0	-1,533.4	3,009.0	1,475.6
27	0.0	-1,533.4	3,009.0	1,475.6
28	0.0	-1,533.4	3,009.0	1,475.6
29	0.0	-1,533.4	3,009.0	1,475.6
30	0.0	-1,533.4	3,009.0	1,475.6
Total	-16,283.4	-52,203.4	90,270.0	21,783.3
NPV	-9,022.6	-7,033.6	12,279.7	-3,776.5
(12%)			IRR=	6.25%
			B/C=	0.76

Source: JICA Study Team

Table. 8-15 Financial Cost and Benefit Stream on Case 2A with FIRR meets WACC=8.59%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 2,363 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-265.3	0.0	0.0	-265.3
	-1,576.4	0.0	0.0	-1,576.4
	-6,882.7	0.0	0.0	-6,882.7
	-9,706.8	0.0	0.0	-9,706.8
0	-9,939.9	0.0	0.0	-9,939.9
1	-6,553.2	-1,253.0	4,726.0	-3,080.2
2	0.0	-1,253.0	4,726.0	3,473.0
3	0.0	-1,253.0	4,726.0	3,473.0
4	0.0	-1,253.0	4,726.0	3,473.0
5	0.0	-1,253.0	4,726.0	3,473.0
6	0.0	-1,253.0	4,726.0	3,473.0
7	0.0	-1,253.0	4,726.0	3,473.0
8	0.0	-1,253.0	4,726.0	3,473.0
9	0.0	-1,253.0	4,726.0	3,473.0
10	0.0	-1,253.0	4,726.0	3,473.0
11	0.0	-1,253.0	4,726.0	3,473.0
12	0.0	-1,253.0	4,726.0	3,473.0
13	0.0	-1,253.0	4,726.0	3,473.0
14	0.0	-1,253.0	4,726.0	3,473.0
15	0.0	-1,253.0	4,726.0	3,473.0
16	0.0	-1,253.0	4,726.0	3,473.0
17	0.0	-1,253.0	4,726.0	3,473.0
18	0.0	-1,253.0	4,726.0	3,473.0
19	0.0	-1,253.0	4,726.0	3,473.0
20	0.0	-1,253.0	4,726.0	3,473.0
21	0.0	-1,253.0	4,726.0	3,473.0
22	0.0	-1,253.0	4,726.0	3,473.0
23	0.0	-1,253.0	4,726.0	3,473.0
24	0.0	-1,253.0	4,726.0	3,473.0
25	0.0	-1,253.0	4,726.0	3,473.0
26	0.0	-1,253.0	4,726.0	3,473.0
27	0.0	-1,253.0	4,726.0	3,473.0
28	0.0	-1,253.0	4,726.0	3,473.0
29	0.0	-1,253.0	4,726.0	3,473.0
30	0.0	-1,253.0	4,726.0	3,473.0
Total	-34,924.3	-37,589.5	141,780.0	69,266.3
NPV	-19,215.7	-5,113.4	19,286.8	-5,042.3
(12%)			IRR=	8.59%
			B/C=	0.79

Source: JICA Study Team

Table 8-16 Financial Cost and Benefit Stream on Case 2AR with FIRR meets WACC=8.28%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 2,100 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-241.9	0.0	0.0	-241.9
	-918.8	0.0	0.0	-918.8
	-6,238.8	0.0	0.0	-6,238.8
	-8,799.0	0.0	0.0	-8,799.0
0	-8,804.4	0.0	0.0	-8,804.4
1	-5,796.2	-1,235.8	4,200.0	-2,832.0
2	0.0	-1,235.8	4,200.0	2,964.2
3	0.0	-1,235.8	4,200.0	2,964.2
4	0.0	-1,235.8	4,200.0	2,964.2
5	0.0	-1,235.8	4,200.0	2,964.2
6	0.0	-1,235.8	4,200.0	2,964.2
7	0.0	-1,235.8	4,200.0	2,964.2
8	0.0	-1,235.8	4,200.0	2,964.2
9	0.0	-1,235.8	4,200.0	2,964.2
10	0.0	-1,235.8	4,200.0	2,964.2
11	0.0	-1,235.8	4,200.0	2,964.2
12	0.0	-1,235.8	4,200.0	2,964.2
13	0.0	-1,235.8	4,200.0	2,964.2
14	0.0	-1,235.8	4,200.0	2,964.2
15	0.0	-1,235.8	4,200.0	2,964.2
16	0.0	-1,235.8	4,200.0	2,964.2
17	0.0	-1,235.8	4,200.0	2,964.2
18	0.0	-1,235.8	4,200.0	2,964.2
19	0.0	-1,235.8	4,200.0	2,964.2
20	0.0	-1,235.8	4,200.0	2,964.2
21	0.0	-1,235.8	4,200.0	2,964.2
22	0.0	-1,235.8	4,200.0	2,964.2
23	0.0	-1,235.8	4,200.0	2,964.2
24	0.0	-1,235.8	4,200.0	2,964.2
25	0.0	-1,235.8	4,200.0	2,964.2
26	0.0	-1,235.8	4,200.0	2,964.2
27	0.0	-1,235.8	4,200.0	2,964.2
28	0.0	-1,235.8	4,200.0	2,964.2
29	0.0	-1,235.8	4,200.0	2,964.2
30	0.0	-1,235.8	4,200.0	2,964.2
Total	-30,799.1	-37,074.5	126,000.0	58,126.4
NPV	-16,887.0	-5,043.4	17,140.2	-4,790.1
(12%)			IRR=	8.28%
			B/C=	0.78

Table. 8-17 Financial Cost and Benefit Stream on Case 2B with FIRR meets WACC=7.96%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 2,164 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-222.9	0.0	0.0	-222.9
	-921.8	0.0	0.0	-921.8
	-5,808.9	0.0	0.0	-5,808.9
	-8,386.6	0.0	0.0	-8,386.6
0	-8,652.7	0.0	0.0	-8,652.7
1	-5,637.1	-1,570.2	4,328.0	-2,879.3
2	0.0	-1,570.2	4,328.0	2,757.8
3	0.0	-1,570.2	4,328.0	2,757.8
4	0.0	-1,570.2	4,328.0	2,757.8
5	0.0	-1,570.2	4,328.0	2,757.8
6	0.0	-1,570.2	4,328.0	2,757.8
7	0.0	-1,570.2	4,328.0	2,757.8
8	0.0	-1,570.2	4,328.0	2,757.8
9	0.0	-1,570.2	4,328.0	2,757.8
10	0.0	-1,570.2	4,328.0	2,757.8
11	0.0	-1,570.2	4,328.0	2,757.8
12	0.0	-1,570.2	4,328.0	2,757.8
13	0.0	-1,570.2	4,328.0	2,757.8
14	0.0	-1,570.2	4,328.0	2,757.8
15	0.0	-1,570.2	4,328.0	2,757.8
16	0.0	-1,570.2	4,328.0	2,757.8
17	0.0	-1,570.2	4,328.0	2,757.8
18	0.0	-1,570.2	4,328.0	2,757.8
19	0.0	-1,570.2	4,328.0	2,757.8
20	0.0	-1,570.2	4,328.0	2,757.8
21	0.0	-1,570.2	4,328.0	2,757.8
22	0.0	-1,570.2	4,328.0	2,757.8
23	0.0	-1,570.2	4,328.0	2,757.8
24	0.0	-1,570.2	4,328.0	2,757.8
25	0.0	-1,570.2	4,328.0	2,757.8
26	0.0	-1,570.2	4,328.0	2,757.8
27	0.0	-1,570.2	4,328.0	2,757.8
28	0.0	-1,570.2	4,328.0	2,757.8
29	0.0	-1,570.2	4,328.0	2,757.8
30	0.0	-1,570.2	4,328.0	2,757.8
Total	-29,630.1	-47,105.9	129,840.0	53,104.0
NPV	-16,218.0	-6,408.0	17,662.6	-4,963.4
(12%)			IRR=	7.96%
			B/C=	0.78

Source: JICA Study Team

Table. 8-18 Financial Cost and Benefit Stream on Case 3 with FIRR meets WACC=6.86%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 1,540 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-160.3	0.0	0.0	-160.3
	-1,152.8	0.0	0.0	-1,152.8
	-4,171.8	0.0	0.0	-4,171.8
	-4,419.5	0.0	0.0	-4,419.5
0	-7,315.0	0.0	0.0	-7,315.0
1	-5,130.4	-1,235.1	3,080.0	-3,285.5
2	0.0	-1,235.1	3,080.0	1,844.9
3	0.0	-1,235.1	3,080.0	1,844.9
4	0.0	-1,235.1	3,080.0	1,844.9
5	0.0	-1,235.1	3,080.0	1,844.9
6	0.0	-1,235.1	3,080.0	1,844.9
7	0.0	-1,235.1	3,080.0	1,844.9
8	0.0	-1,235.1	3,080.0	1,844.9
9	0.0	-1,235.1	3,080.0	1,844.9
10	0.0	-1,235.1	3,080.0	1,844.9
11	0.0	-1,235.1	3,080.0	1,844.9
12	0.0	-1,235.1	3,080.0	1,844.9
13	0.0	-1,235.1	3,080.0	1,844.9
14	0.0	-1,235.1	3,080.0	1,844.9
15	0.0	-1,235.1	3,080.0	1,844.9
16	0.0	-1,235.1	3,080.0	1,844.9
17	0.0	-1,235.1	3,080.0	1,844.9
18	0.0	-1,235.1	3,080.0	1,844.9
19	0.0	-1,235.1	3,080.0	1,844.9
20	0.0	-1,235.1	3,080.0	1,844.9
21	0.0	-1,235.1	3,080.0	1,844.9
22	0.0	-1,235.1	3,080.0	1,844.9
23	0.0	-1,235.1	3,080.0	1,844.9
24	0.0	-1,235.1	3,080.0	1,844.9
25	0.0	-1,235.1	3,080.0	1,844.9
26	0.0	-1,235.1	3,080.0	1,844.9
27	0.0	-1,235.1	3,080.0	1,844.9
28	0.0	-1,235.1	3,080.0	1,844.9
29	0.0	-1,235.1	3,080.0	1,844.9
30	0.0	-1,235.1	3,080.0	1,844.9
Total	-22,349.7	-37,053.3	92,400.0	32,997.1
NPV	-12,134.0	-5,040.5	12,569.5	-4,605.0
(12%)			IRR=	6.86%
			B/C=	0.73

Source: JICA Study Team

8.6.3 Scenario 3: Tariff Rate which improve FIRR equivalent to 12%

According to Pakistan Railway, Pakistan inflation rate is assumed at 10% to 12% and FIRR should be bigger than inflation rate. Financial cost and benefit streams which meets FIRR=12 % are shown from Table. 8-18 to Table. **8-23**. Net Profit Value is equivalent to zero since discount rate is assumed at 12% in all cases.

Table. 8-19 Financial Cost and Benefit Stream on Case 1 with FIRR =12%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 1,967 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-104.9	0.0	0.0	-104.9
	-561.1	0.0	0.0	-561.1
	-3,799.3	0.0	0.0	-3,799.3
	-4,598.8	0.0	0.0	-4,598.8
0	-4,605.4	0.0	0.0	-4,605.4
1	-2,614.0	-1,533.4	3,934.0	-213.4
2	0.0	-1,533.4	3,934.0	2,400.6
3	0.0	-1,533.4	3,934.0	2,400.6
4	0.0	-1,533.4	3,934.0	2,400.6
5	0.0	-2,773.5	3,934.0	1,160.5
6	0.0	-1,533.4	3,934.0	2,400.6
7	0.0	-1,533.4	3,934.0	2,400.6
8	0.0	-1,533.4	3,934.0	2,400.6
9	0.0	-1,533.4	3,934.0	2,400.6
10	0.0	-2,773.5	3,934.0	1,160.5
11	0.0	-1,533.4	3,934.0	2,400.6
12	0.0	-1,533.4	3,934.0	2,400.6
13	0.0	-1,533.4	3,934.0	2,400.6
14	0.0	-1,533.4	3,934.0	2,400.6
15	0.0	-2,773.5	3,934.0	1,160.5
16	0.0	-1,533.4	3,934.0	2,400.6
17	0.0	-1,533.4	3,934.0	2,400.6
18	0.0	-1,533.4	3,934.0	2,400.6
19	0.0	-1,533.4	3,934.0	2,400.6
20	0.0	-2,773.5	3,934.0	1,160.5
21	0.0	-1,533.4	3,934.0	2,400.6
22	0.0	-1,533.4	3,934.0	2,400.6
23	0.0	-1,533.4	3,934.0	2,400.6
24	0.0	-1,533.4	3,934.0	2,400.6
25	0.0	-2,773.5	3,934.0	1,160.5
26	0.0	-1,533.4	3,934.0	2,400.6
27	0.0	-1,533.4	3,934.0	2,400.6
28	0.0	-1,533.4	3,934.0	2,400.6
29	0.0	-1,533.4	3,934.0	2,400.6
30	0.0	-1,533.4	3,934.0	2,400.6
Total	-16,283.4	-52,203.4	118,020.0	49,533.3
NPV	-9,022.6	-7,033.6	16,054.7	-1.5
(12%)			IRR=	12.00%
Source: JICA Study Team			B/C=	1.00

Table 8-20 Financial Cost and Benefit Stream on Case 2A with FIRR =12%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 2,980 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-265.3	0.0	0.0	-265.3
	-1,576.4	0.0	0.0	-1,576.4
	-6,882.7	0.0	0.0	-6,882.7
	-9,706.8	0.0	0.0	-9,706.8
0	-9,939.9	0.0	0.0	-9,939.9
1	-6,553.2	-1,253.0	5,960.0	-1,846.2
2	0.0	-1,253.0	5,960.0	4,707.0
3	0.0	-1,253.0	5,960.0	4,707.0
4	0.0	-1,253.0	5,960.0	4,707.0
5	0.0	-1,253.0	5,960.0	4,707.0
6	0.0	-1,253.0	5,960.0	4,707.0
7	0.0	-1,253.0	5,960.0	4,707.0
8	0.0	-1,253.0	5,960.0	4,707.0
9	0.0	-1,253.0	5,960.0	4,707.0
10	0.0	-1,253.0	5,960.0	4,707.0
11	0.0	-1,253.0	5,960.0	4,707.0
12	0.0	-1,253.0	5,960.0	4,707.0
13	0.0	-1,253.0	5,960.0	4,707.0
14	0.0	-1,253.0	5,960.0	4,707.0
15	0.0	-1,253.0	5,960.0	4,707.0
16	0.0	-1,253.0	5,960.0	4,707.0
17	0.0	-1,253.0	5,960.0	4,707.0
18	0.0	-1,253.0	5,960.0	4,707.0
19	0.0	-1,253.0	5,960.0	4,707.0
20	0.0	-1,253.0	5,960.0	4,707.0
21	0.0	-1,253.0	5,960.0	4,707.0
22	0.0	-1,253.0	5,960.0	4,707.0
23	0.0	-1,253.0	5,960.0	4,707.0
24	0.0	-1,253.0	5,960.0	4,707.0
25	0.0	-1,253.0	5,960.0	4,707.0
26	0.0	-1,253.0	5,960.0	4,707.0
27	0.0	-1,253.0	5,960.0	4,707.0
28	0.0	-1,253.0	5,960.0	4,707.0
29	0.0	-1,253.0	5,960.0	4,707.0
30	0.0	-1,253.0	5,960.0	4,707.0
Total	-34,924.3	-37,589.5	178,800.0	106,286.3
NPV	-19,215.7	-5,113.4	24,322.8	-6.3
(12%)			IRR=	12.00%
			B/C=	1.00

Table. 8-21 Financial Cost and Benefit Stream on Case 2AR with FIRR =12%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 2,687 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-241.9	0.0	0.0	-241.9
	-918.8	0.0	0.0	-918.8
	-6,238.8	0.0	0.0	-6,238.8
	-8,799.0	0.0	0.0	-8,799.0
0	-8,804.4	0.0	0.0	-8,804.4
1	-5,796.2	-1,235.8	5,374.0	-1,658.0
2	0.0	-1,235.8	5,374.0	4,138.2
3	0.0	-1,235.8	5,374.0	4,138.2
4	0.0	-1,235.8	5,374.0	4,138.2
5	0.0	-1,235.8	5,374.0	4,138.2
6	0.0	-1,235.8	5,374.0	4,138.2
7	0.0	-1,235.8	5,374.0	4,138.2
8	0.0	-1,235.8	5,374.0	4,138.2
9	0.0	-1,235.8	5,374.0	4,138.2
10	0.0	-1,235.8	5,374.0	4,138.2
11	0.0	-1,235.8	5,374.0	4,138.2
12	0.0	-1,235.8	5,374.0	4,138.2
13	0.0	-1,235.8	5,374.0	4,138.2
14	0.0	-1,235.8	5,374.0	4,138.2
15	0.0	-1,235.8	5,374.0	4,138.2
16	0.0	-1,235.8	5,374.0	4,138.2
17	0.0	-1,235.8	5,374.0	4,138.2
18	0.0	-1,235.8	5,374.0	4,138.2
19	0.0	-1,235.8	5,374.0	4,138.2
20	0.0	-1,235.8	5,374.0	4,138.2
21	0.0	-1,235.8	5,374.0	4,138.2
22	0.0	-1,235.8	5,374.0	4,138.2
23	0.0	-1,235.8	5,374.0	4,138.2
24	0.0	-1,235.8	5,374.0	4,138.2
25	0.0	-1,235.8	5,374.0	4,138.2
26	0.0	-1,235.8	5,374.0	4,138.2
27	0.0	-1,235.8	5,374.0	4,138.2
28	0.0	-1,235.8	5,374.0	4,138.2
29	0.0	-1,235.8	5,374.0	4,138.2
30	0.0	-1,235.8	5,374.0	4,138.2
Total	-30,799.1	-37,074.5	161,220.0	93,346.4
NPV	-16,887.0	-5,043.4	21,931.3	1.0
(12%)			IRR=	12.00%
			B/C=	1.00

Source: JICA Study Team

Table. 8-22 Financial Cost and Benefit Stream on Case 2B with FIRR =12%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 2,772 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-222.9	0.0	0.0	-222.9
	-921.8	0.0	0.0	-921.8
	-5,808.9	0.0	0.0	-5,808.9
	-8,386.6	0.0	0.0	-8,386.6
0	-8,652.7	0.0	0.0	-8,652.7
1	-5,637.1	-1,570.2	5,544.0	-1,663.3
2	0.0	-1,570.2	5,544.0	3,973.8
3	0.0	-1,570.2	5,544.0	3,973.8
4	0.0	-1,570.2	5,544.0	3,973.8
5	0.0	-1,570.2	5,544.0	3,973.8
6	0.0	-1,570.2	5,544.0	3,973.8
7	0.0	-1,570.2	5,544.0	3,973.8
8	0.0	-1,570.2	5,544.0	3,973.8
9	0.0	-1,570.2	5,544.0	3,973.8
10	0.0	-1,570.2	5,544.0	3,973.8
11	0.0	-1,570.2	5,544.0	3,973.8
12	0.0	-1,570.2	5,544.0	3,973.8
13	0.0	-1,570.2	5,544.0	3,973.8
14	0.0	-1,570.2	5,544.0	3,973.8
15	0.0	-1,570.2	5,544.0	3,973.8
16	0.0	-1,570.2	5,544.0	3,973.8
17	0.0	-1,570.2	5,544.0	3,973.8
18	0.0	-1,570.2	5,544.0	3,973.8
19	0.0	-1,570.2	5,544.0	3,973.8
20	0.0	-1,570.2	5,544.0	3,973.8
21	0.0	-1,570.2	5,544.0	3,973.8
22	0.0	-1,570.2	5,544.0	3,973.8
23	0.0	-1,570.2	5,544.0	3,973.8
24	0.0	-1,570.2	5,544.0	3,973.8
25	0.0	-1,570.2	5,544.0	3,973.8
26	0.0	-1,570.2	5,544.0	3,973.8
27	0.0	-1,570.2	5,544.0	3,973.8
28	0.0	-1,570.2	5,544.0	3,973.8
29	0.0	-1,570.2	5,544.0	3,973.8
30	0.0	-1,570.2	5,544.0	3,973.8
Total	-29,630.1	-47,105.9	166,320.0	89,584.0
NPV	-16,218.0	-6,408.0	22,625.1	-0.8
(12%)			IRR=	12.00%
			B/C=	1.00

Source: JICA Study Team

Table. 8-23 Financial Cost and Benefit Stream on Case 3 with FIRR =12%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Tariff 2,104 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-160.3	0.0	0.0	-160.3
	-1,152.8	0.0	0.0	-1,152.8
	-4,171.8	0.0	0.0	-4,171.8
	-4,419.5	0.0	0.0	-4,419.5
0	-7,315.0	0.0	0.0	-7,315.0
1	-5,130.4	-1,235.1	4,208.0	-2,157.5
2	0.0	-1,235.1	4,208.0	2,972.9
3	0.0	-1,235.1	4,208.0	2,972.9
4	0.0	-1,235.1	4,208.0	2,972.9
5	0.0	-1,235.1	4,208.0	2,972.9
6	0.0	-1,235.1	4,208.0	2,972.9
7	0.0	-1,235.1	4,208.0	2,972.9
8	0.0	-1,235.1	4,208.0	2,972.9
9	0.0	-1,235.1	4,208.0	2,972.9
10	0.0	-1,235.1	4,208.0	2,972.9
11	0.0	-1,235.1	4,208.0	2,972.9
12	0.0	-1,235.1	4,208.0	2,972.9
13	0.0	-1,235.1	4,208.0	2,972.9
14	0.0	-1,235.1	4,208.0	2,972.9
15	0.0	-1,235.1	4,208.0	2,972.9
16	0.0	-1,235.1	4,208.0	2,972.9
17	0.0	-1,235.1	4,208.0	2,972.9
18	0.0	-1,235.1	4,208.0	2,972.9
19	0.0	-1,235.1	4,208.0	2,972.9
20	0.0	-1,235.1	4,208.0	2,972.9
21	0.0	-1,235.1	4,208.0	2,972.9
22	0.0	-1,235.1	4,208.0	2,972.9
23	0.0	-1,235.1	4,208.0	2,972.9
24	0.0	-1,235.1	4,208.0	2,972.9
25	0.0	-1,235.1	4,208.0	2,972.9
26	0.0	-1,235.1	4,208.0	2,972.9
27	0.0	-1,235.1	4,208.0	2,972.9
28	0.0	-1,235.1	4,208.0	2,972.9
29	0.0	-1,235.1	4,208.0	2,972.9
30	0.0	-1,235.1	4,208.0	2,972.9
Total	-22,349.7	-37,053.3	126,240.0	66,837.1
NPV	-12,134.0	-5,040.5	17,172.9	-1.6
(12%)			IRR=	12.00%
			B/C=	1.00

Source: JICA Study Team

8.7 Financial Analysis of the Case Study: Railway Access to PIBT

Initial cost and railway O&M cost will be covered by railway tariff. F-IRR rate is calculated by revenue-fixed cash flow and F-IRR could not be calculated without fixed railway tariff. Here the railway tariff which satisfies three scenarios of FIRR, (1) IRR=0%, (2) IRR= Weighted Average Cost of Capital (WACC) and (3) IRR=12% were calculated.

The Weighted Average Cost of Capital (WACC) is revised as shown Table 8-24 according to revised cost given in Table 8-24.

Table 8-24 Nominal Weighted Average Cost of Capital

Case	Item	Formula	Loan		Equity	Total
			(Yen LIBOR Loan)	(Pakistan Rupee Loan)	Tax, Land	
Common	A. Nominal cost		4.63%	15.00%	12.00%	
	B. Tax rate		35.00%	35.00%	0.00%	
	C. Tax-adjusted nominal cost	Ax(1-B)	3.01%	9.75%	12.00%	
Case Study	D. Amount (Mil. Rs.)		8,764	23,784	7,791	40,339
	E. Weighing		21.73%	58.96%	19.31%	100%
	F. Weighted component of WACC	CxE	0.65%	5.75%	2.32%	**8.72%**

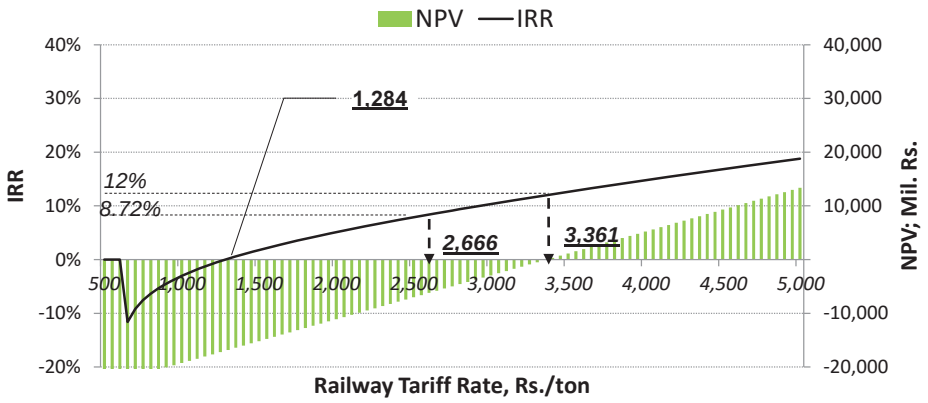
Source: JICA Study Team

Table 8-25 summarizes the result of railway tariff to cover all railway concerned cost including railway O&M cost by three scenarios of IRR. Also the Figure 8-7 shows the rate in the scenario (1), (2) and (3) by finding any percent of the left side vertical axis in the graph.

Table 8-25 Railway Tariff Rate by Hurdle Rate of IRR Level

IRR	0%	WACC=8.72%	12%
Railway Tariff Rate (Rs./ton)	1,284	2,666	3,361

Source: JICA Study Team



Source: JICA Study Team

Figure 8-7 FIRR and NPV(12%) by Railway Tariff

Financial cost and benefit streams by scenarios are shown from Table. 8-26 to Table. 8-28.

Table. 8-26 Financial Cost and Benefit Stream with FIRR equivalent to Zero

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Revenue 1,284 Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-340.5	0.0	0.0	-340.5
	-1,066.7	0.0	0.0	-1,066.7
	-7,482.2	0.0	0.0	-7,482.2
	-12,233.4	0.0	0.0	-12,233.4
0	-12,238.8	0.0	0.0	-12,238.8
1	-8,085.8	-1,185.9	2,568.0	-6,703.6
2	0.0	-1,185.9	2,568.0	1,382.1
3	0.0	-1,185.9	2,568.0	1,382.1
4	0.0	-1,185.9	2,568.0	1,382.1
5	0.0	-1,185.9	2,568.0	1,382.1
6	0.0	-1,185.9	2,568.0	1,382.1
7	0.0	-1,185.9	2,568.0	1,382.1
8	0.0	-1,185.9	2,568.0	1,382.1
9	0.0	-1,185.9	2,568.0	1,382.1
10	0.0	-1,185.9	2,568.0	1,382.1
11	0.0	-1,185.9	2,568.0	1,382.1
12	0.0	-1,185.9	2,568.0	1,382.1
13	0.0	-1,185.9	2,568.0	1,382.1
14	0.0	-1,185.9	2,568.0	1,382.1
15	0.0	-1,185.9	2,568.0	1,382.1
16	0.0	-1,185.9	2,568.0	1,382.1
17	0.0	-1,185.9	2,568.0	1,382.1
18	0.0	-1,185.9	2,568.0	1,382.1
19	0.0	-1,185.9	2,568.0	1,382.1
20	0.0	-1,185.9	2,568.0	1,382.1
21	0.0	-1,185.9	2,568.0	1,382.1
22	0.0	-1,185.9	2,568.0	1,382.1
23	0.0	-1,185.9	2,568.0	1,382.1
24	0.0	-1,185.9	2,568.0	1,382.1
25	0.0	-1,185.9	2,568.0	1,382.1
26	0.0	-1,185.9	2,568.0	1,382.1
27	0.0	-1,185.9	2,568.0	1,382.1
28	0.0	-1,185.9	2,568.0	1,382.1
29	0.0	-1,185.9	2,568.0	1,382.1
30	0.0	-1,185.9	2,568.0	1,382.1
Total	-41,447.4	-35,575.6	77,040.0	17.0
NPV (12%)	-22,585.5	-4,839.5	10,480.0	-16,944.9
			IRR=	0.00%
			B/C=	0.38

Unit: Mil. Rs., Source: JICA Study team

Table. 8-27 Financial Cost and Benefit Stream with FIRR equivalent to WACC=8.72%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Revenue 2,666Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-340.5	0.0	0.0	-340.5
	-1,066.7	0.0	0.0	-1,066.7
	-7,482.2	0.0	0.0	-7,482.2
	-12,233.4	0.0	0.0	-12,233.4
0	-12,238.8	0.0	0.0	-12,238.8
1	-8,085.8	-1,185.9	5,332.0	-3,939.6
2	0.0	-1,185.9	5,332.0	4,146.1
3	0.0	-1,185.9	5,332.0	4,146.1
4	0.0	-1,185.9	5,332.0	4,146.1
5	0.0	-1,185.9	5,332.0	4,146.1
6	0.0	-1,185.9	5,332.0	4,146.1
7	0.0	-1,185.9	5,332.0	4,146.1
8	0.0	-1,185.9	5,332.0	4,146.1
9	0.0	-1,185.9	5,332.0	4,146.1
10	0.0	-1,185.9	5,332.0	4,146.1
11	0.0	-1,185.9	5,332.0	4,146.1
12	0.0	-1,185.9	5,332.0	4,146.1
13	0.0	-1,185.9	5,332.0	4,146.1
14	0.0	-1,185.9	5,332.0	4,146.1
15	0.0	-1,185.9	5,332.0	4,146.1
16	0.0	-1,185.9	5,332.0	4,146.1
17	0.0	-1,185.9	5,332.0	4,146.1
18	0.0	-1,185.9	5,332.0	4,146.1
19	0.0	-1,185.9	5,332.0	4,146.1
20	0.0	-1,185.9	5,332.0	4,146.1
21	0.0	-1,185.9	5,332.0	4,146.1
22	0.0	-1,185.9	5,332.0	4,146.1
23	0.0	-1,185.9	5,332.0	4,146.1
24	0.0	-1,185.9	5,332.0	4,146.1
25	0.0	-1,185.9	5,332.0	4,146.1
26	0.0	-1,185.9	5,332.0	4,146.1
27	0.0	-1,185.9	5,332.0	4,146.1
28	0.0	-1,185.9	5,332.0	4,146.1
29	0.0	-1,185.9	5,332.0	4,146.1
30	0.0	-1,185.9	5,332.0	4,146.1
Total	-41,447.4	-35,575.6	159,960.0	82,937.0
NPV	-22,585.5	-4,839.5	21,759.9	-5,665.0
(12%)			IRR=	8.72%
			B/C=	0.79

Unit: Mil. Rs., Source: JICA Study team

Table. 8-28 Financial Cost and Benefit Stream with FIRR equivalent to 12%

	(A)	(B)	(C)	Profit Stream
After Operation	Initial Cost	Railway O&M	Revenue 3,361Rs./ton	A+B+C
	0.0	0.0	0.0	0.0
	-340.5	0.0	0.0	-340.5
	-1,066.7	0.0	0.0	-1,066.7
	-7,482.2	0.0	0.0	-7,482.2
	-12,233.4	0.0	0.0	-12,233.4
0	-12,238.8	0.0	0.0	-12,238.8
1	-8,085.8	-1,185.9	6,722.0	-2,549.6
2	0.0	-1,185.9	6,722.0	5,536.1
3	0.0	-1,185.9	6,722.0	5,536.1
4	0.0	-1,185.9	6,722.0	5,536.1
5	0.0	-1,185.9	6,722.0	5,536.1
6	0.0	-1,185.9	6,722.0	5,536.1
7	0.0	-1,185.9	6,722.0	5,536.1
8	0.0	-1,185.9	6,722.0	5,536.1
9	0.0	-1,185.9	6,722.0	5,536.1
10	0.0	-1,185.9	6,722.0	5,536.1
11	0.0	-1,185.9	6,722.0	5,536.1
12	0.0	-1,185.9	6,722.0	5,536.1
13	0.0	-1,185.9	6,722.0	5,536.1
14	0.0	-1,185.9	6,722.0	5,536.1
15	0.0	-1,185.9	6,722.0	5,536.1
16	0.0	-1,185.9	6,722.0	5,536.1
17	0.0	-1,185.9	6,722.0	5,536.1
18	0.0	-1,185.9	6,722.0	5,536.1
19	0.0	-1,185.9	6,722.0	5,536.1
20	0.0	-1,185.9	6,722.0	5,536.1
21	0.0	-1,185.9	6,722.0	5,536.1
22	0.0	-1,185.9	6,722.0	5,536.1
23	0.0	-1,185.9	6,722.0	5,536.1
24	0.0	-1,185.9	6,722.0	5,536.1
25	0.0	-1,185.9	6,722.0	5,536.1
26	0.0	-1,185.9	6,722.0	5,536.1
27	0.0	-1,185.9	6,722.0	5,536.1
28	0.0	-1,185.9	6,722.0	5,536.1
29	0.0	-1,185.9	6,722.0	5,536.1
30	0.0	-1,185.9	6,722.0	5,536.1
Total	-41,447.4	-35,575.6	201,660.0	124,637.0
NPV (12%)	-22,585.5	-4,839.5	27,432.5	7.6
			IRR=	12.00%
			B/C=	1.00

Unit: Mil. Rs., Source: JICA Study team

Appendix 9 : Cost Breakdown of Revised Jamshoro PC-1 Portion in Case 2AR

Cost Breakdown of Revised Jamshoro PC-1 (Kotri~Akhundabad) Portion in Case 2AR

Ref: Revised PC-I Dated 23.11.2015

			Total unit cost			Qty	Cost		
S.#	Item		LC	FC	in mil. Rs.		LC	FC	in mil. Rs.
1	Additional line from Kotri to Jamshoro Power Plant and two loops (2kms)	km	21.4	14.5	35.9	1.0	21.4	14.5	35.9
2	Rehabilitation of existing track between Kotri to Jamshoro (10.66km)	km	19.2	14.5	33.8	10.7	205.2	154.8	360.0
3	Turnouts 54/60kg (19sets)	L.S.					11.8	26.8	38.5
	Turn out 1:16 54kg complete	set	2.9	6.7	9.6	4.0	11.8	26.8	38.5
	Turn out 1:12 54kg complete	set	2.3	5.5	7.9	0.0	0.0	0.0	0.0
	Turn out 1:81/2 54kg complete	set	1.8	4.5	6.2	0.0	0.0	0.0	0.0
4	Remodeling of Signaling system from Kotri to Akhundabad & at Sindh Univ. Station yds.	L.S.					179.2	0.0	179.2
	Main equipment	set	30.0	0.0	30.0	3.0	90.0	0.0	90.0
	Block equipment	sites	12.0	0.0	12.0	3.0	36.0	0.0	36.0
	Signaling equipment	set	15.0	0.0	15.0	3.0	45.0	0.0	45.0
	Fibber Pptic	km	0.5	0.0	0.5	10.7	5.0	0.0	5.0
	Installation & commisioning	km	0.3	0.0	0.3	10.7	3.1	0.0	3.1
5	Structural works: Rehabilitation of Bridges, Provision of Turn Table, earthworks etc.	L.S.					84.0	0.0	84.0
	Estimate cost of Rehabilitation of existing Bridges between Kotri- Akhundabad	L.S.	50.0	0.0	50.0	1.0	50.0	0.0	50.0
	Construction of Signal cabin	Nos	1.0	0.0	1.0	3.0	3.0	0.0	3.0
	Construction of Turn Table at Jamshoro Power Plant (Lump Sum)	L.S.	31.0	0.0	31.0	1.0	31.0	0.0	31.0
	Earthworks	L.S.	2.9	0.0	2.9	0.0	0.0	0.0	0.0
							501.5	196.1	697.6

Appendix 10 : Work Methods generally adapted for Reinforcement of Track and Bridges – Additional Note for Environmental Stuudy

Appendix 10 Work Methods generally adapted for Reinforcement of Track and Bridges - Additional Note for Environmental Study

1. Work Method of Reinforcement of Track

The main work items of reinforcement of track are addition and replacement of ballast, replacement of sleepers with new and heavier sleepers, and replacement of existing rail with heavier rail. Generally these replacement works for a long section, such as 40km, will be done continuously using standard length rail. The work process generally adopted are as follows;

- Preparatory work;

1) New rail and sleeper with fastening sets will be transported to the site using the flat wagon hauled by small locomotive. Then these materials will be unloaded and placed beside the existing track of working area.

2) Ballast will be transported by hopper wagons hauled by small locomotive and unloaded and placed beside the work area.

- Main works;

1) Existing rail fastening system will be released and removed,

2) Existing rail will be removed from sleeper by small crane on the flat wagon or by manpower using tools,

3) Existing sleepers will be removed by manpower or by small crane on the flat wagon.

4) Dirty part of existing ballast will be removed, and the remaining ballast will be raked flat. Then new ballast unloaded beside the existing track will be moved on the existing ballast and raked flat and tamped,

5) New sleepers will be placed on the ballast at proper position adjusting interval and straightness,

6) The new rail will be placed on the sleepers, and fastened by the new fastening system,

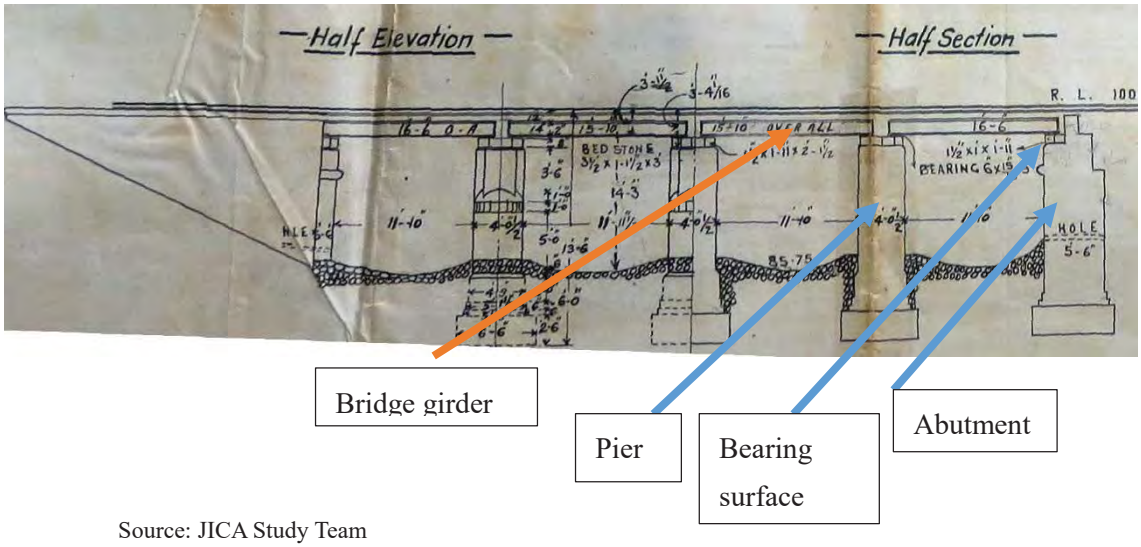
7) Additional ballast will be placed on the renewed track by hopper wagon, then tamped, adjusting the alignment of new rail.

- These works will be repeated for a unit length, such as 40km.

- Unit length of this work will be depending on the manpower, number of machines available for this operation.
- Materials used for 12.5m long track are;
  - 2 rails of 12.5m long (500kg/12.5m for one 40kg rail)
  - Sleeper: 15-16 sleepers. PC sleeper is recommendable.
  - Ballast: about 28 m^3

2. Work Method of Reinforcement of Bridge

One typical bridge on the line between Kotri Junction and Budapur station is as shown below.



Source: JICA Study Team

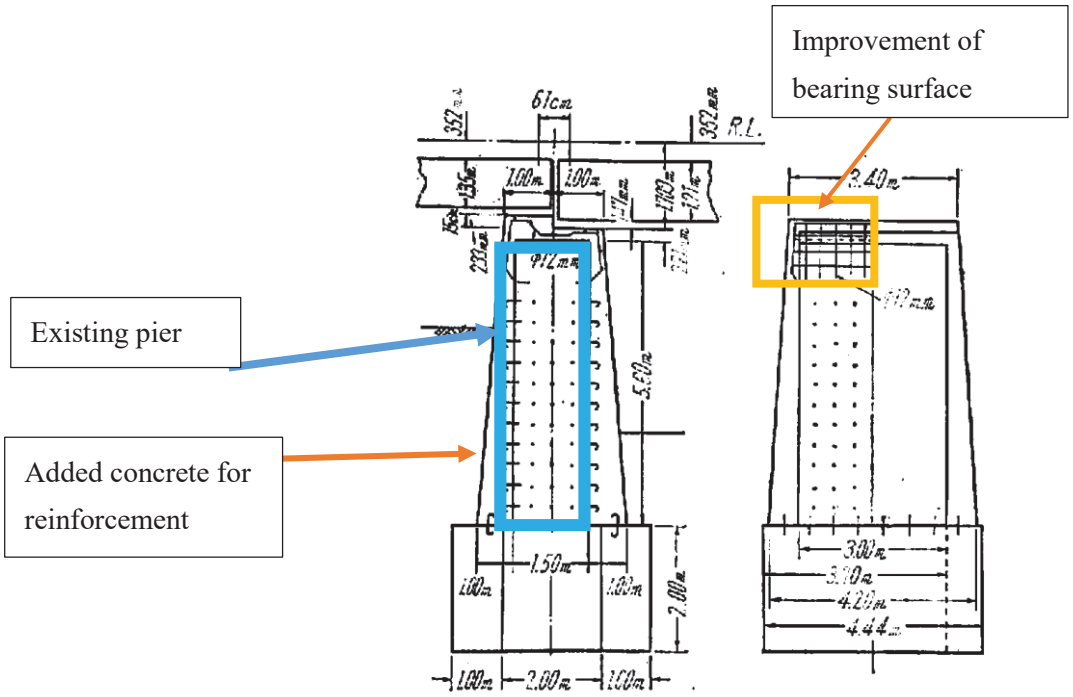
Figure 1 Typical bridge dimensions between Kotri Jn. and Budapur station

(1) Reinforcement and improvement of sub-structure

The ground condition of this section looks sound as the foundation of piers and abutments of small bridges. Since there is no information about soil condition, there will be a possibility to reinforce the foundation after the detailed geological survey. History of scouring of the foundation shall also be investigated.

When deterioration and/or serious damage of the body of the abutment and pier are found, the reinforcement of the abutment and pier of the bridges will be required. Typical reinforcement methods are shown follow;

(a) Reinforcement of Abutment and Pier



Source: JICA Study Team

Figure 2 The structure of Reinforcement of Abutment and Pier

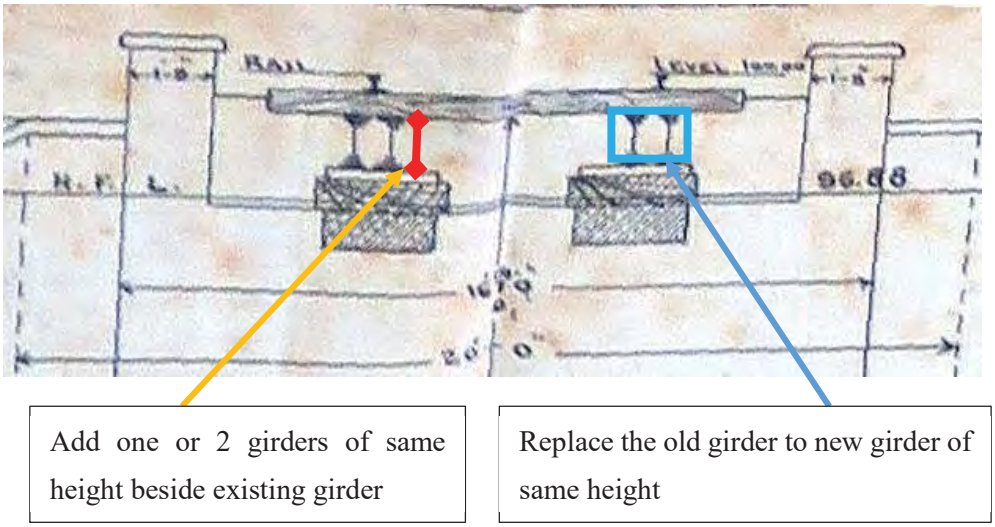
When surface of concrete abutments and piers are deteriorated or damaged, the surface of concrete will be chipped off about 5-10cm then short reinforcement steel bars will be inserted and the concrete about 10-20cm thickness will be placed covering the existing concrete of abutments and piers as shown on the above sketch.

(b) Improvement of bearing surface

1) Existing girder will be removed, then the existing concrete with reinforced bars beneath the bridge bearing will be removed,
2) Reinforcing steel bars will be installed, then concrete will be placed forming a base of new bridge bearing.
3) Bridge bearing and the girder will be restored on the repaired bearing.
4) It is recommended to use the high-early strengthen concrete to resume the early train operation.

(2) Reinforcement and replacement of super-structure

There are two methods of reinforcement of super-structure depending on the type of bridge and level of strengthening. One case is reinforcement of existing girder and the other case is replace the existing girder to new girder. Detailed methods are as follows;



Source: JICA Study Team

Figure 3 Reinforcement and replacement of super-structure

(a)Reinforcement of Girder

(1) Rail and sleepers will be removed temporarily,
(2) Additional new reinforcement girders will be installed beside the existing girder and fix on the bearing,
(3) Original reinforcement girders will be sifted and installed by small crane on the flat wagon or man power with tools,
(4) Sleepers and rail will be restored on the reinforced girders,
(5) If necessary, the sleepers and rail will be replaced with new ones.

(b)Replacement old girder with new girder

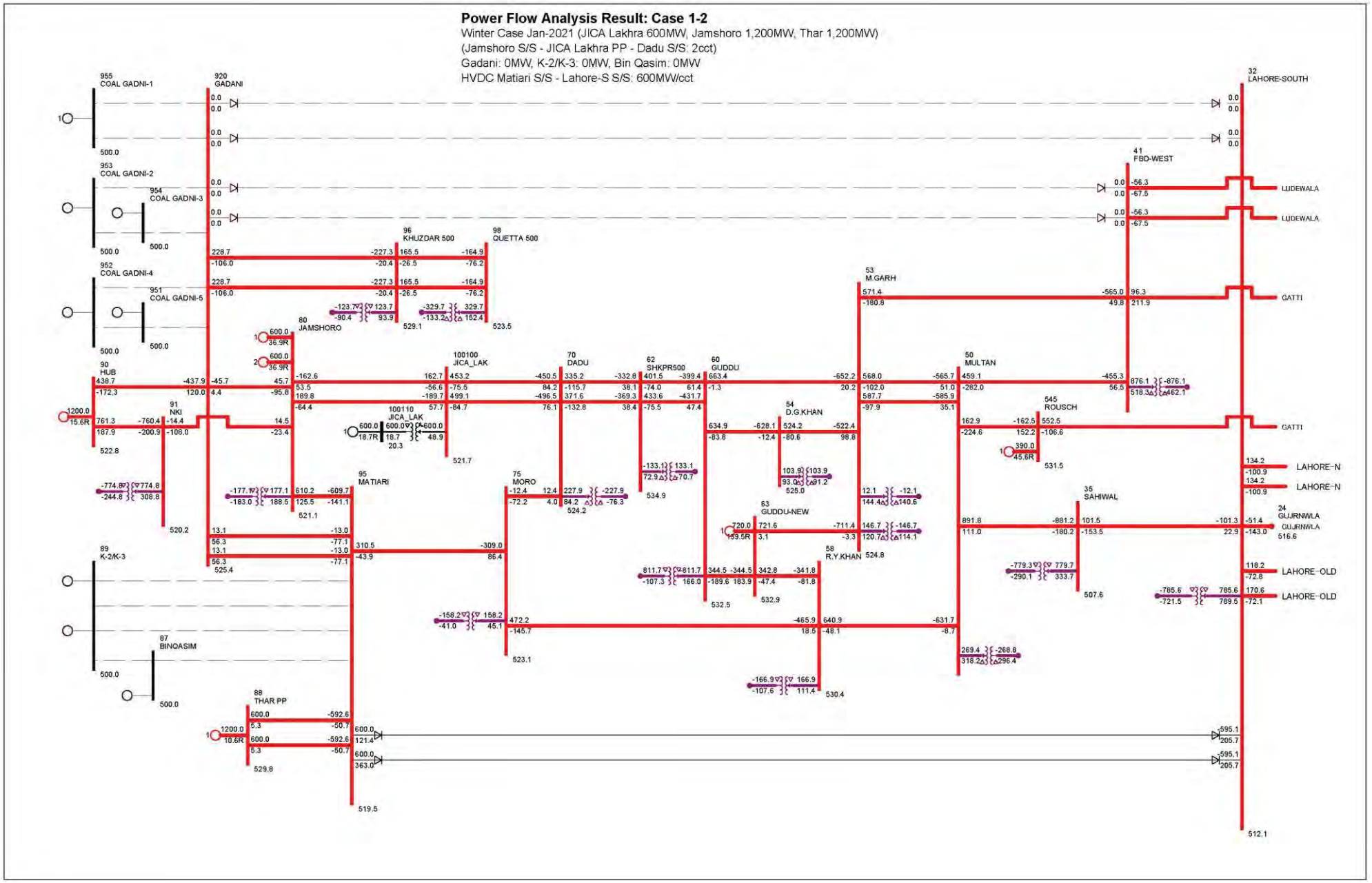
(1) Sleepers and rail will be removed temporarily and stored near the bridge,
(2) Existing girders will be removed,
(3) Existing bearing surface will be repaired or reinforced and new bearing will be installed,
(4) New girder will be installed with small crane on the flat wagon or manpower with tools, and fixed on the new bearing,
(5) Sleepers and rails will be restored on the new girder, and if necessary the sleepers and rails will be replace with new ones.

[Over]

6 - 1 STABILITY ANALYSIS CASE ST1-2

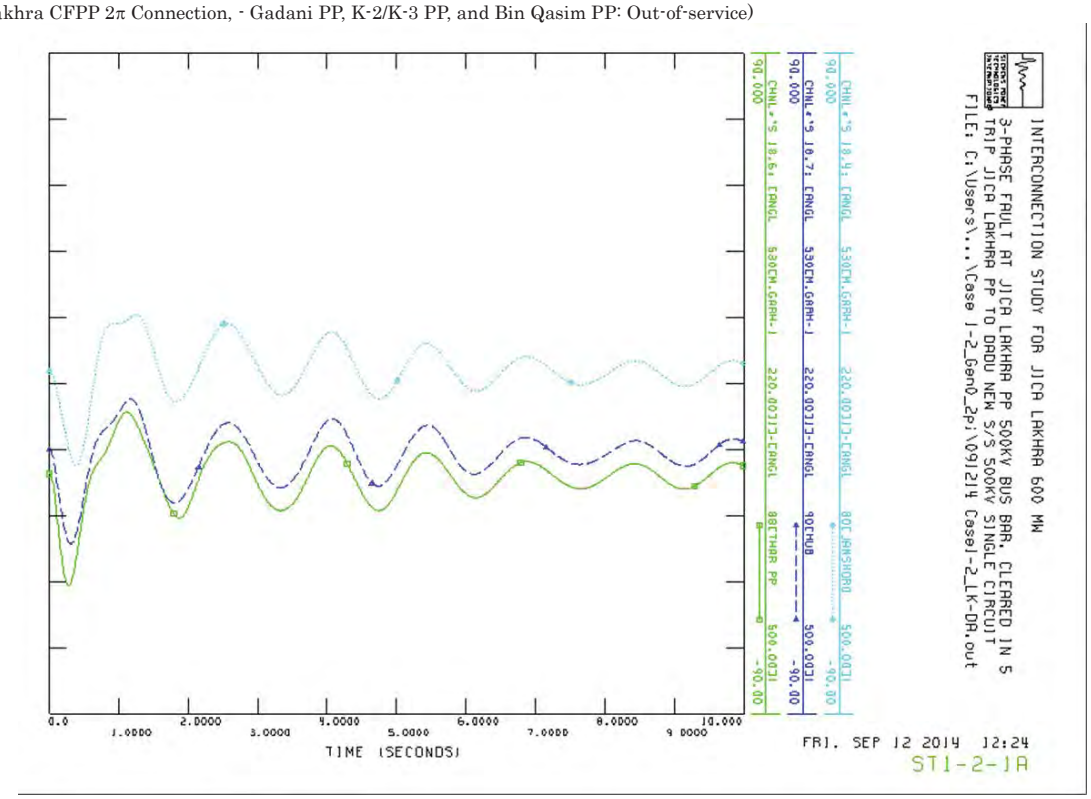
Stability Analysis Result Case ST-1-2

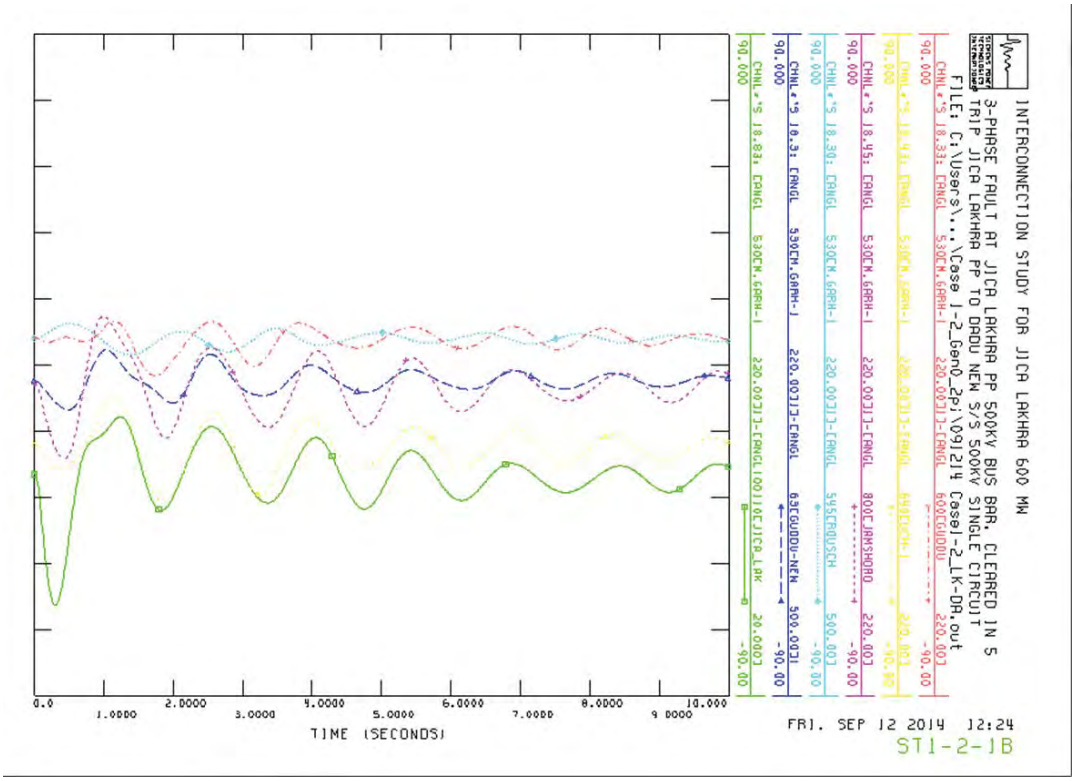
(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)



Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

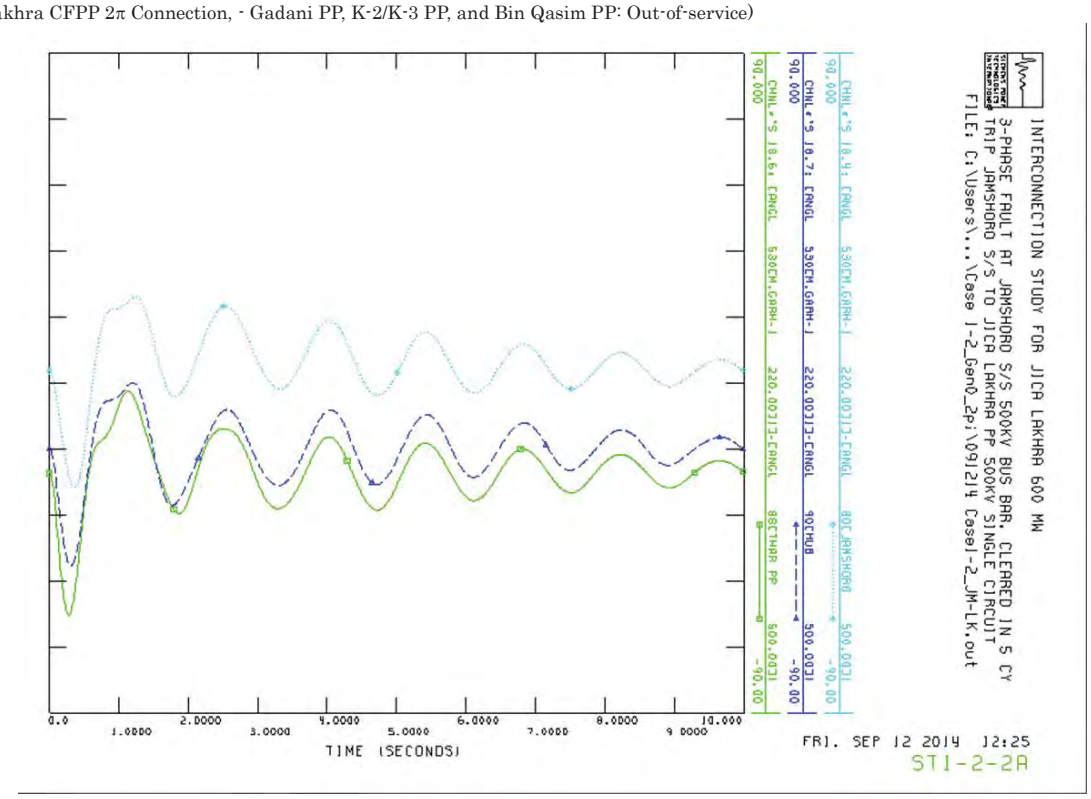


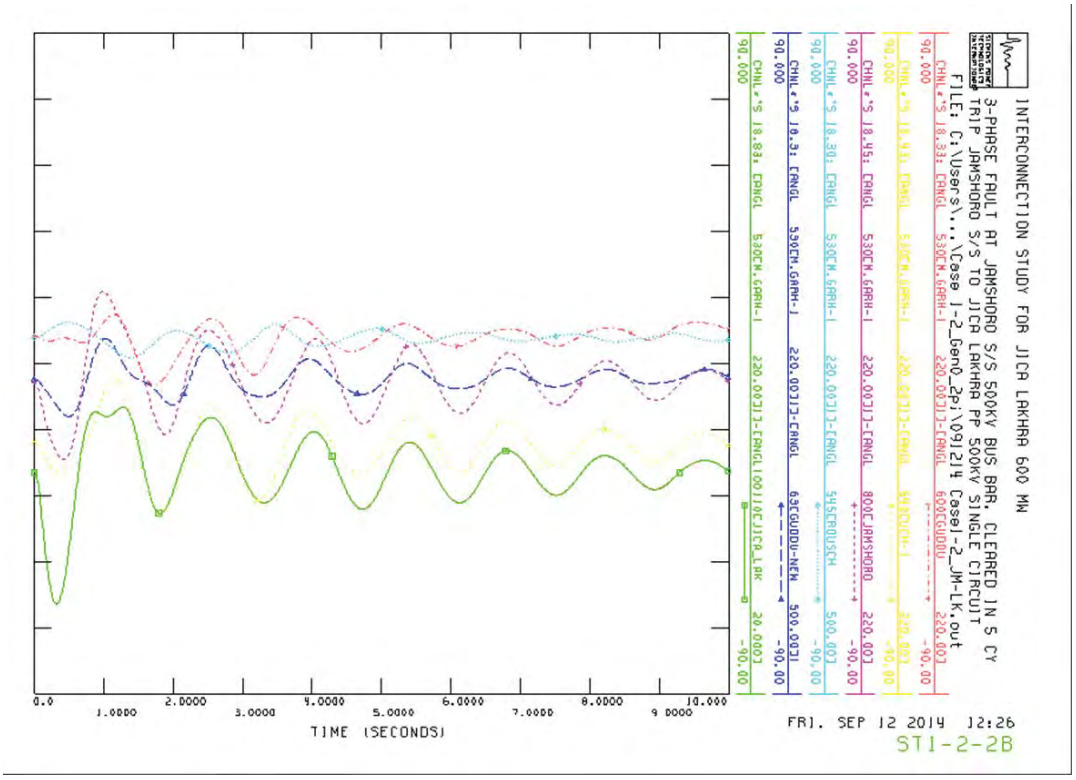


Fault Section: JICA Lakhra PP – Dadu New S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

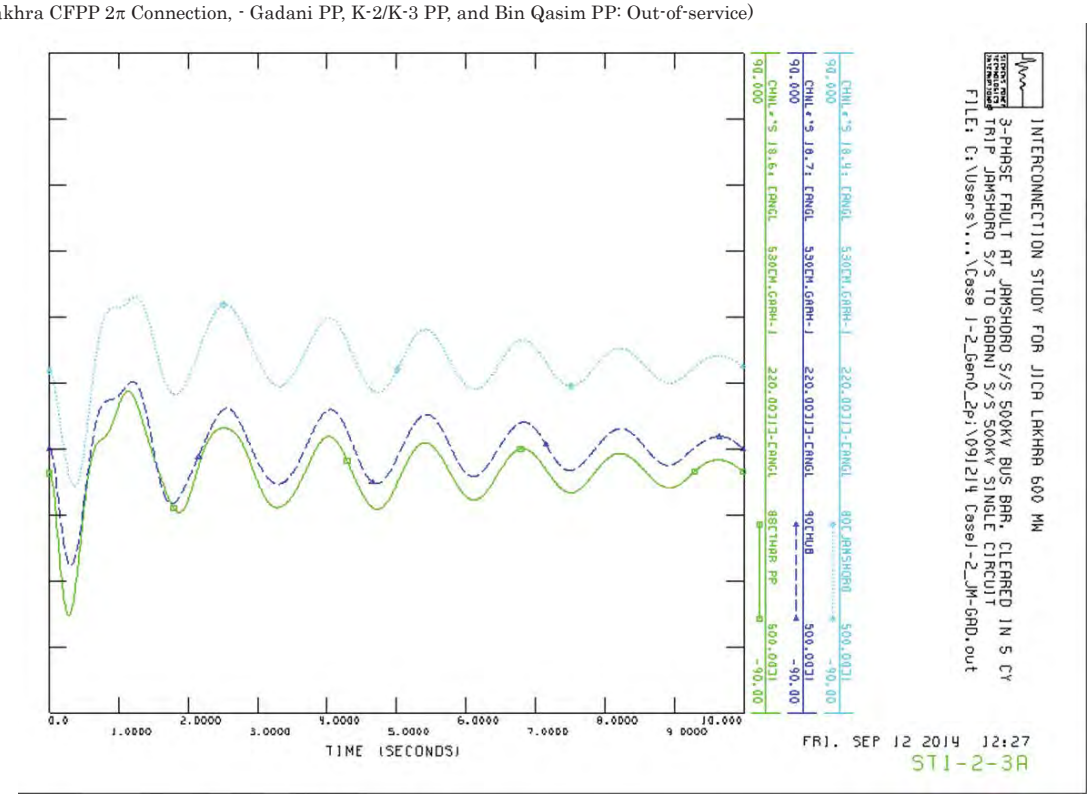


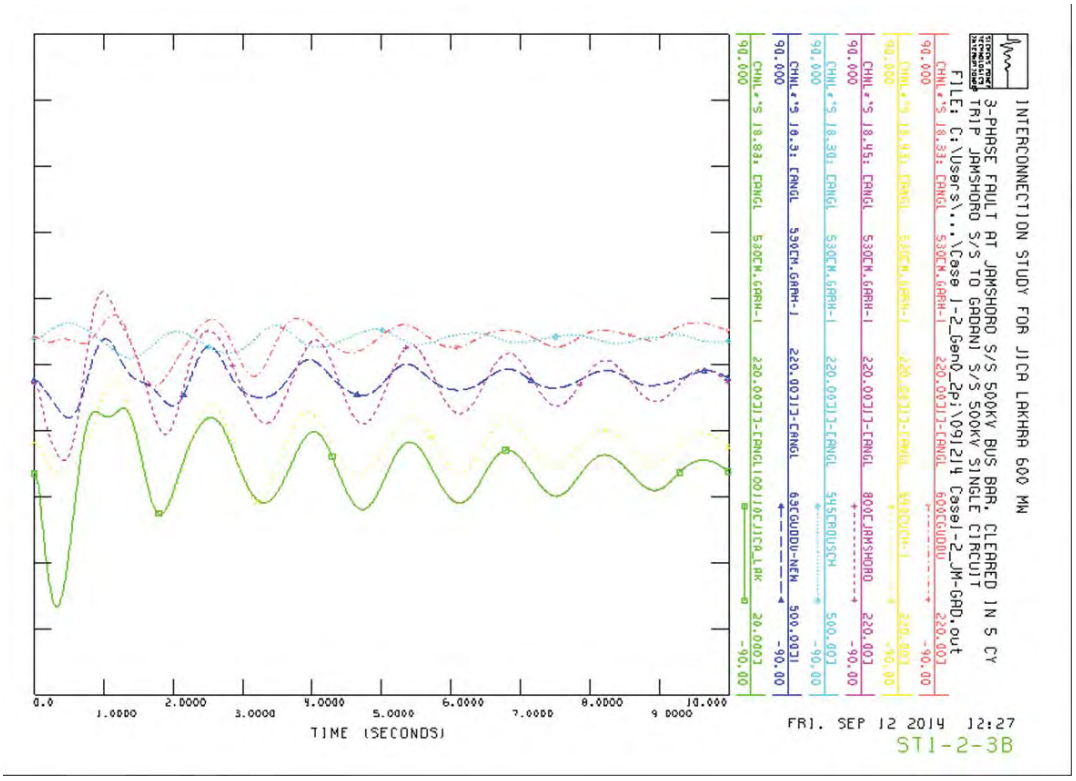


Fault Section: Jamshoro S/S – JICA Lakhra PP

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

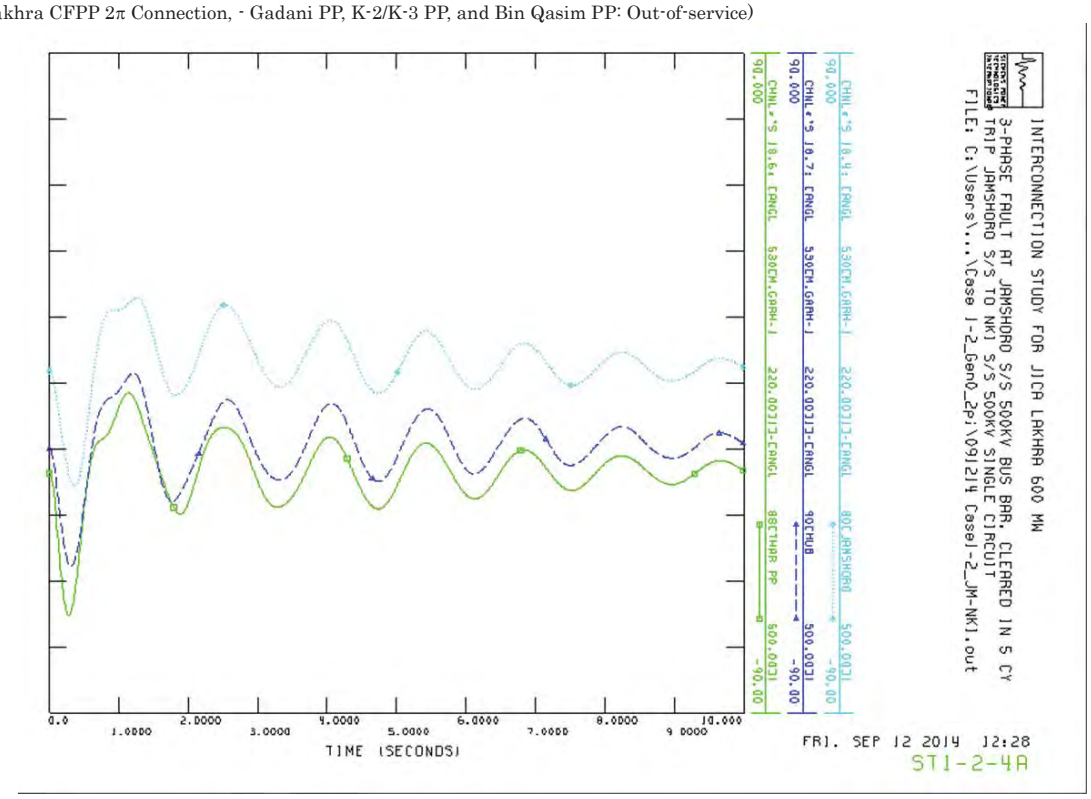


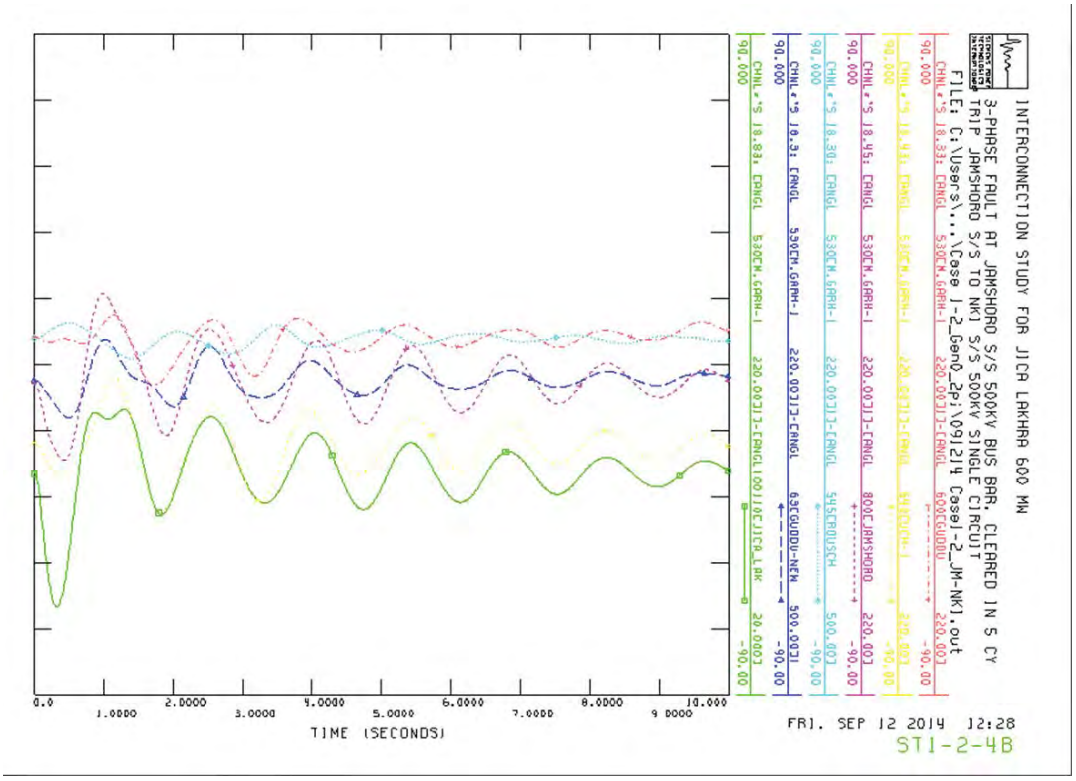


Fault Section: Jamshoro S/S – Gadani S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

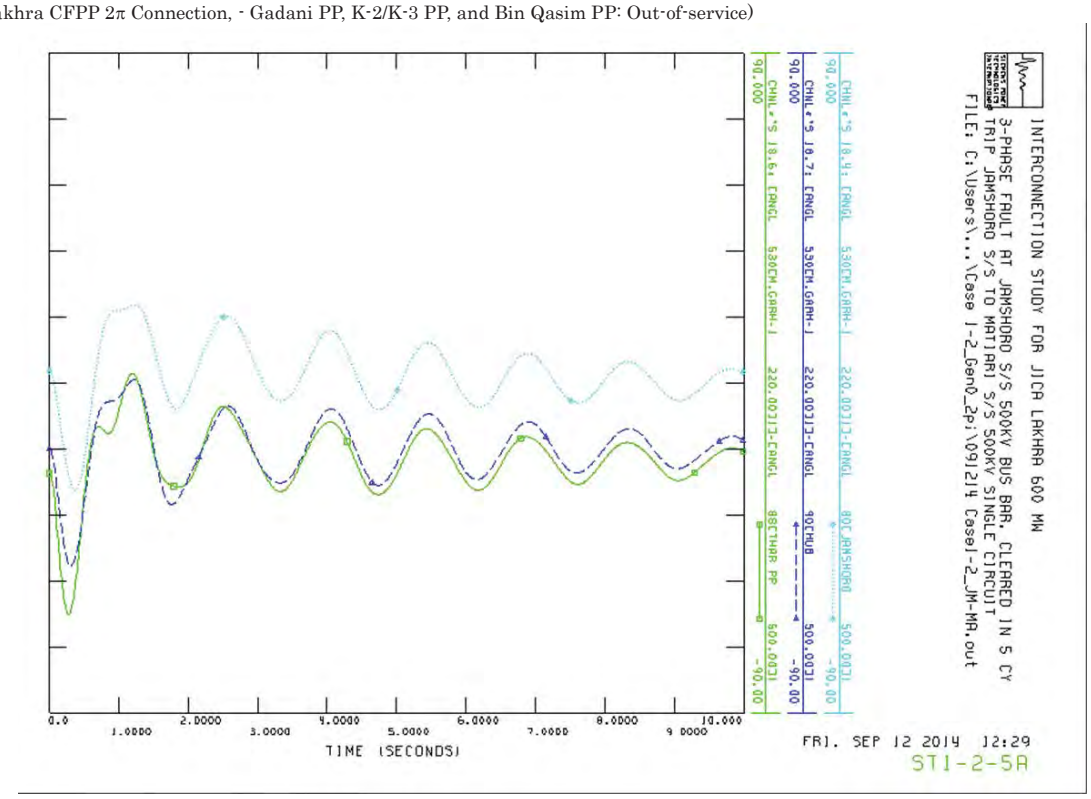


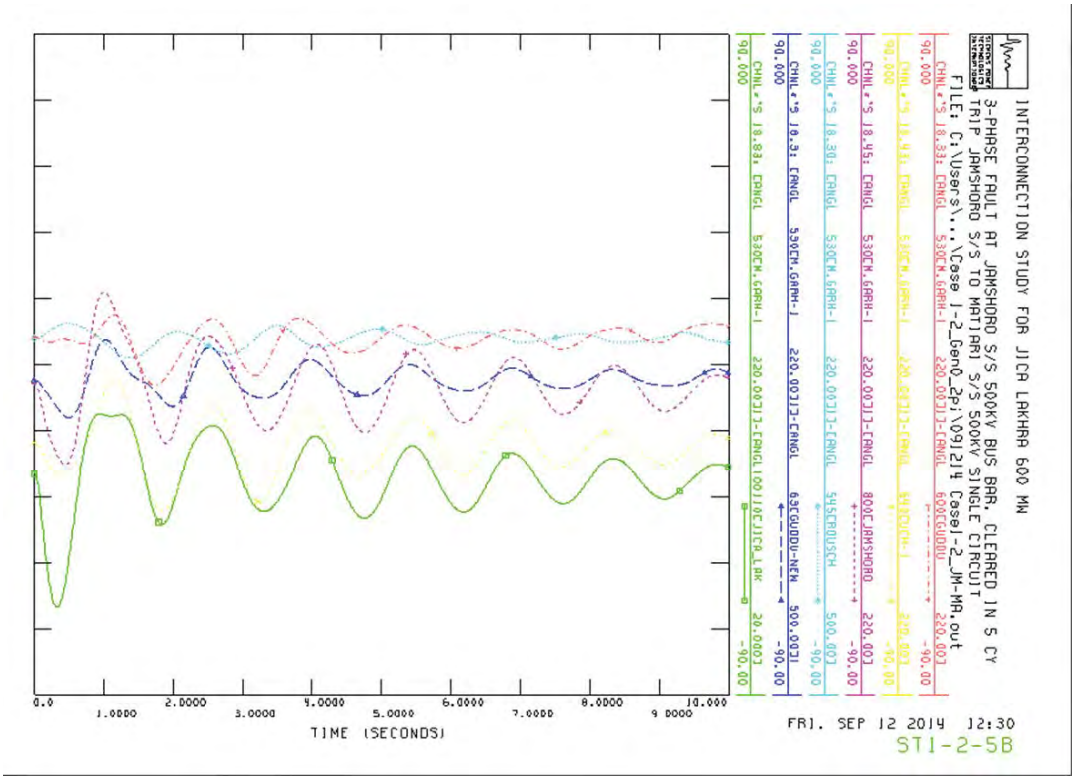


Fault Section: Jamshoro S/S – NKI S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

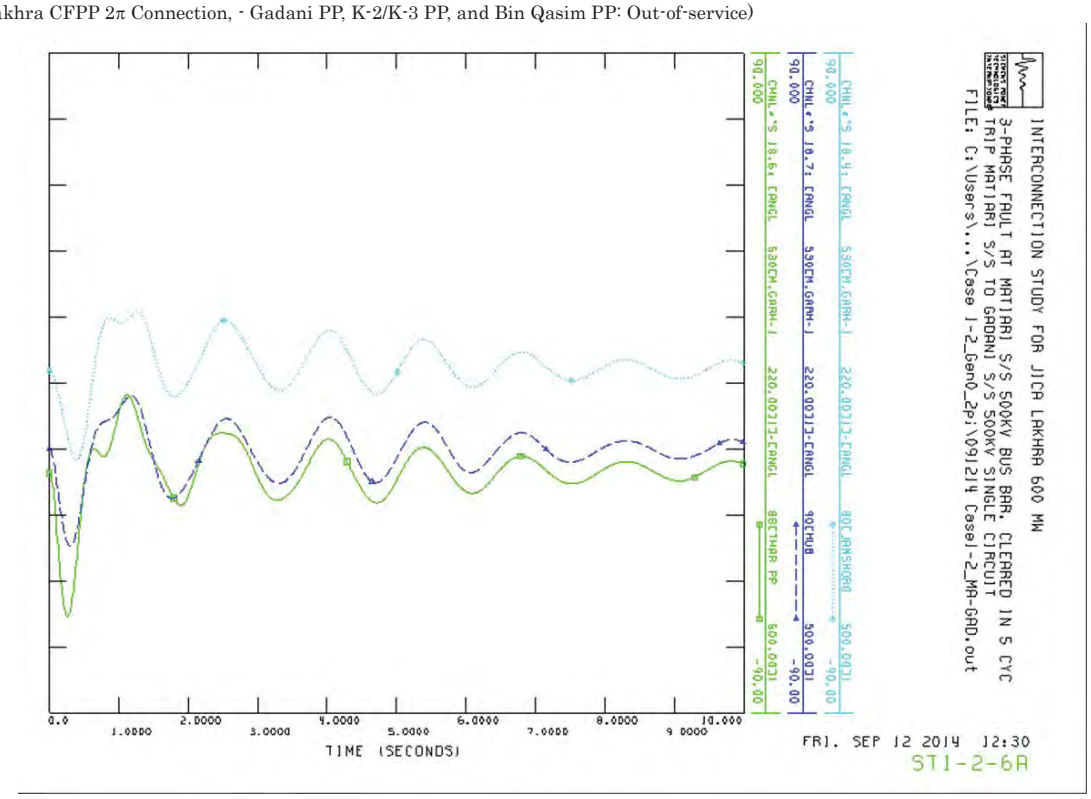


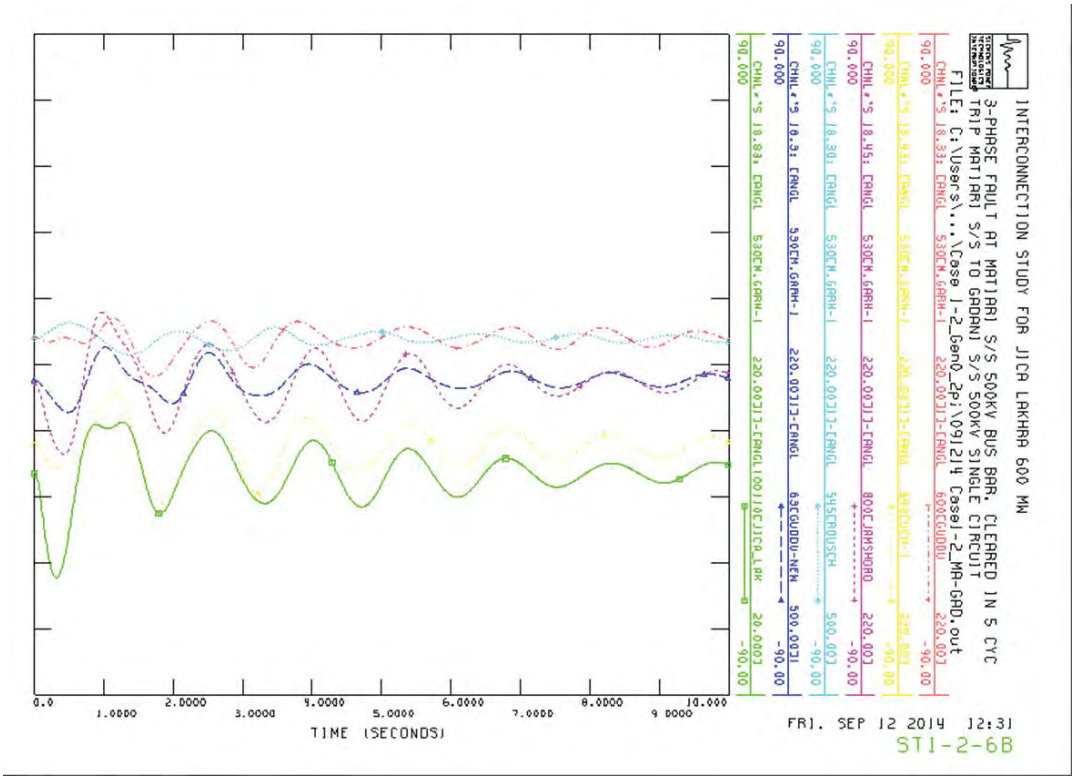


Fault Section: Jamshoro S/S – Matiari S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

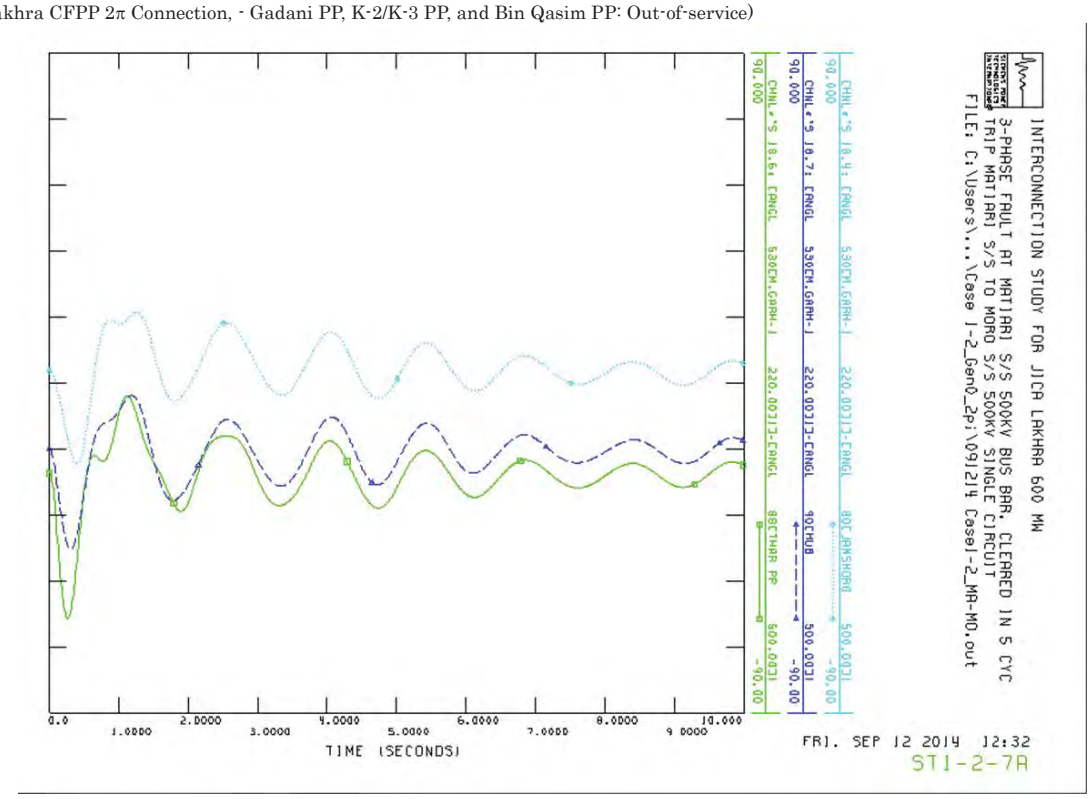


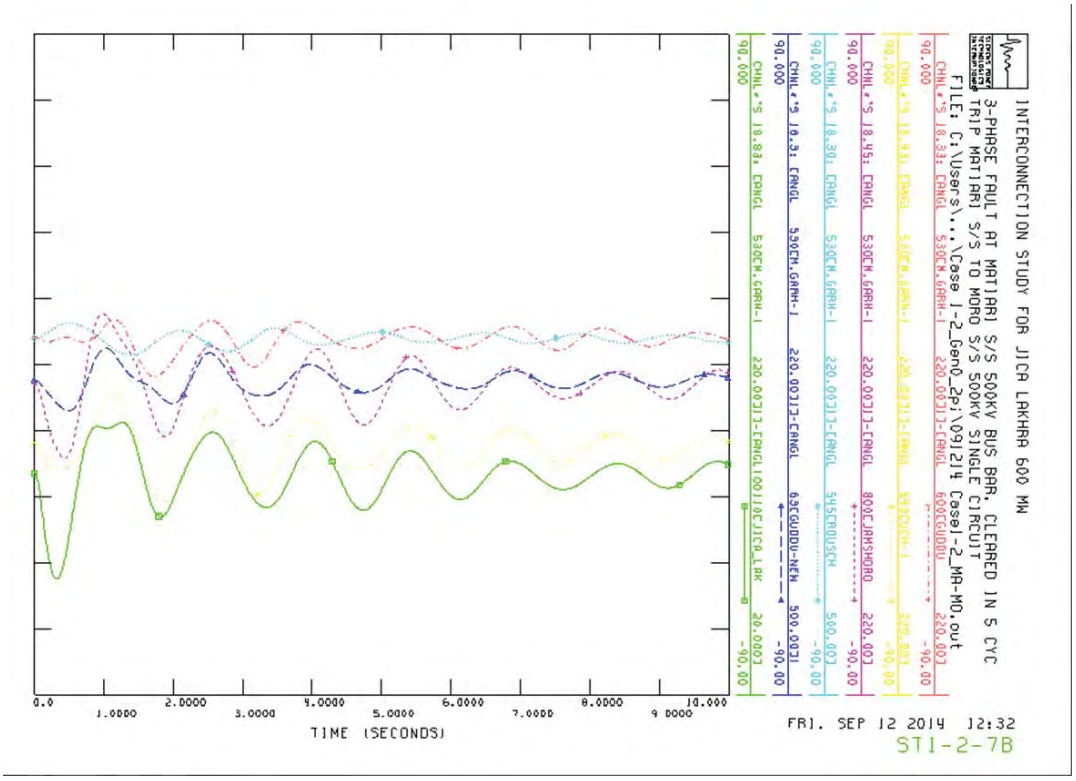


Fault Section: Matiari S/S – Gadani S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

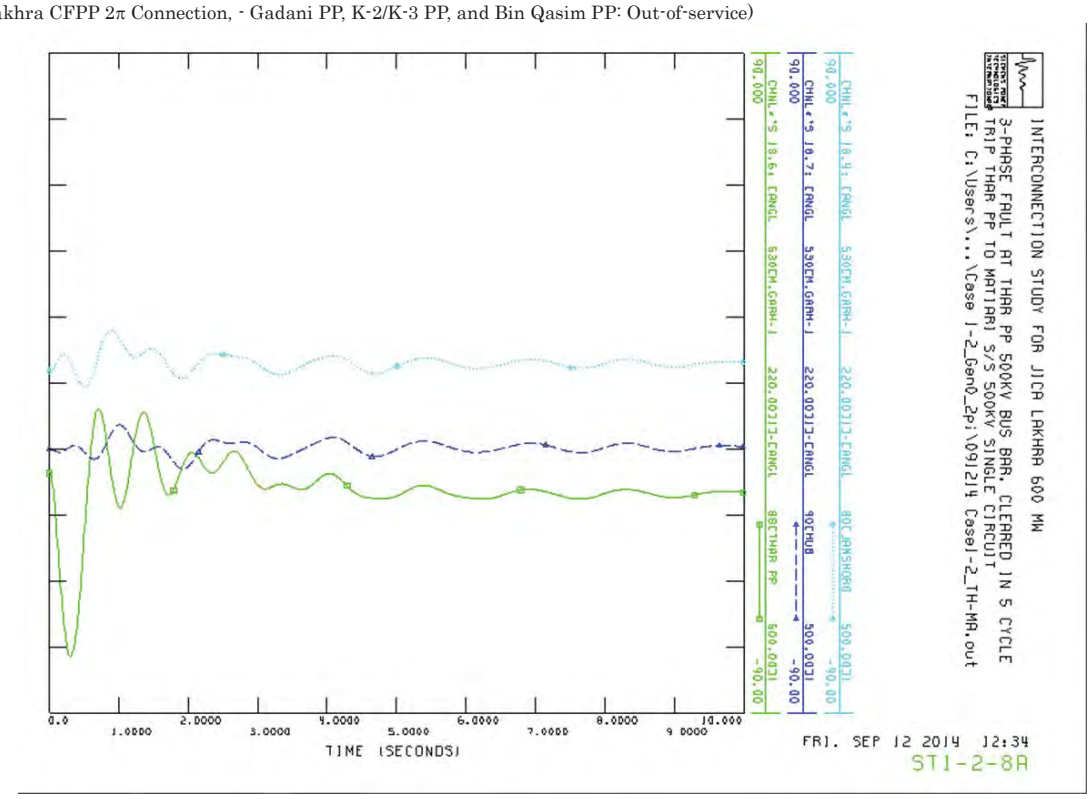


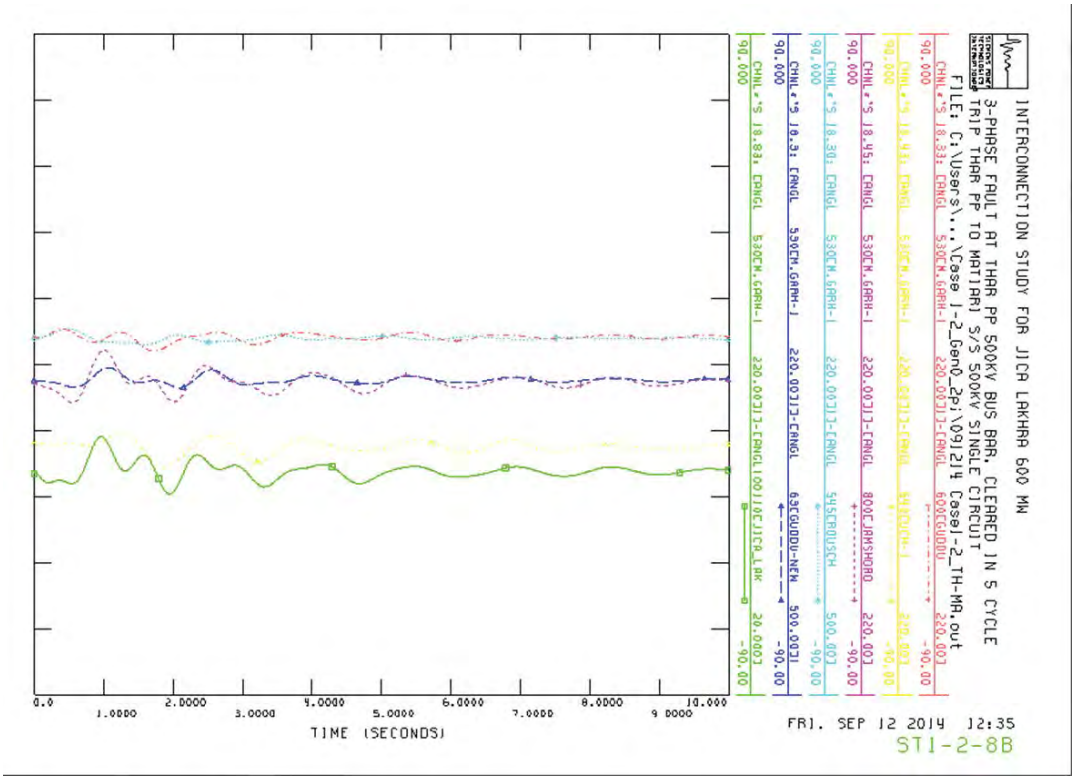


Fault Section: Matiari S/S – Moro S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

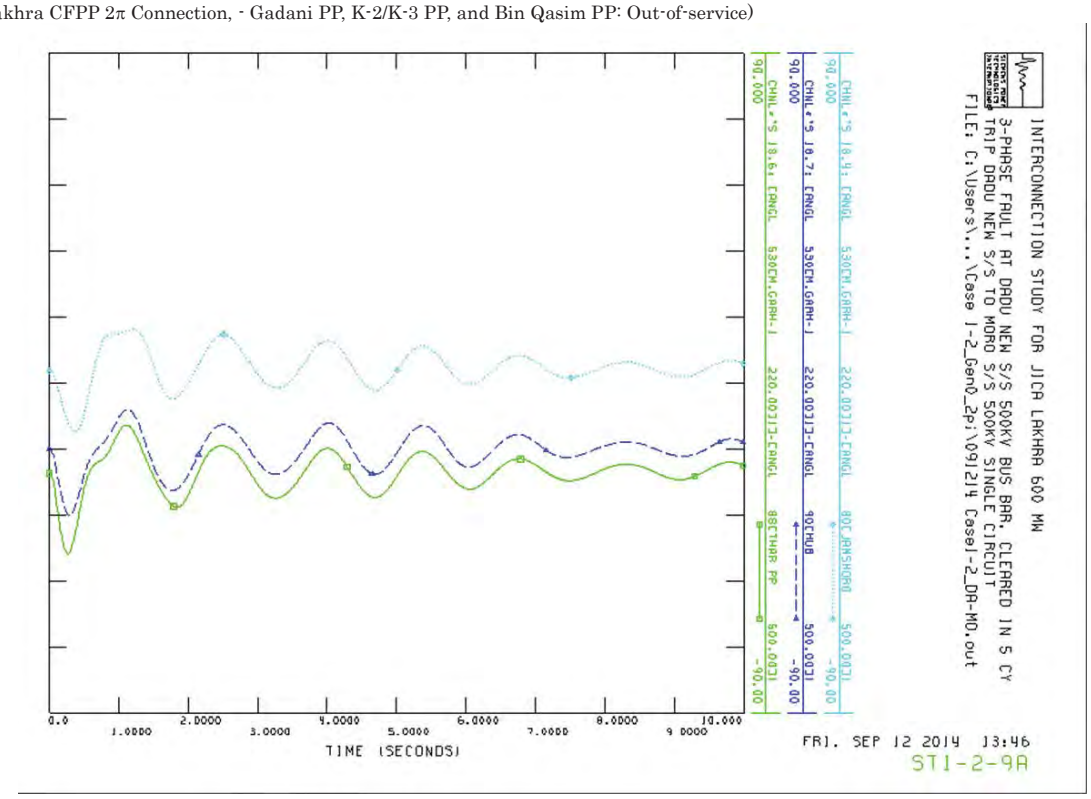


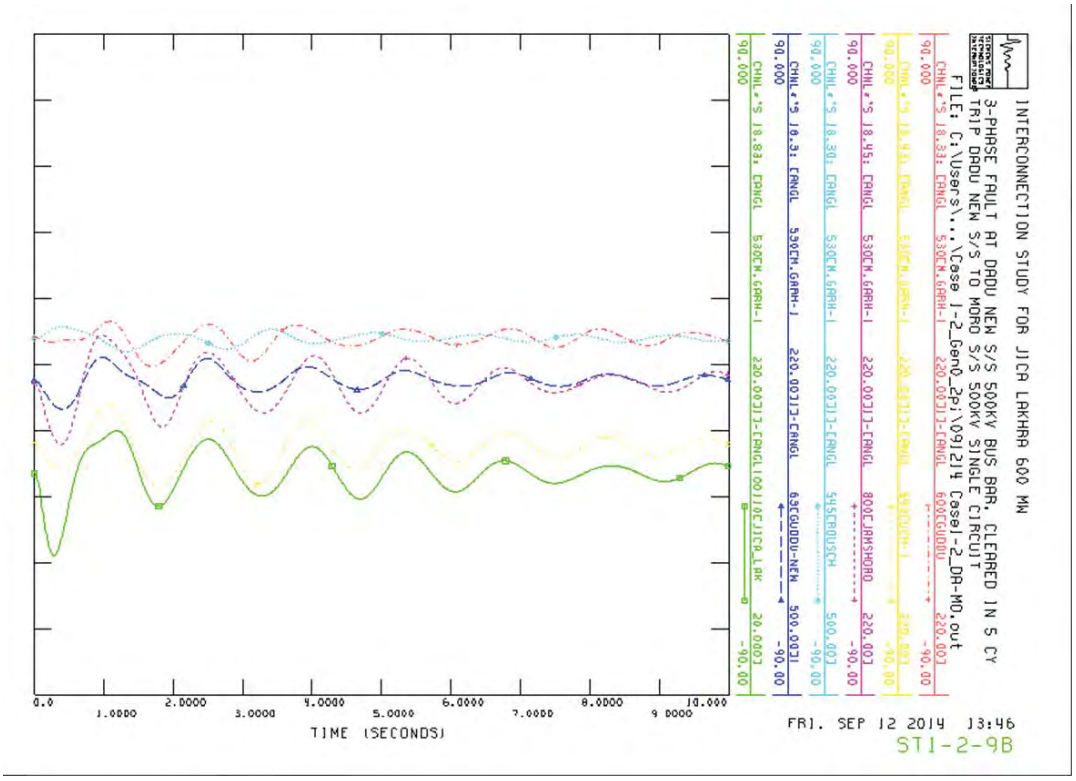


Fault Section: Thar PP – Matiari S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

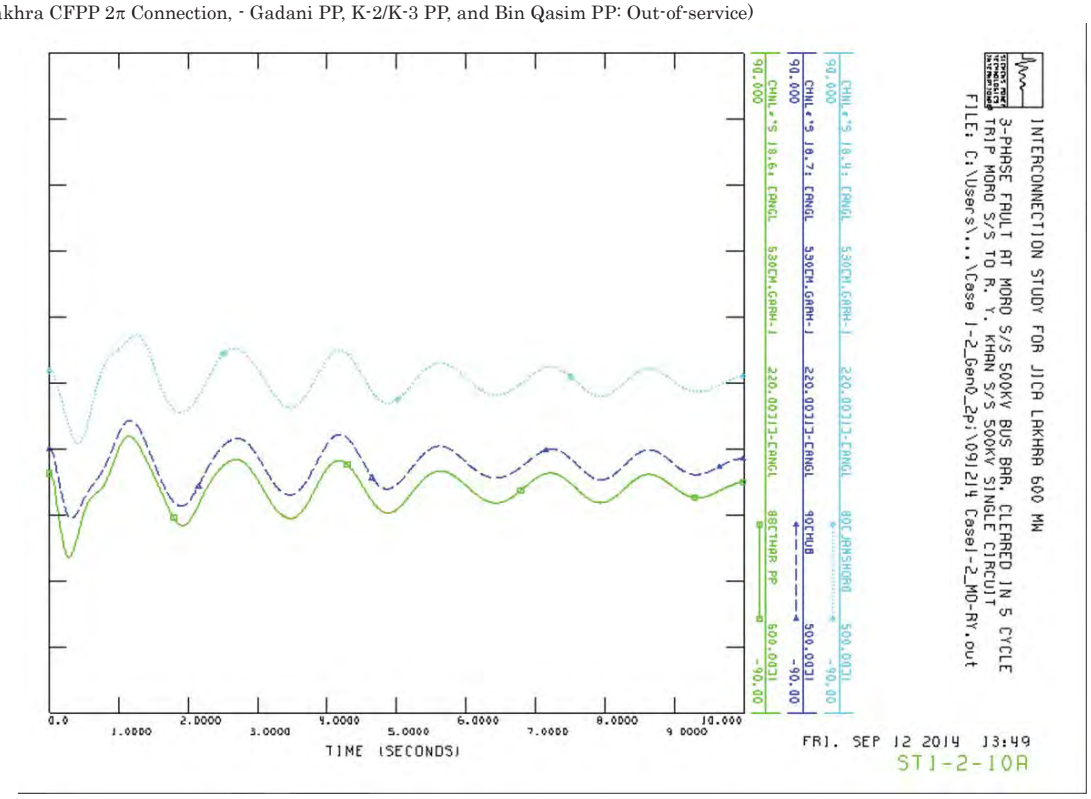


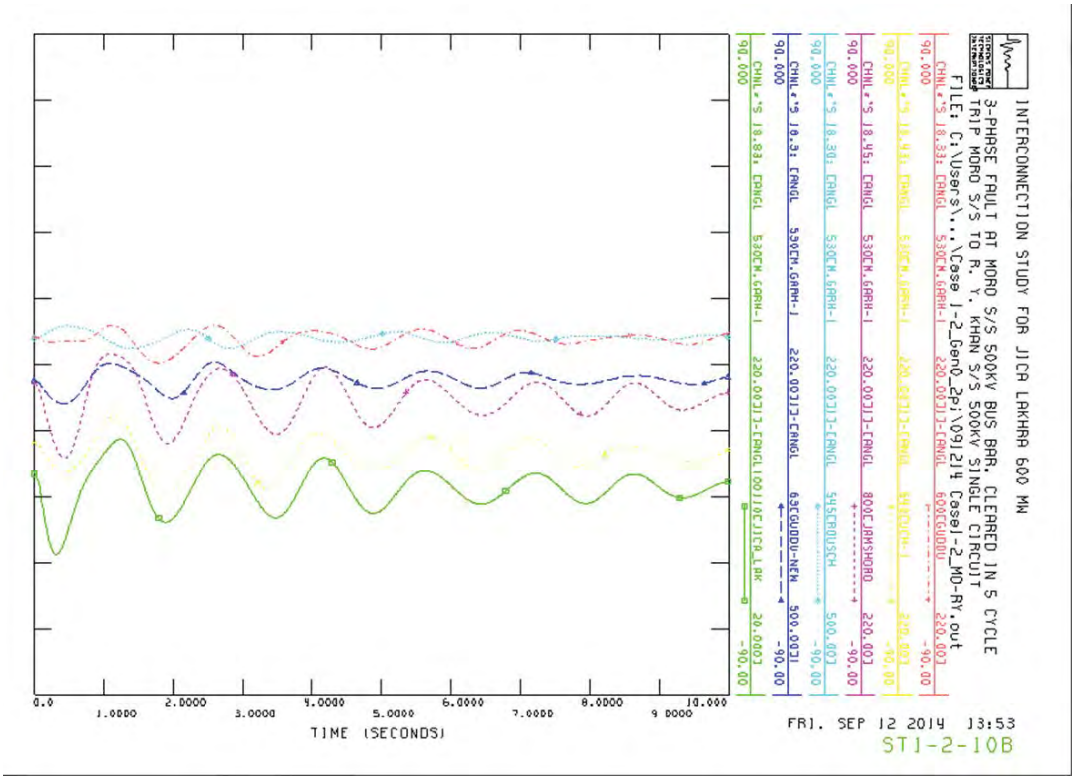


Fault Section: Dadu New S/S – Moro S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

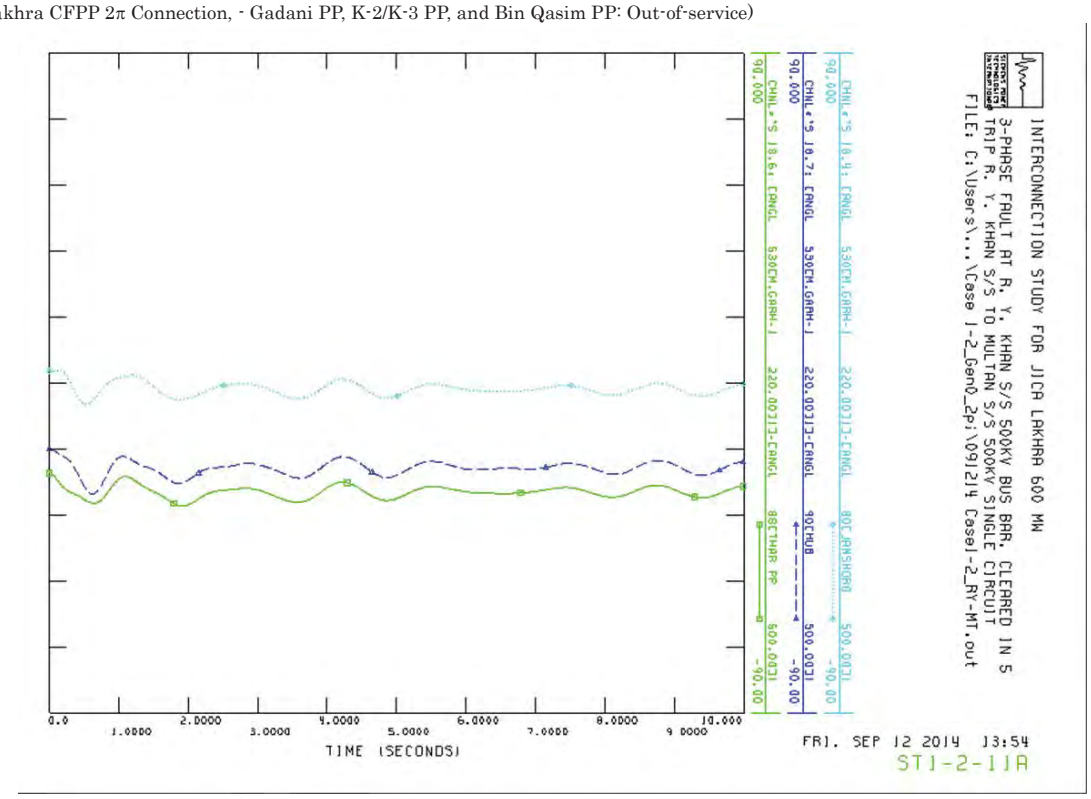


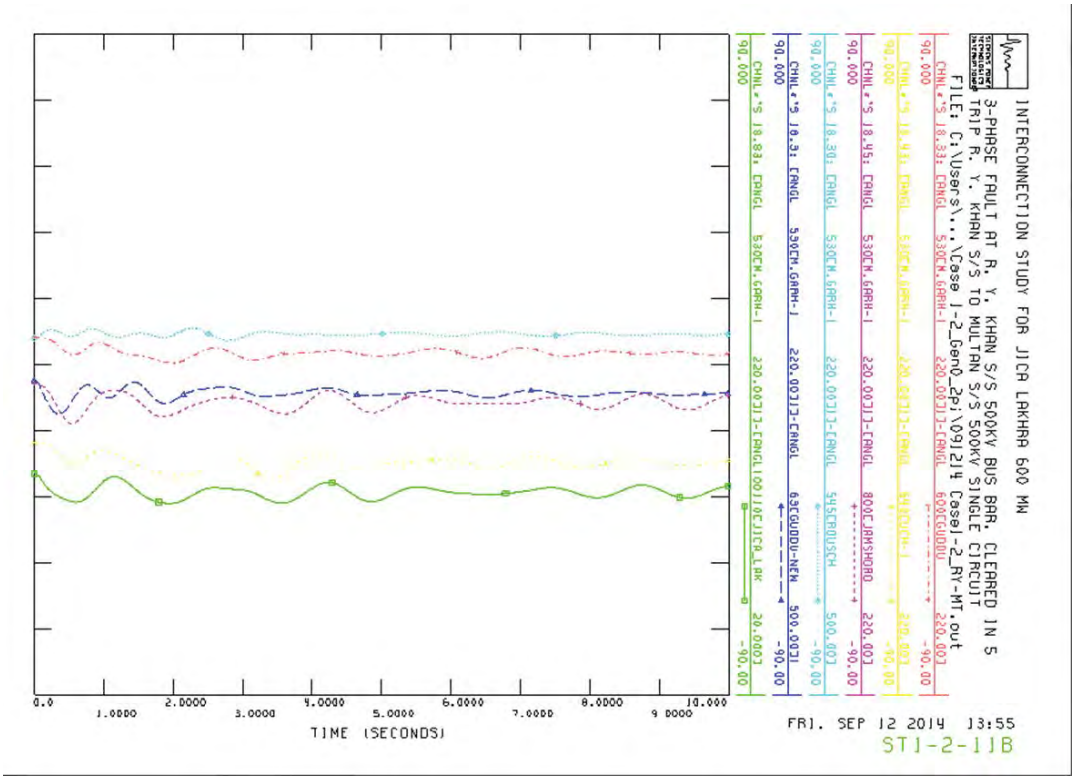


Fault Section: Moro S/S – R. Y. Khan S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

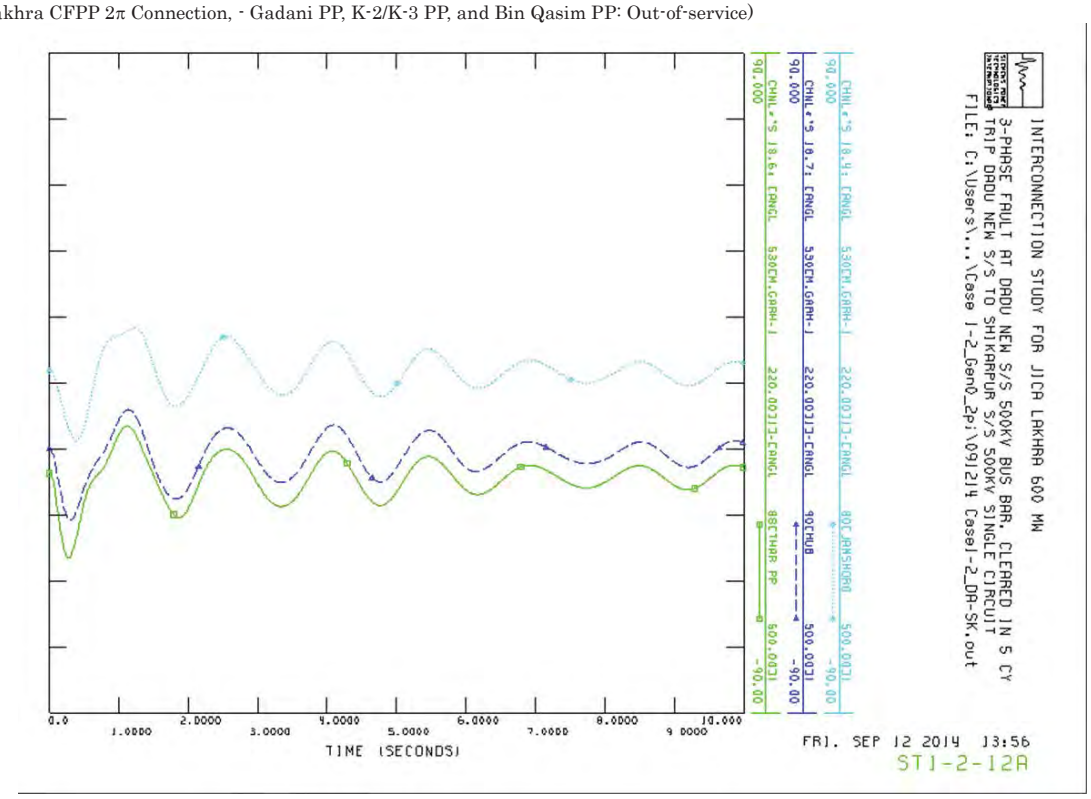


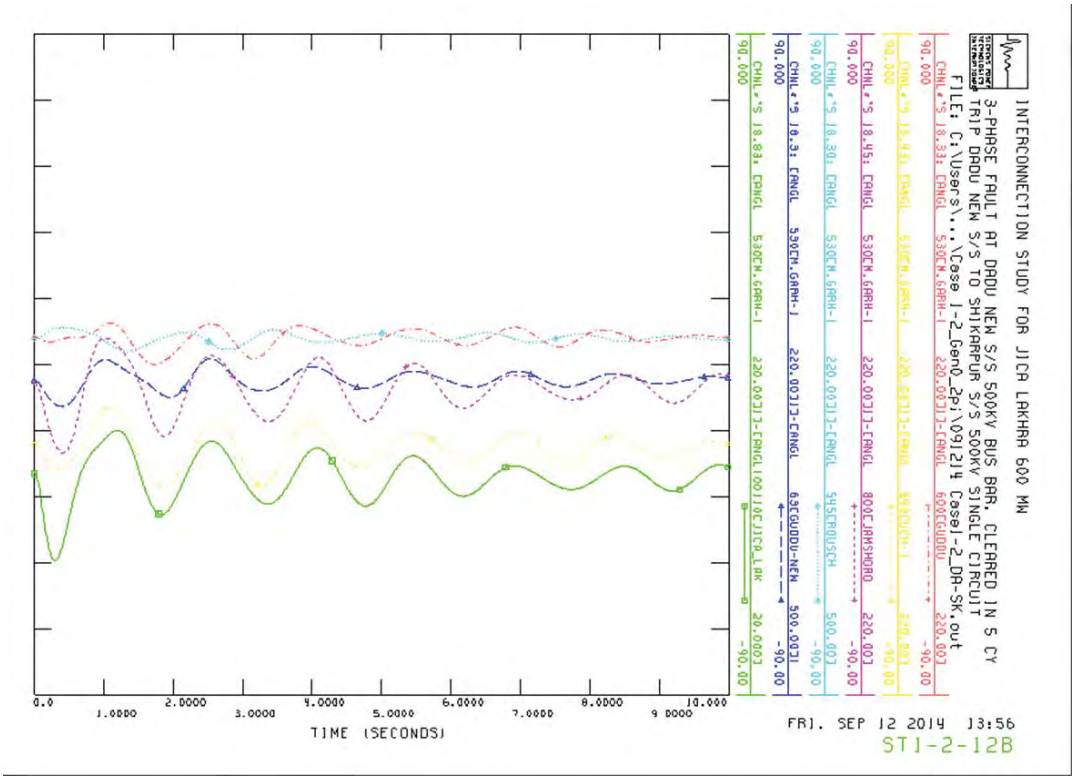


Fault Section: R. Y. Khan S/S – Multan S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

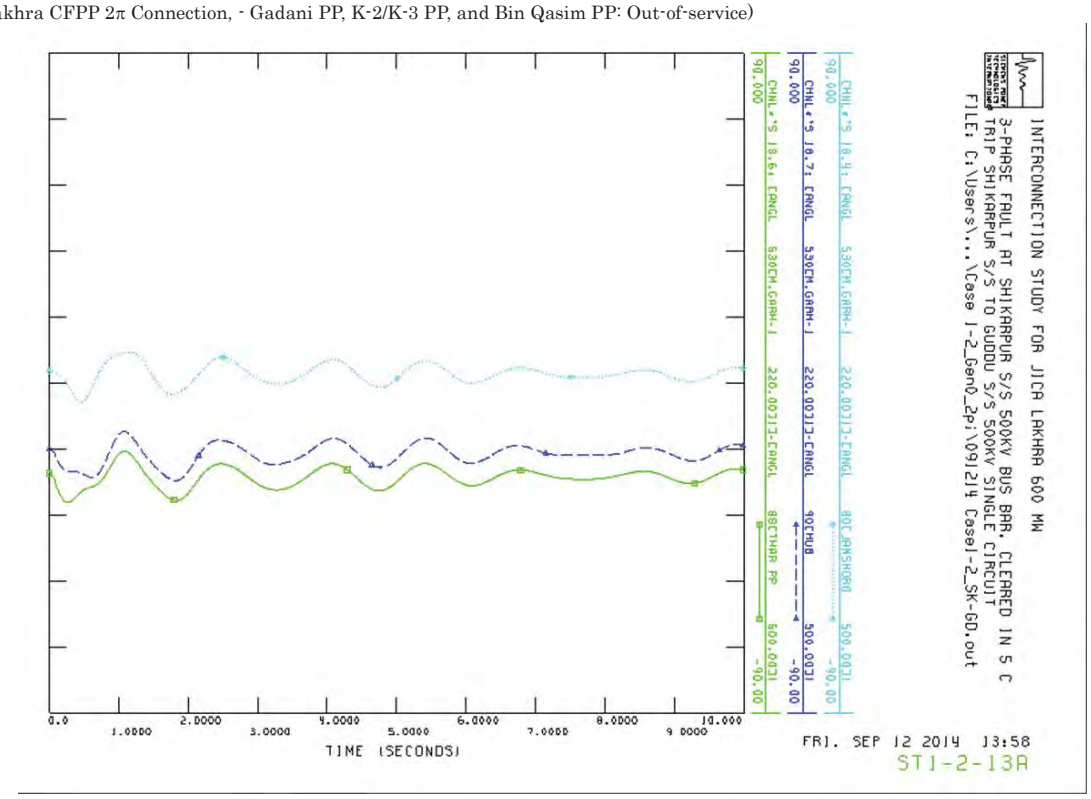


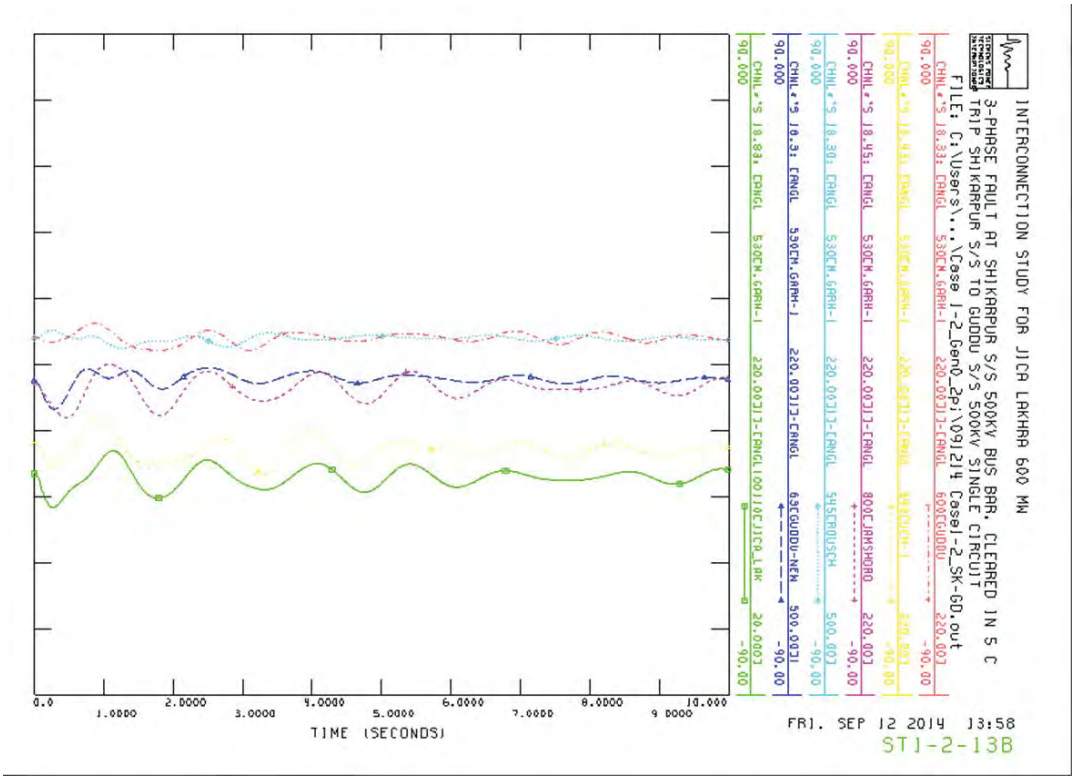


Fault Section: Dadu New S/S – Shikarpur S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

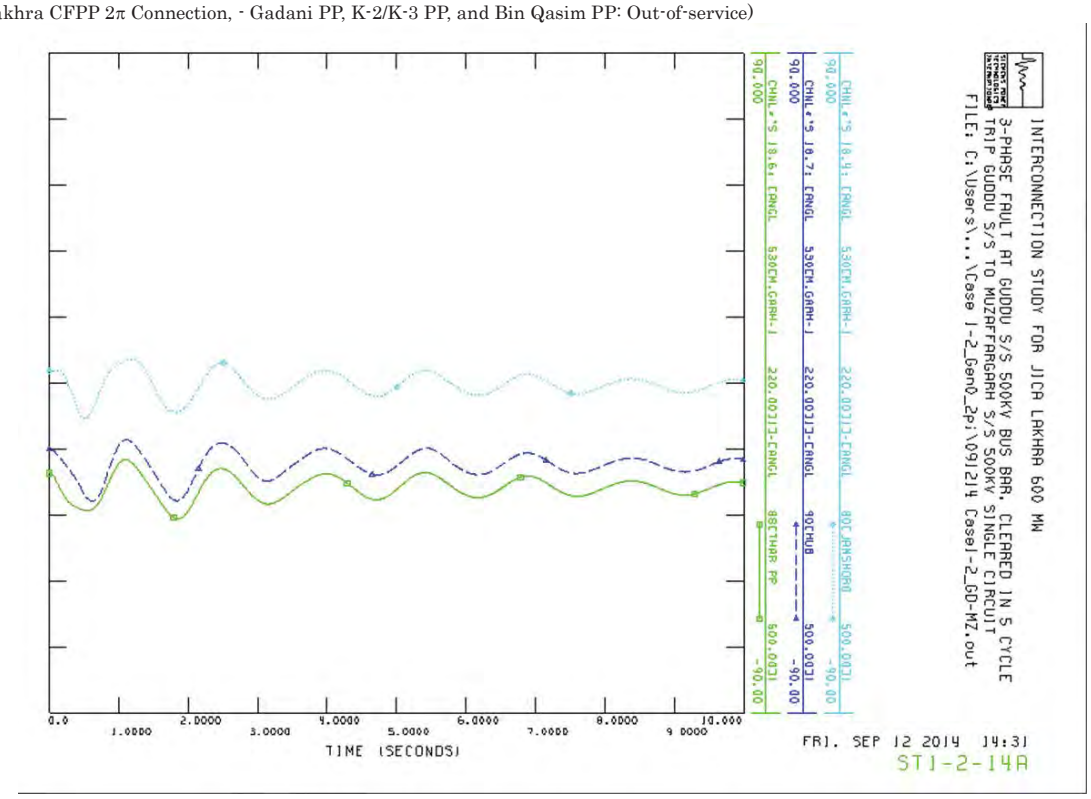


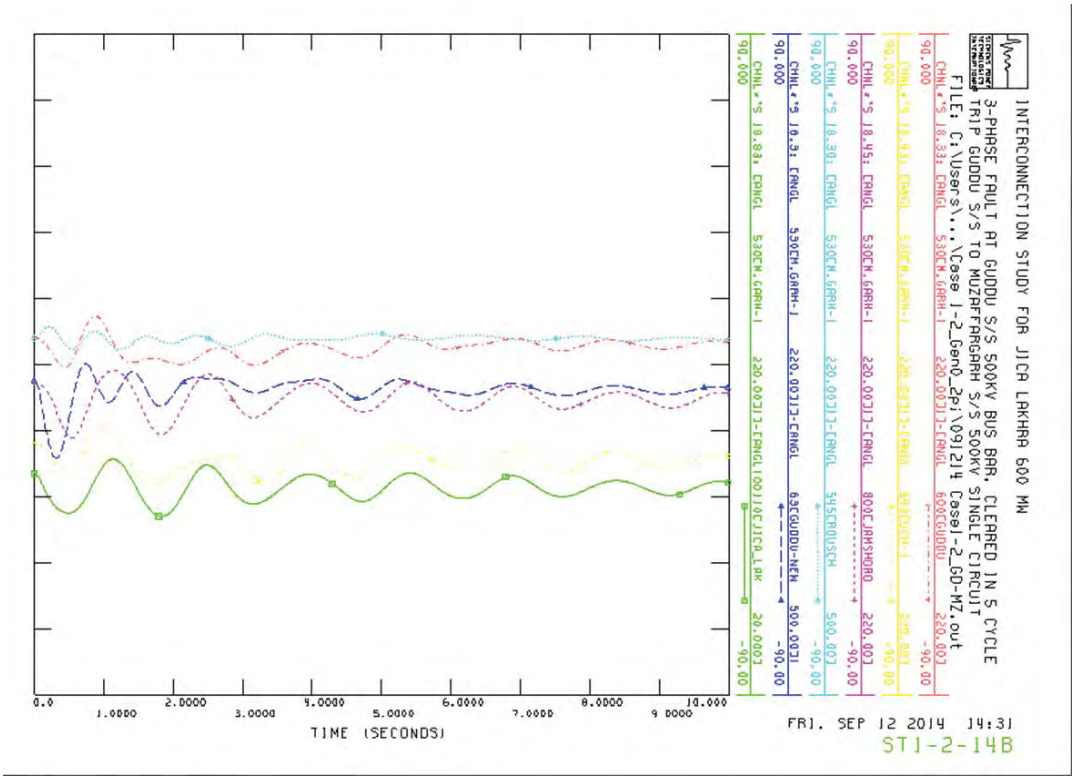


Fault Section: Shikarpur S/S – Guddu S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

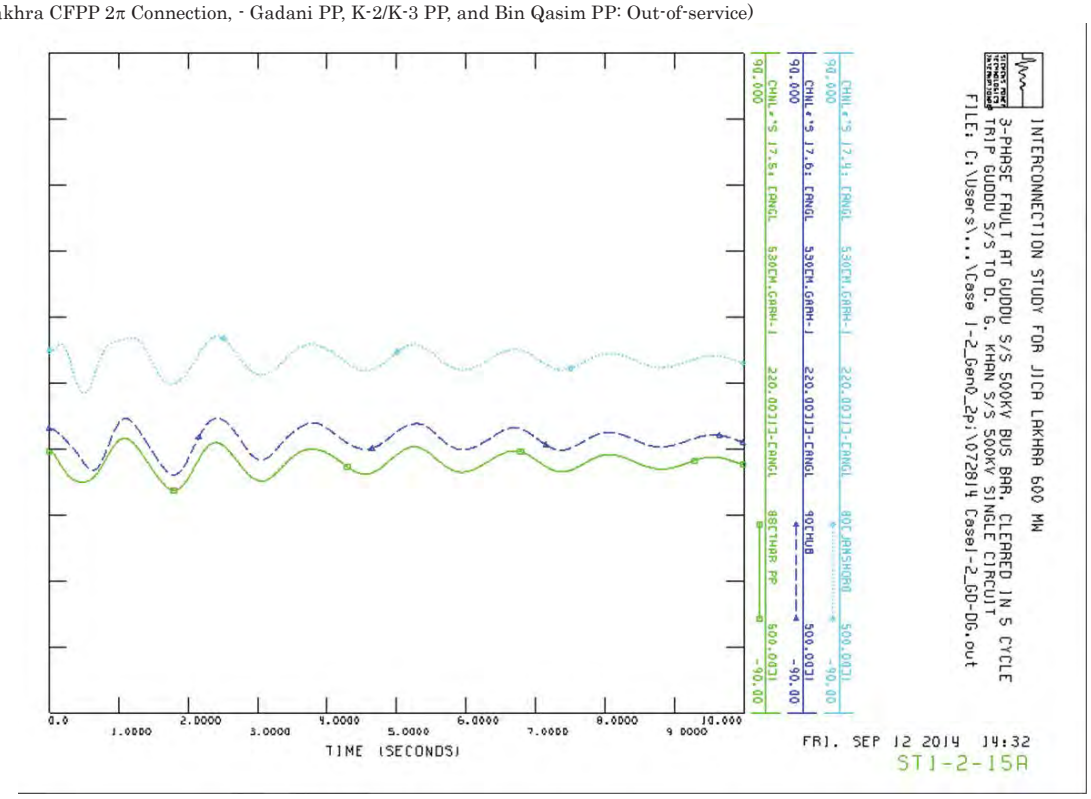


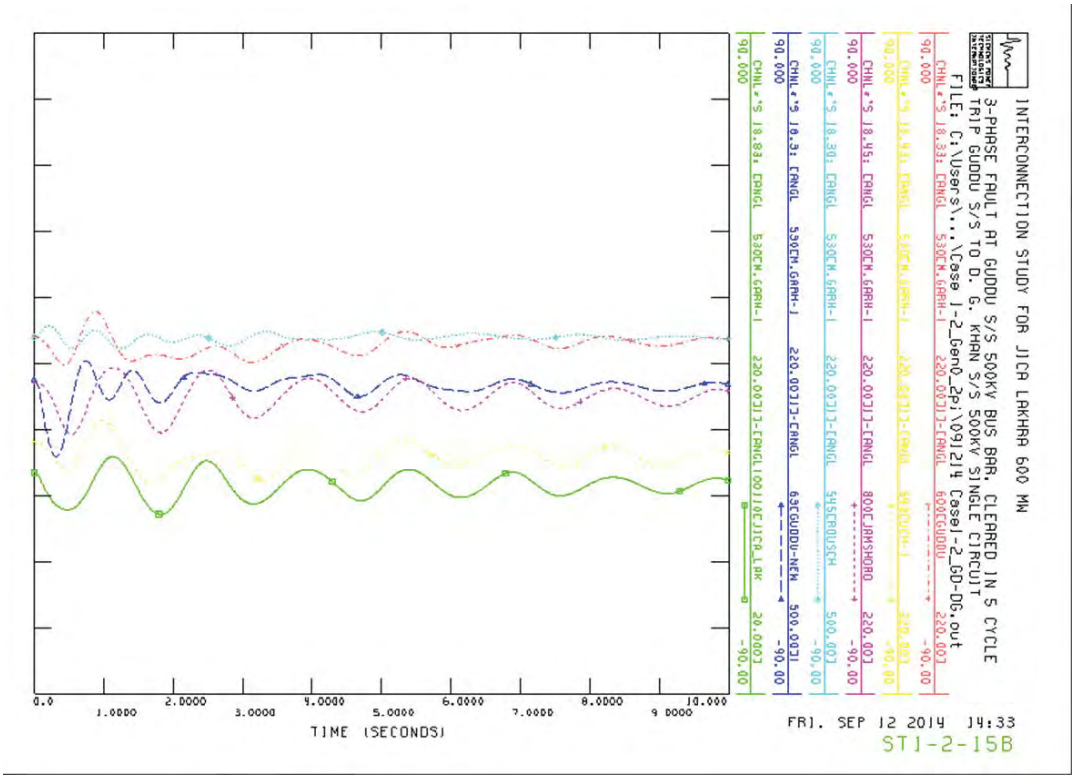


Fault Section: Guddu S/S – Muzaffargarh S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

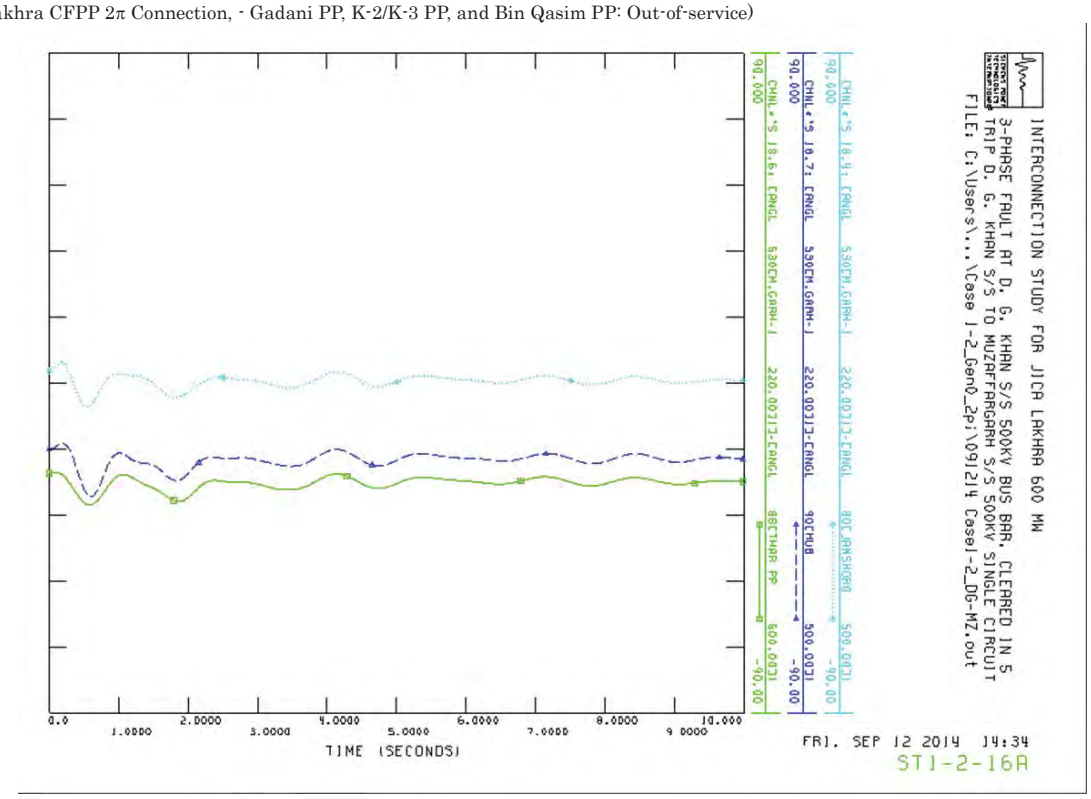


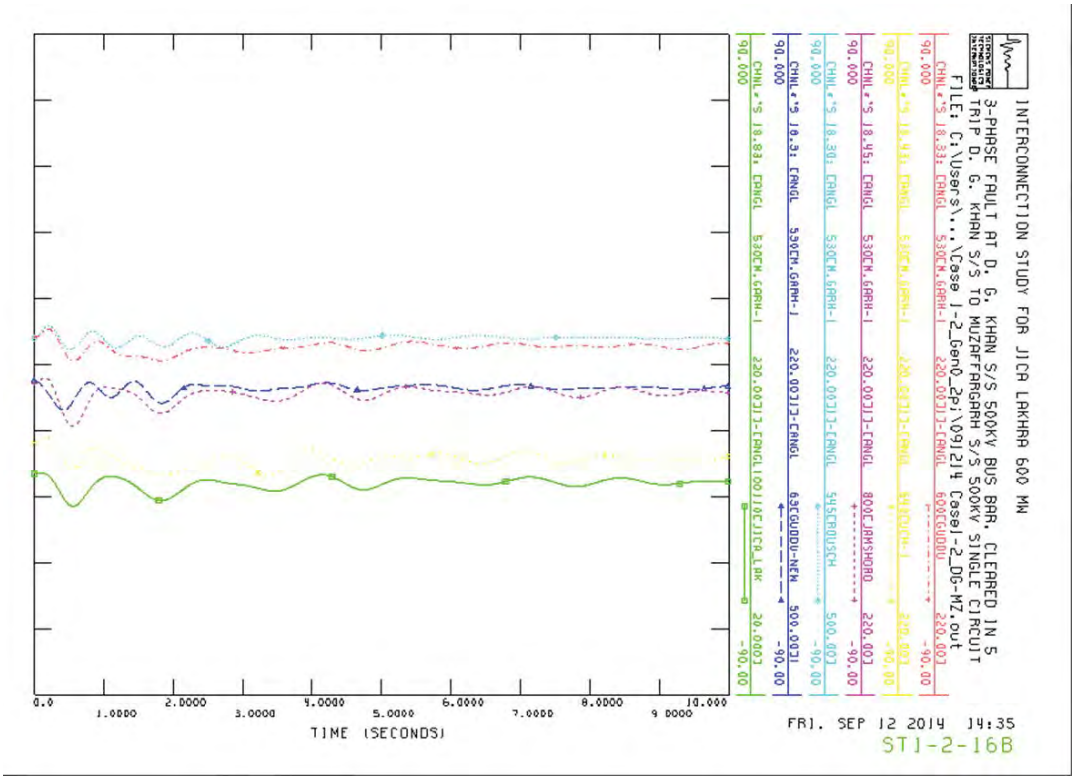


Fault Section: Guddu S/S – D. G. Khan S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

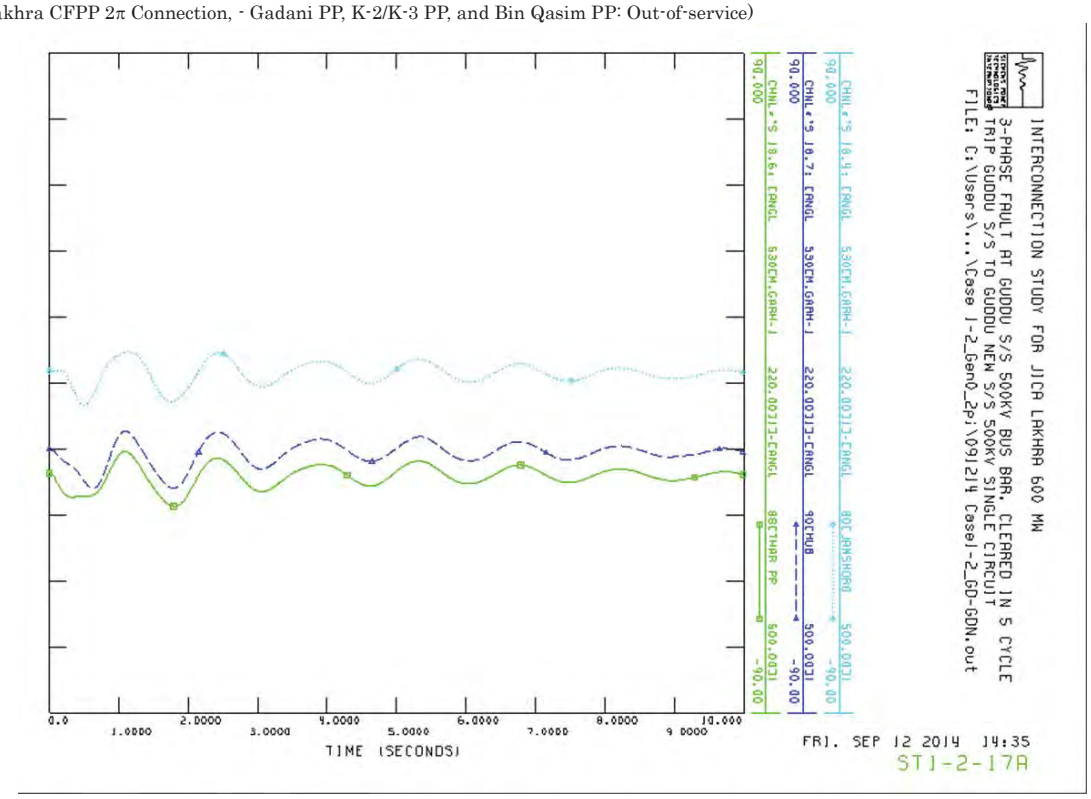


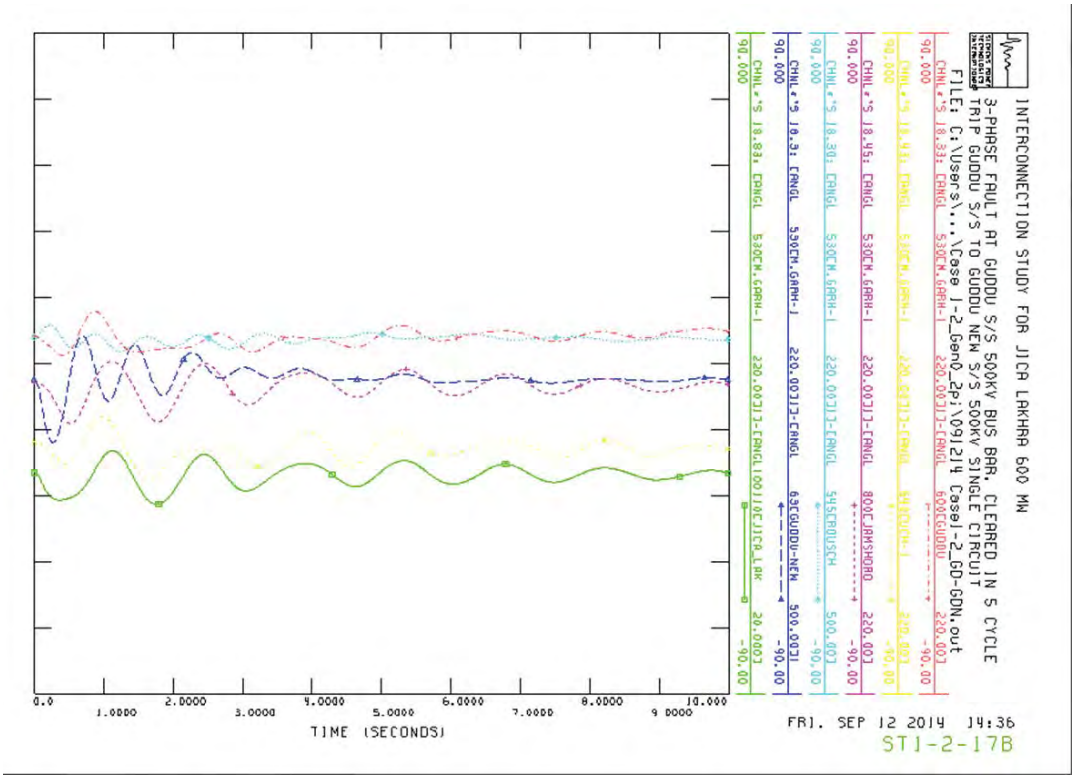


Fault Section: D. G. Khan S/S – Muzaffargarh S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

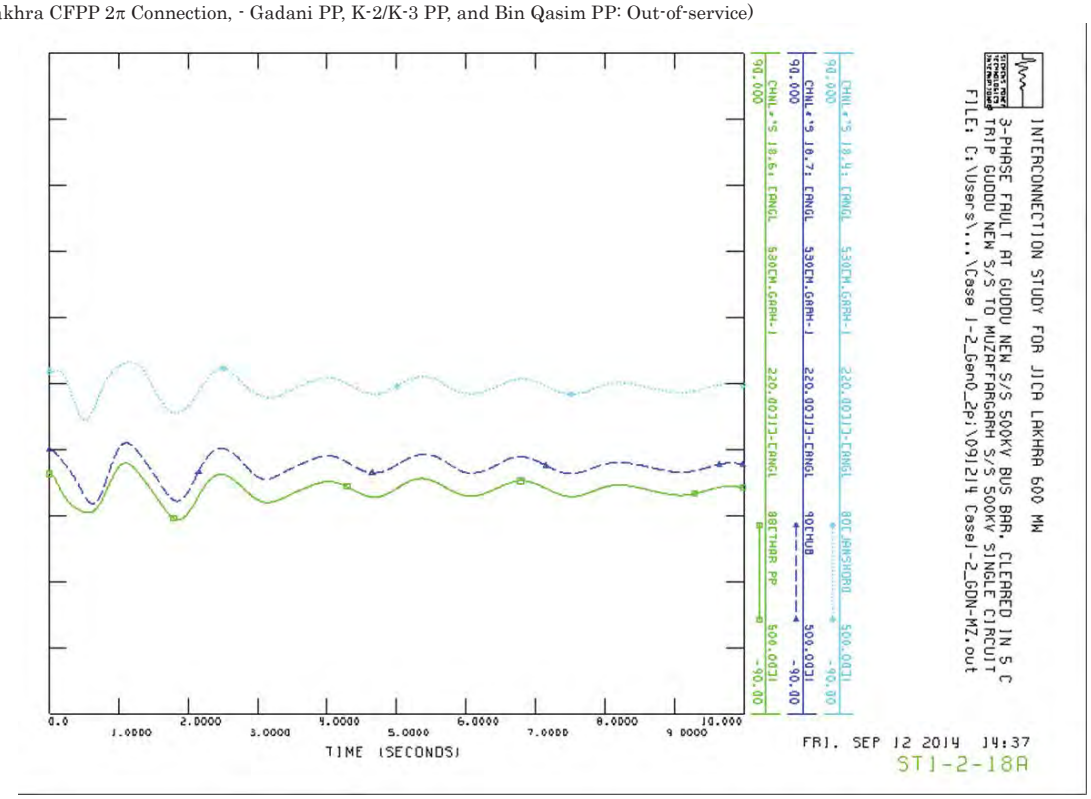


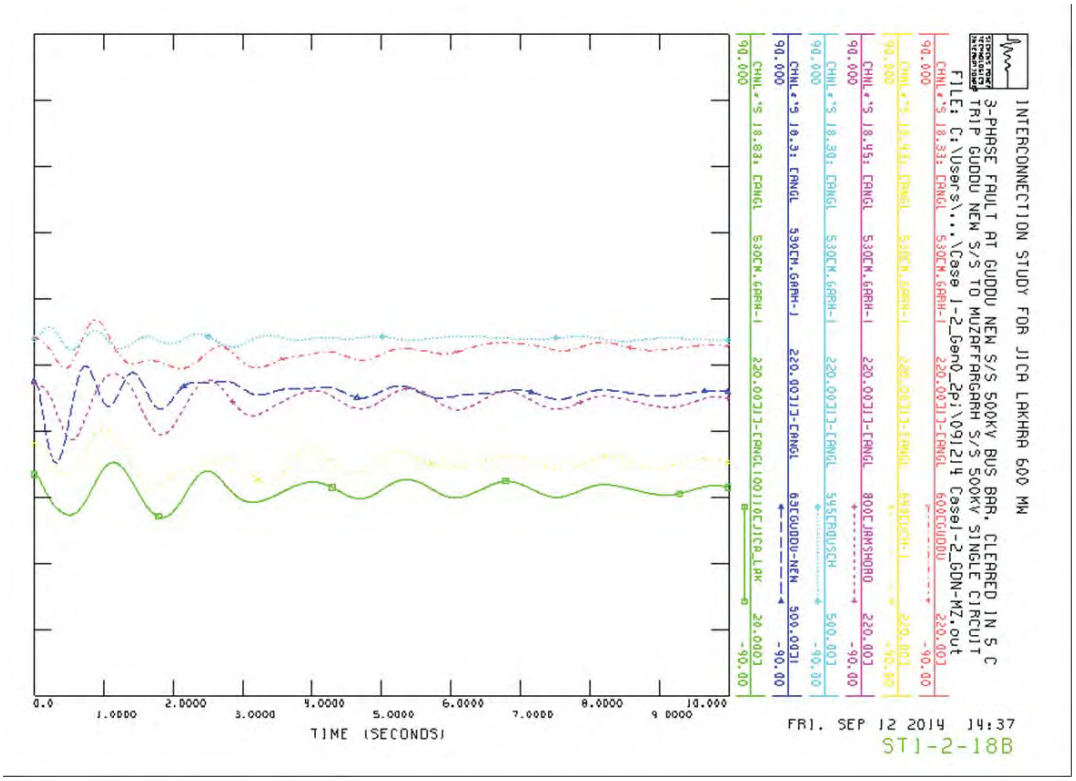


Fault Section: Guddu S/S – Guddu New PP

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

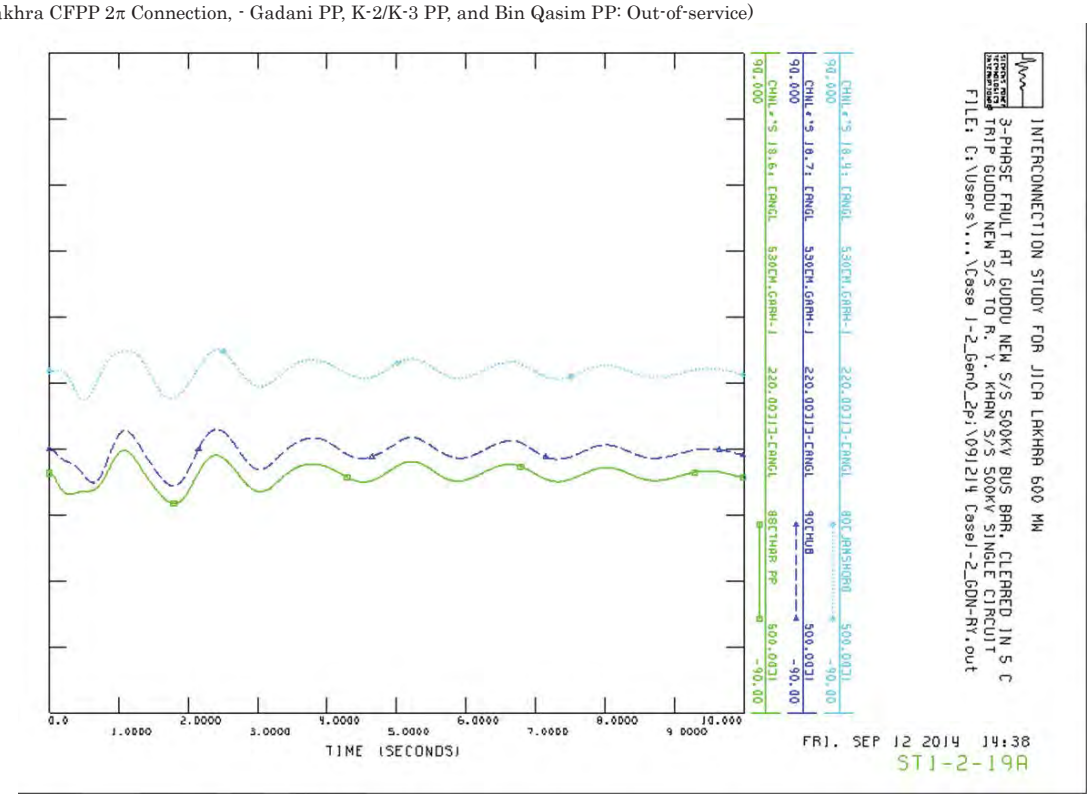


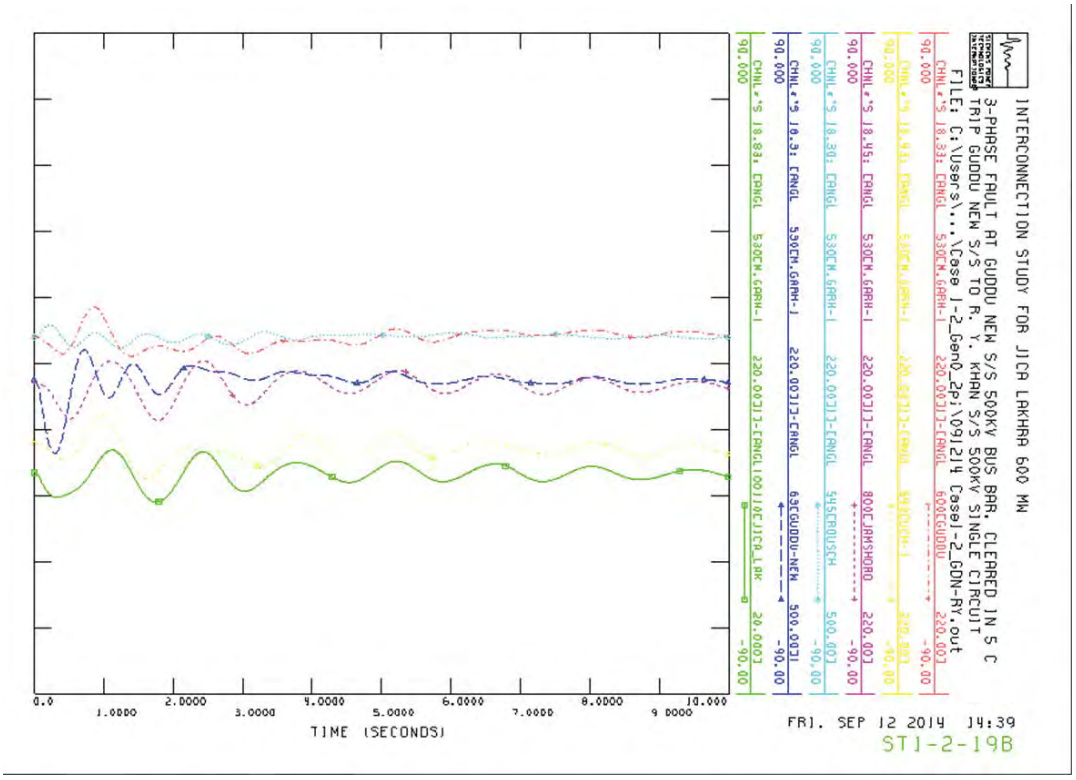


Fault Section: Guddu New PP – Muzaffargarh S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)

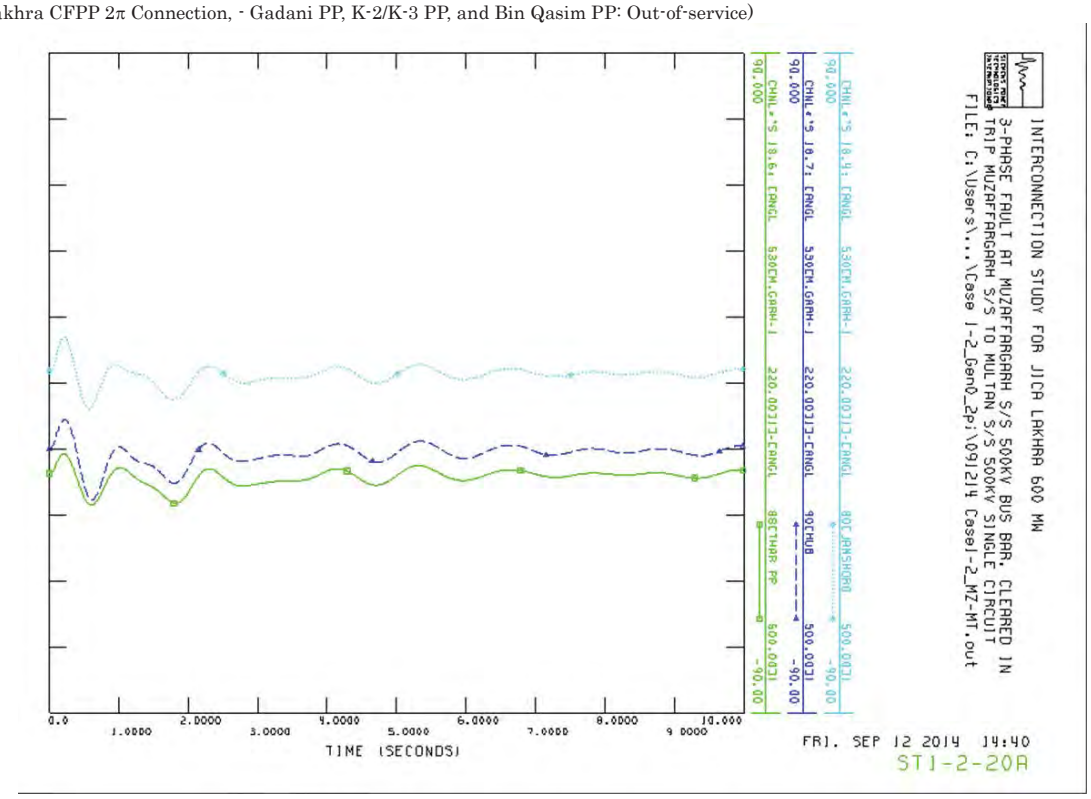


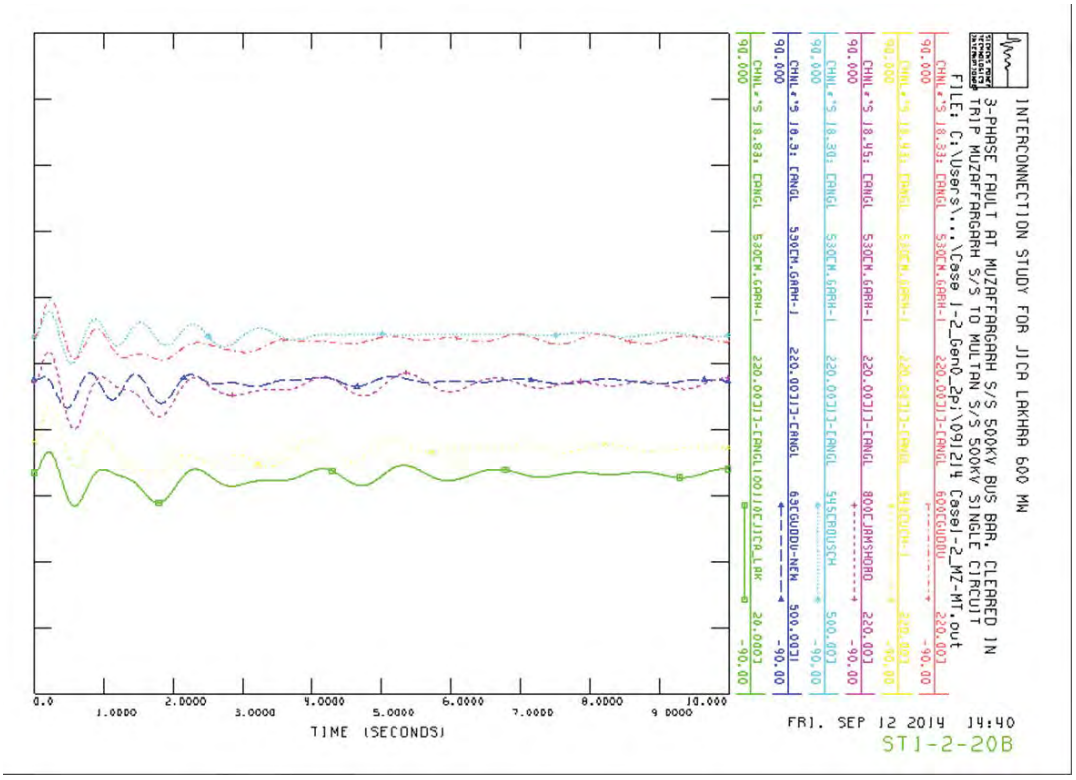


Fault Section: Guddu New PP – R. Y. Khan S/S

Stability Analysis Result Case ST-1-2

(-Lakhra CFPP 2π Connection, - Gadani PP, K-2/K-3 PP, and Bin Qasim PP: Out-of-service)



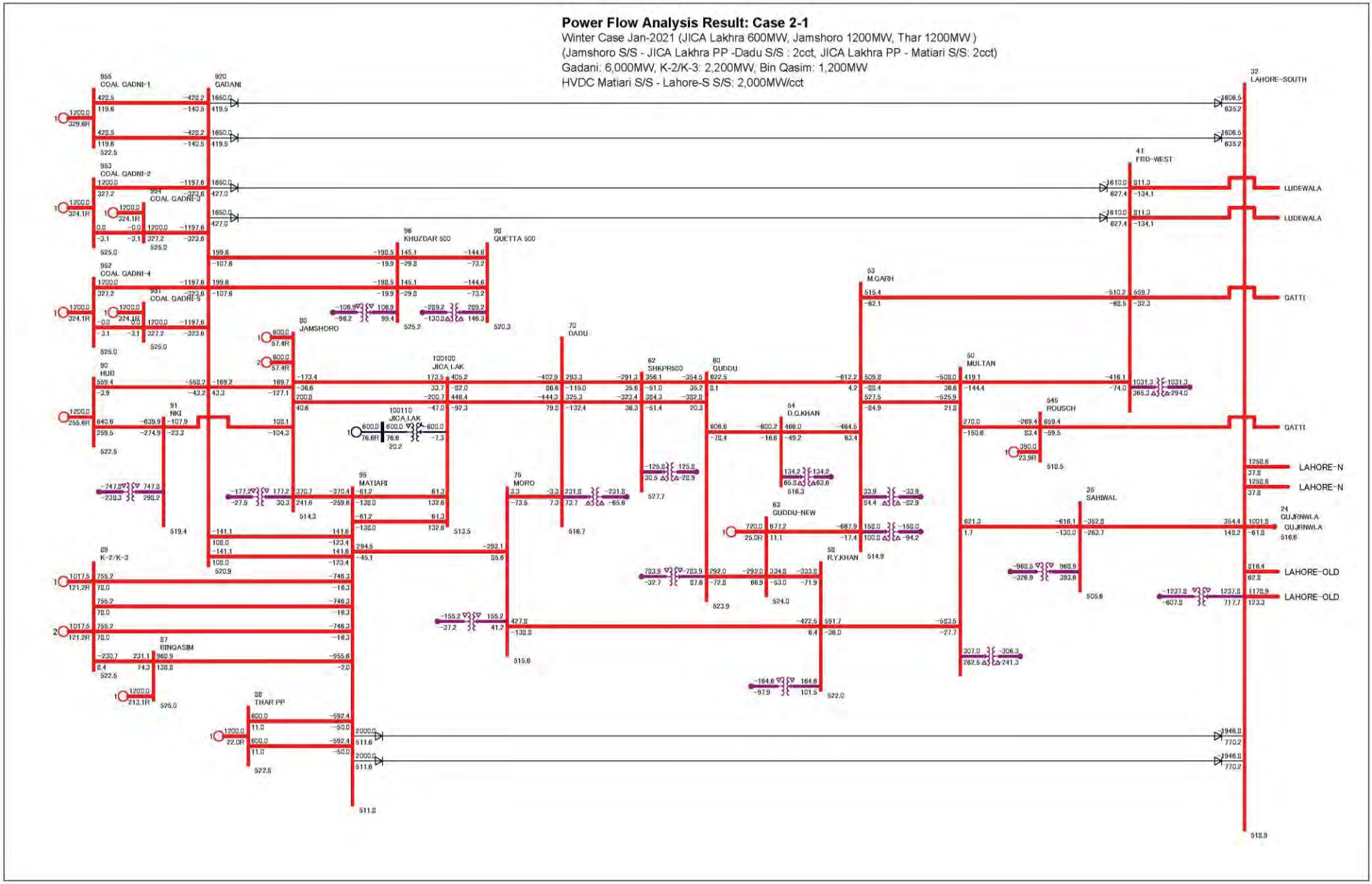


Fault Section: Muzaffargarh S/S – Multan S/S

6 - 2 STABILITY ANALYSIS CASE ST2-1

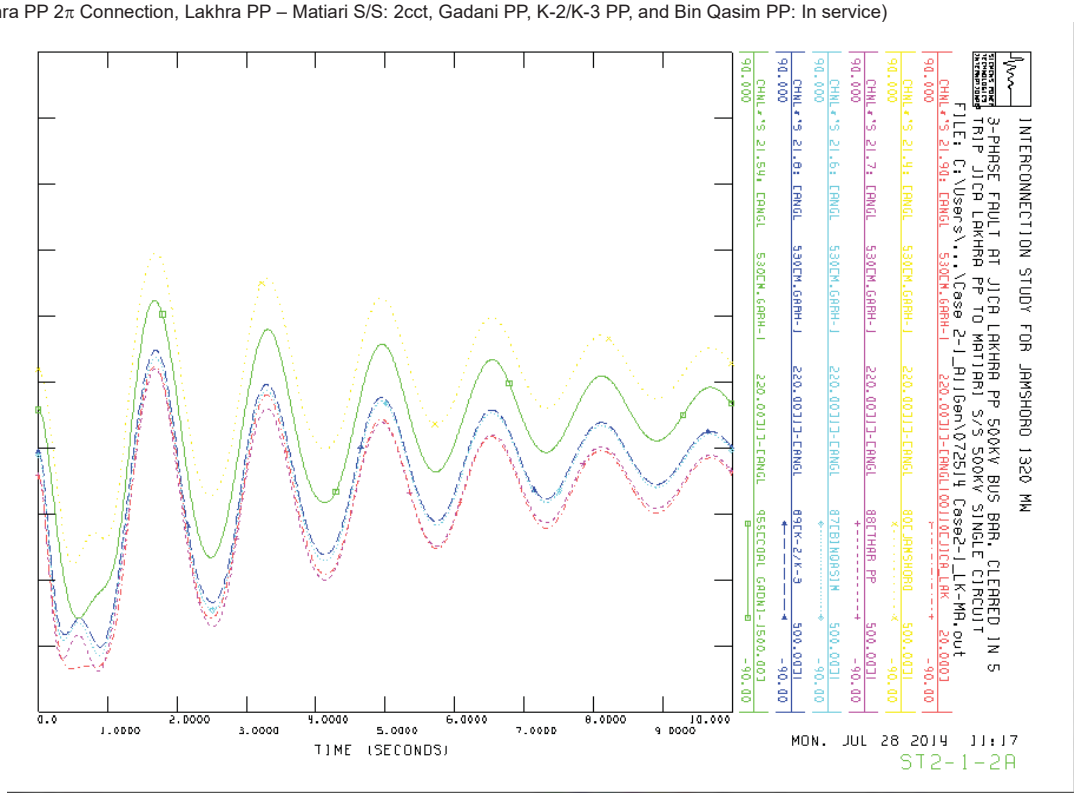
Stability Analysis Result Case ST-2-1

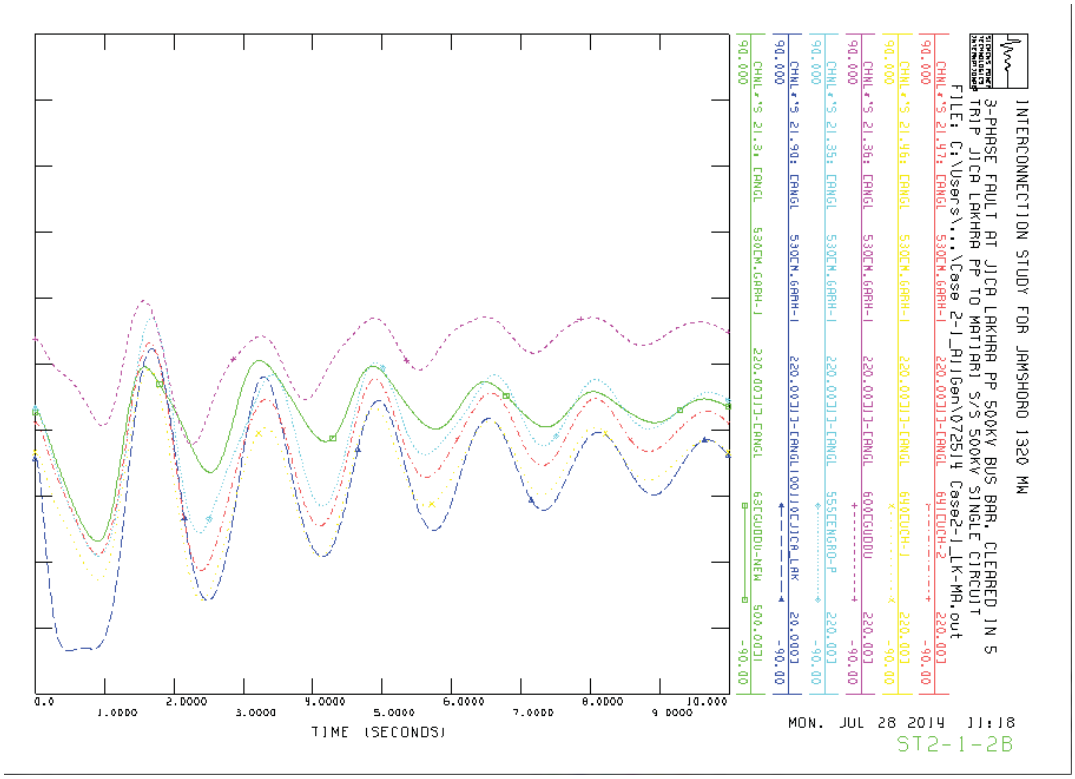
(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)



Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

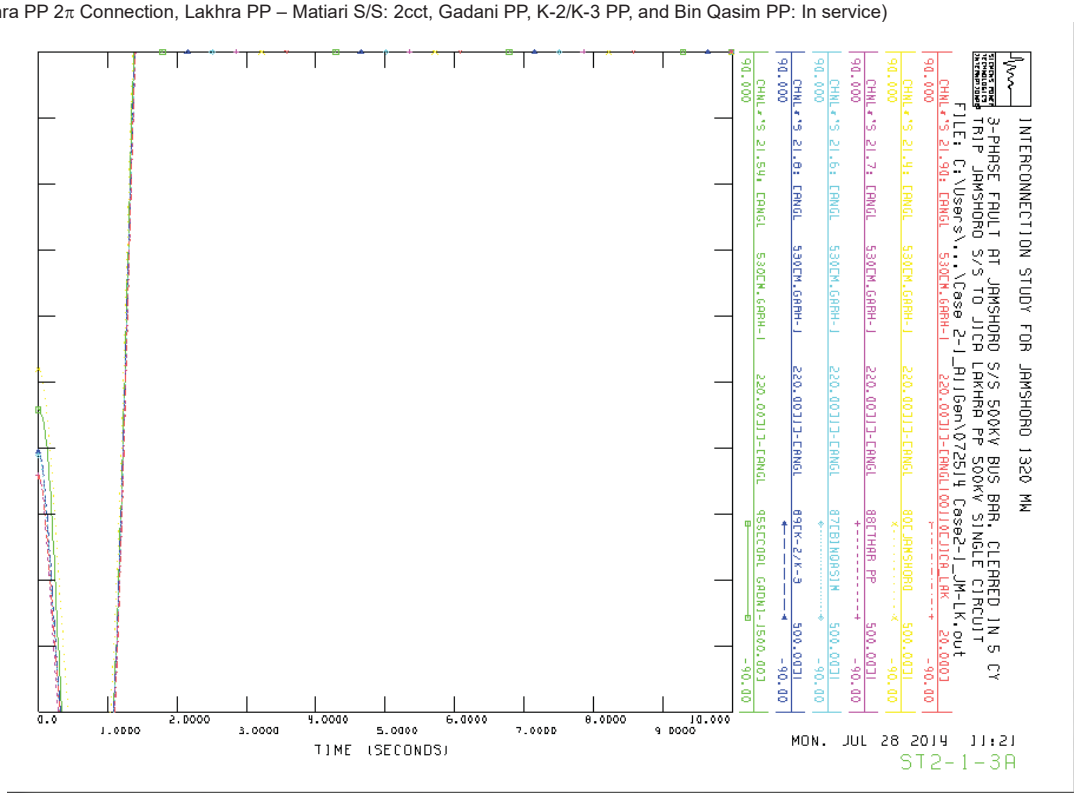


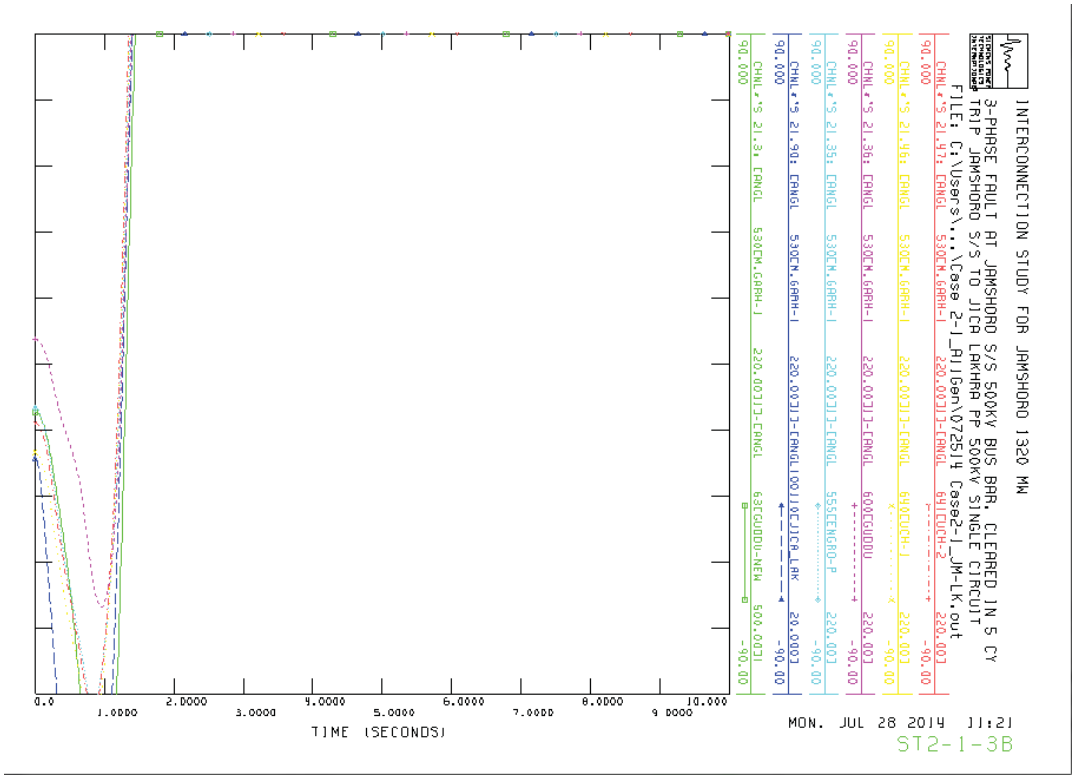


Fault Section: JICA Lakhra PP – Matiari S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

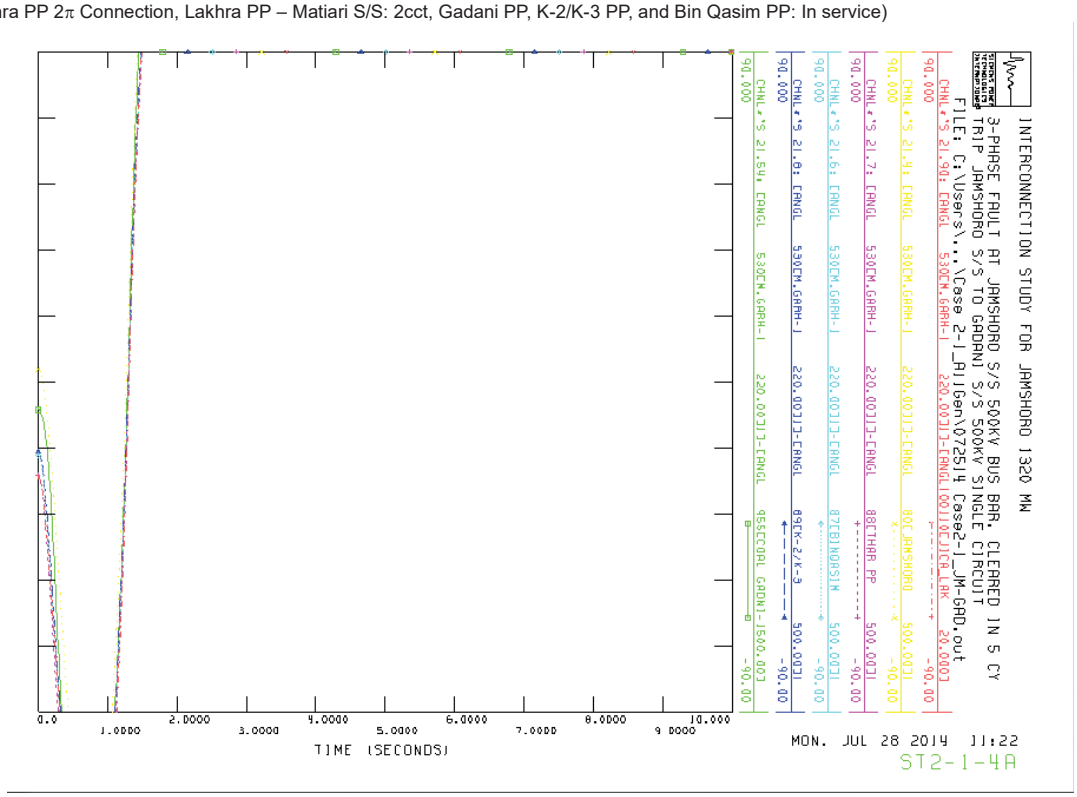


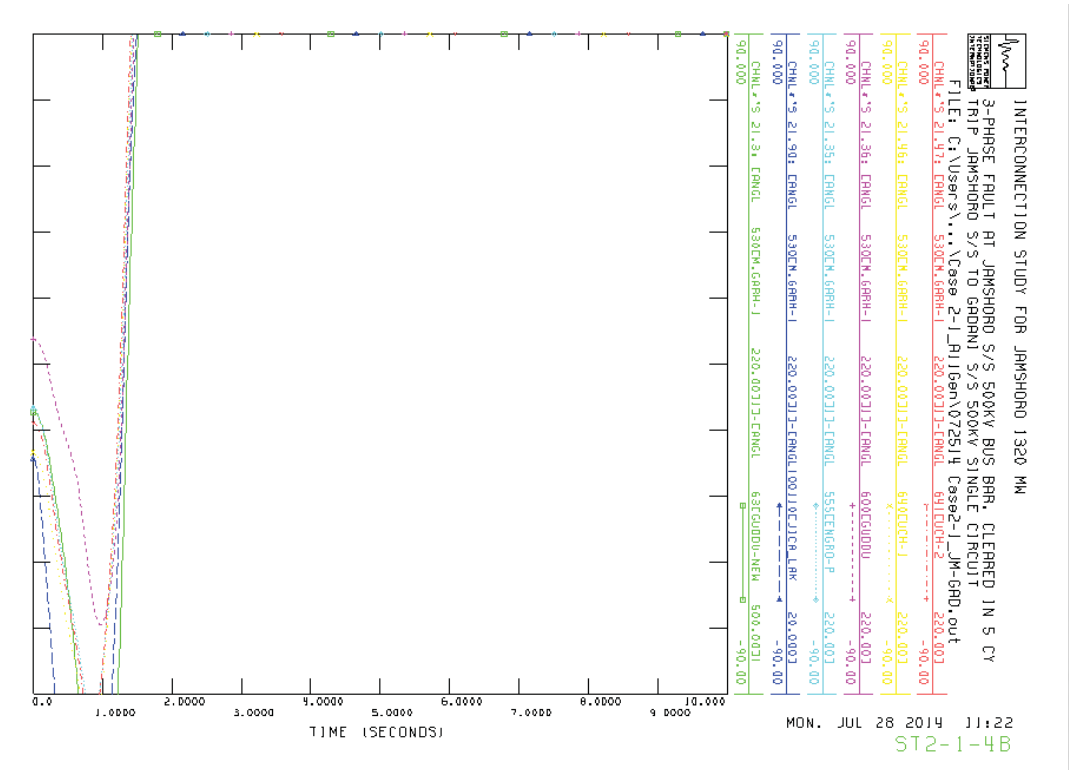


Fault Section: Jamshoro S/S – JICA Lakhra PP

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

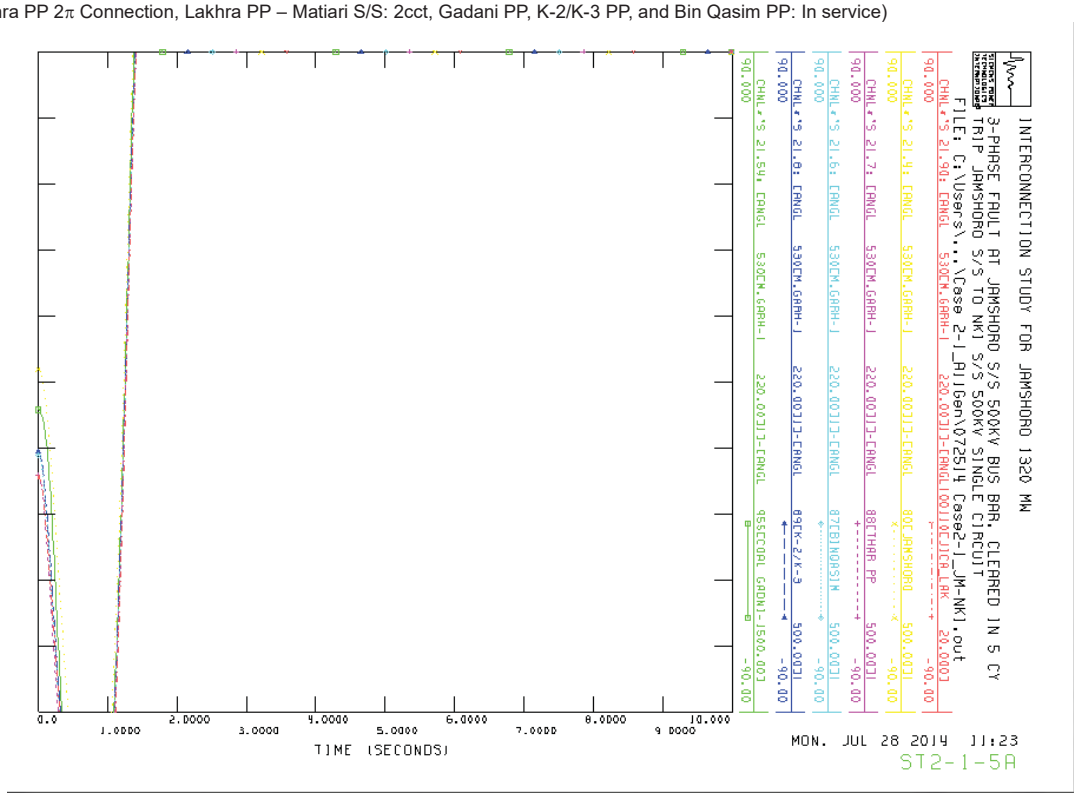


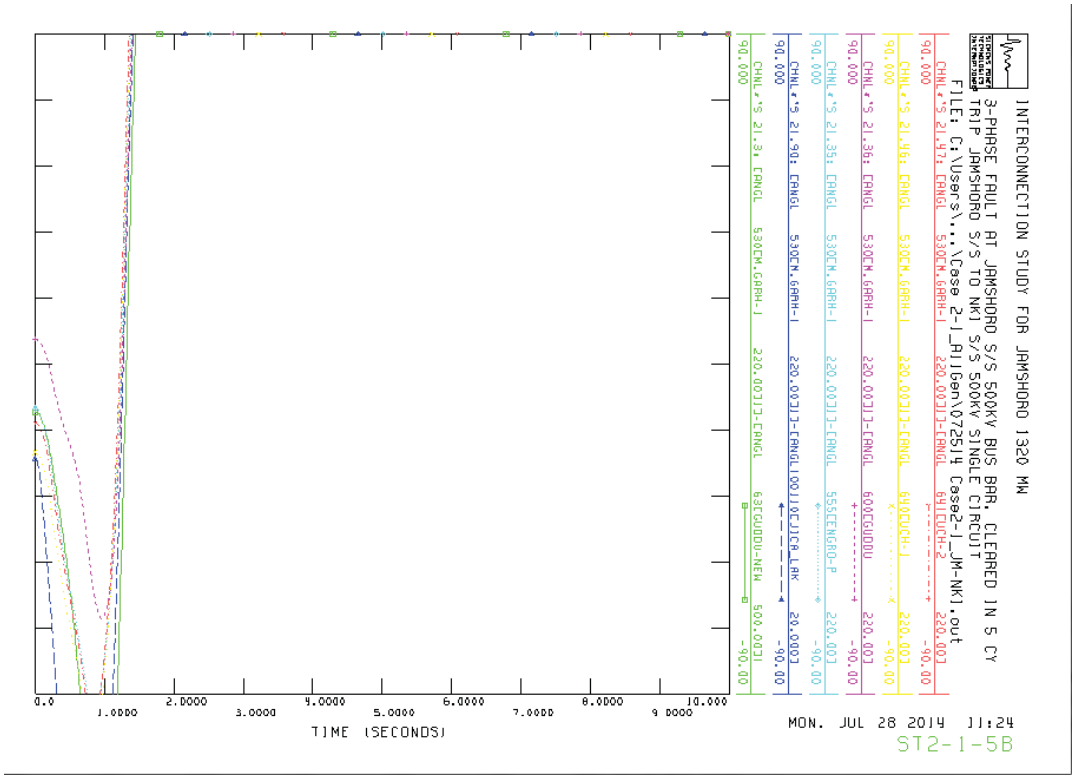


Fault Section: Jamshoro S/S – Gadani S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

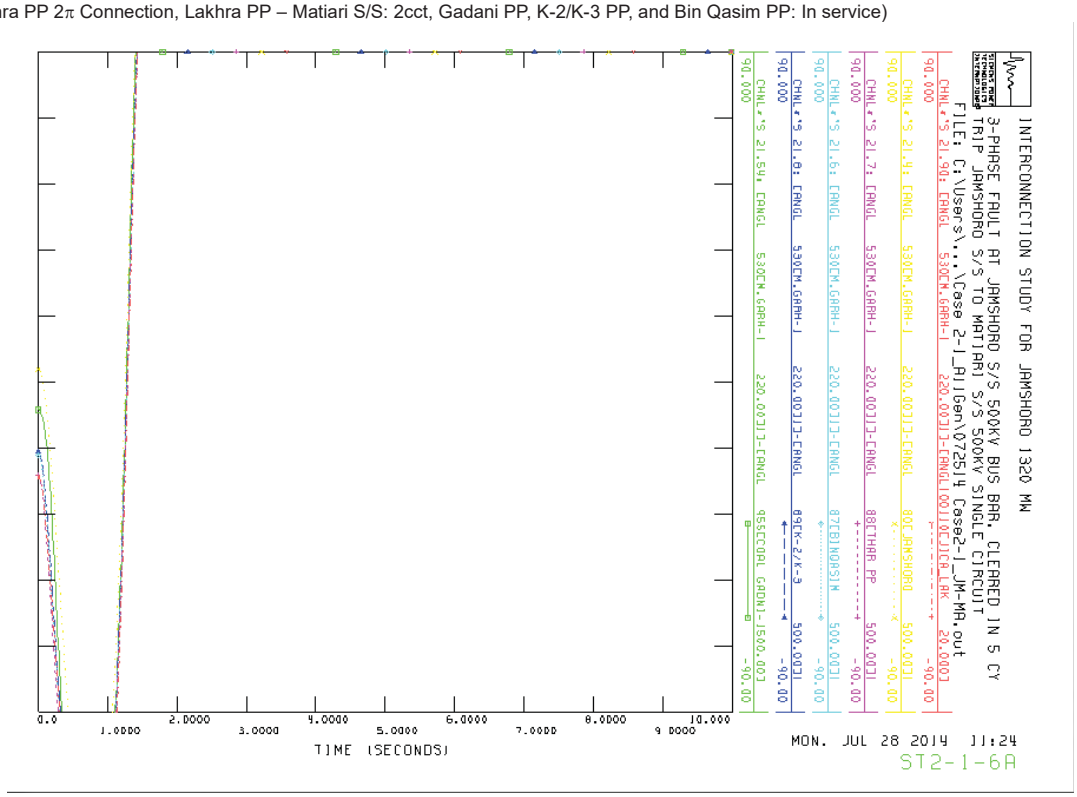


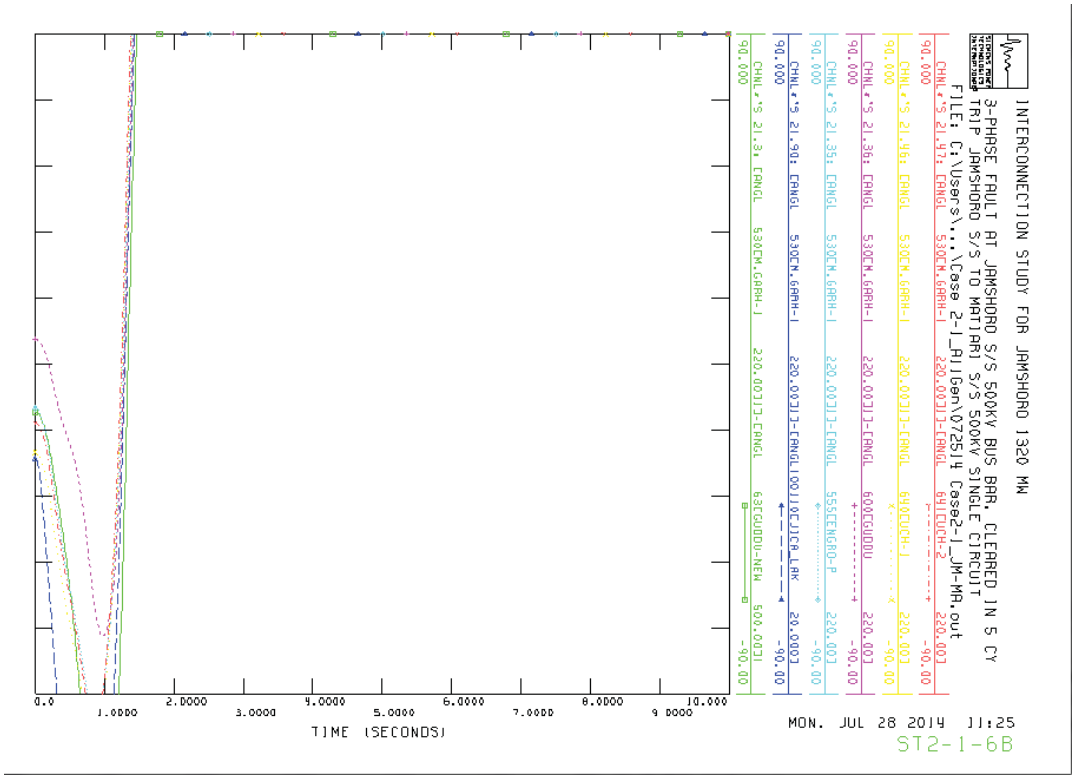


Fault Section: Jamshoro S/S – NKI S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

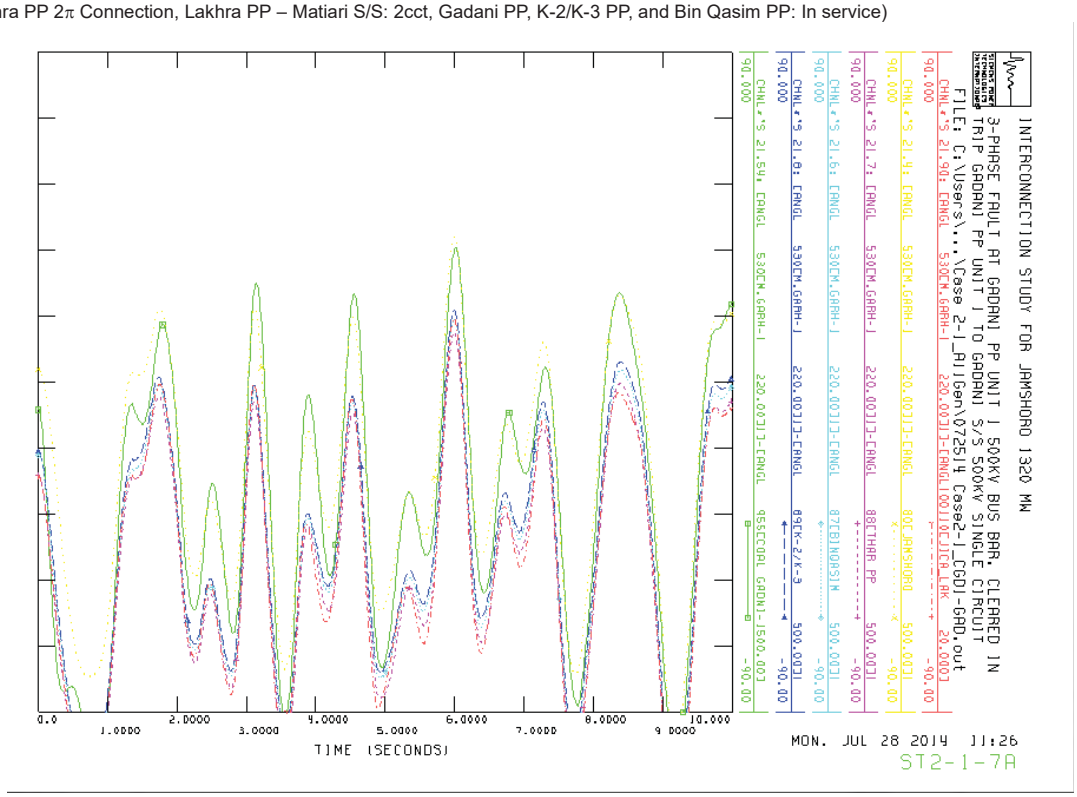


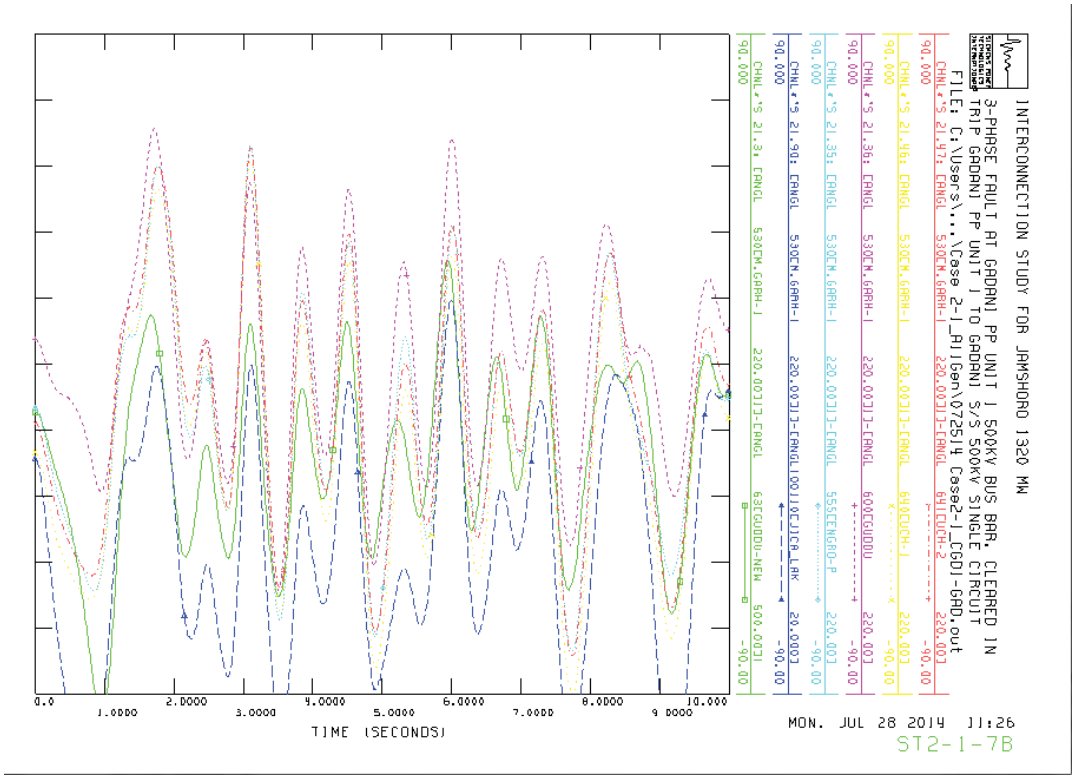


Fault Section: Jamshoro S/S – Matiari S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

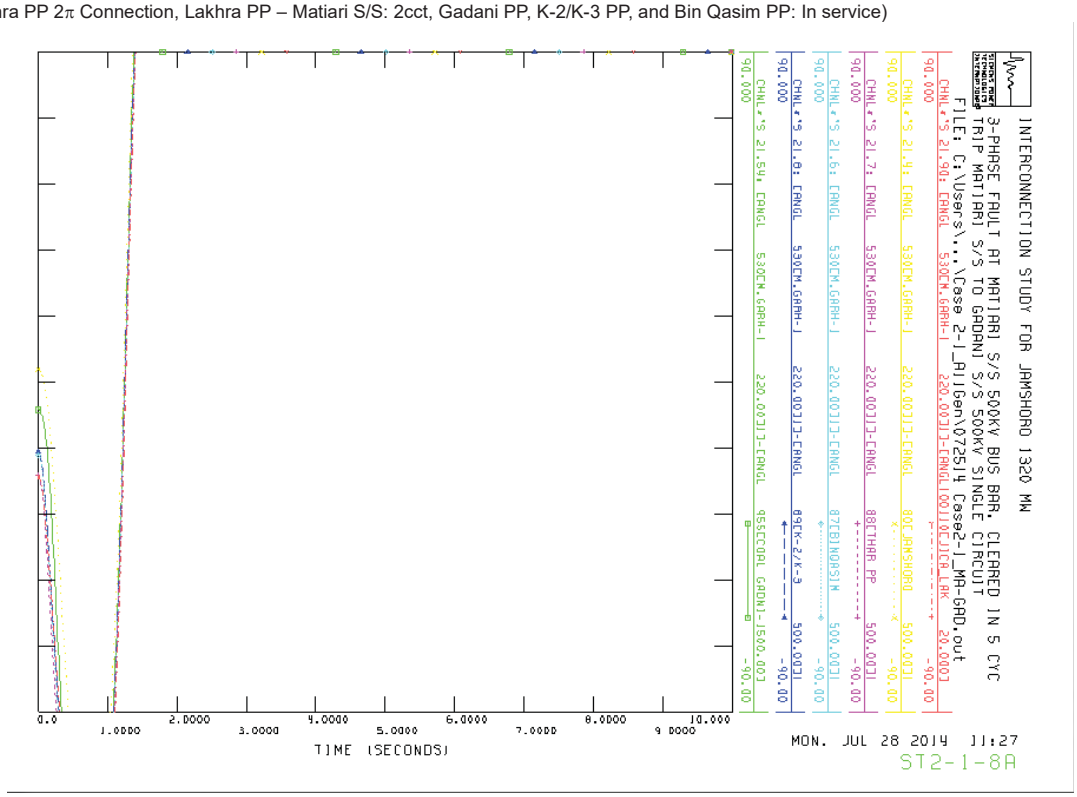


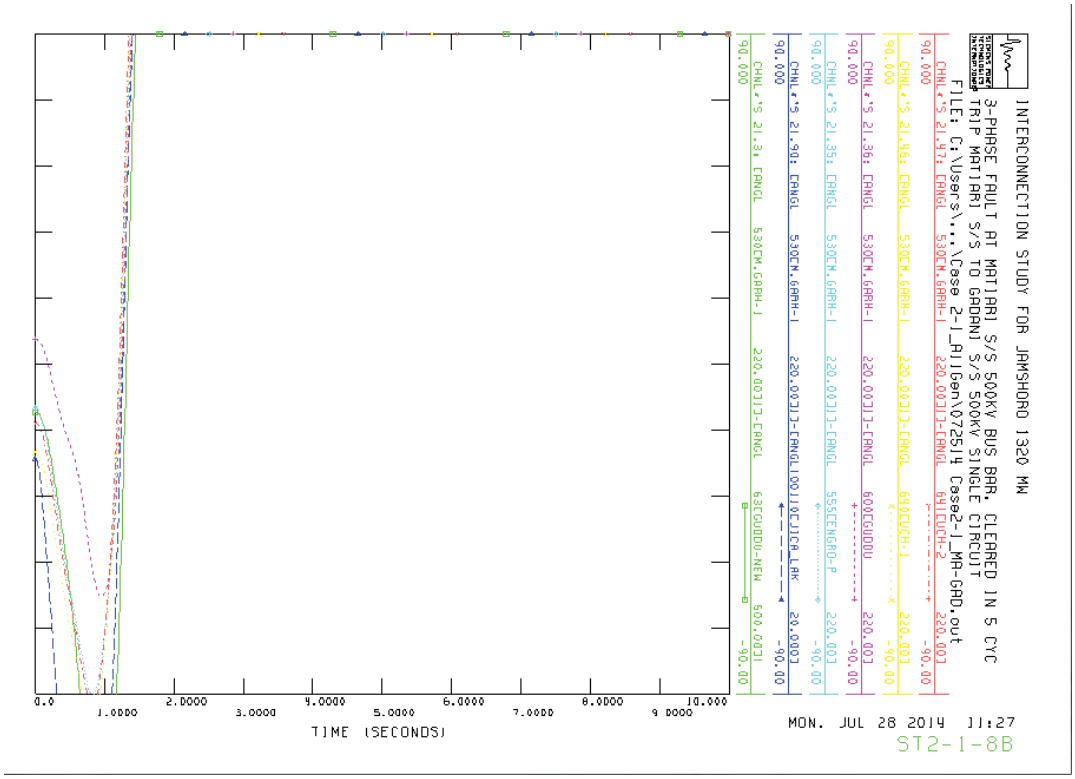


Fault Section: Coal Gadani PP – Gadani S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

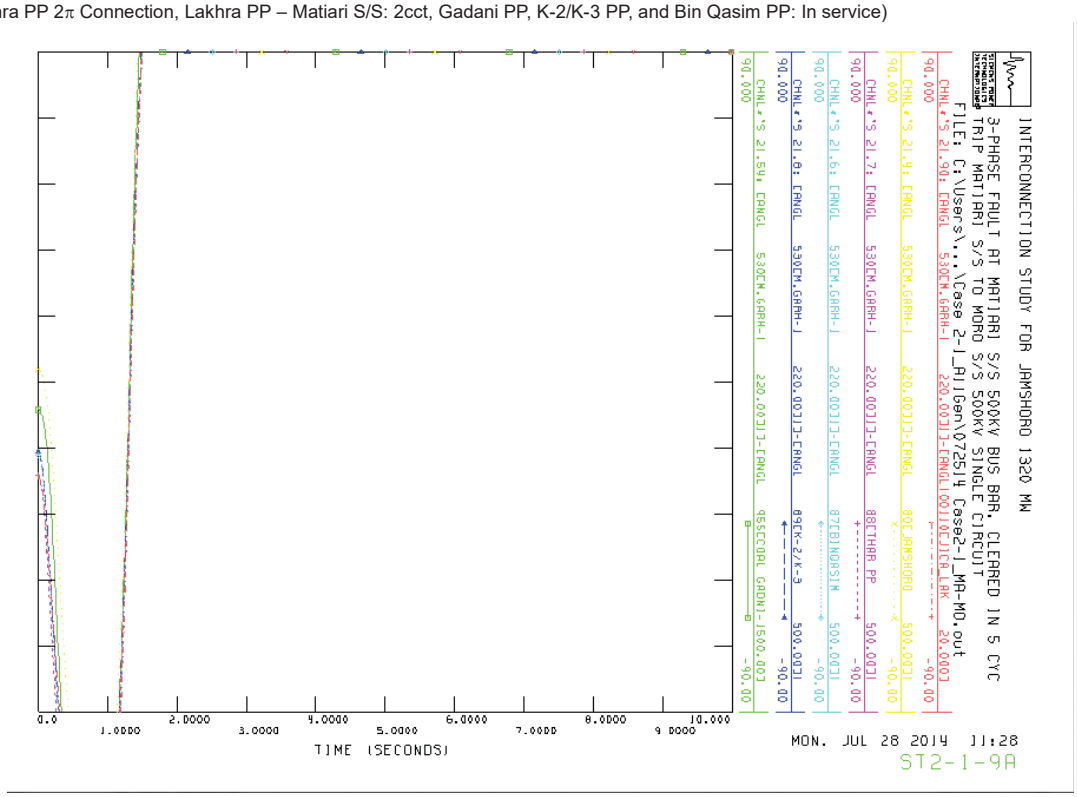


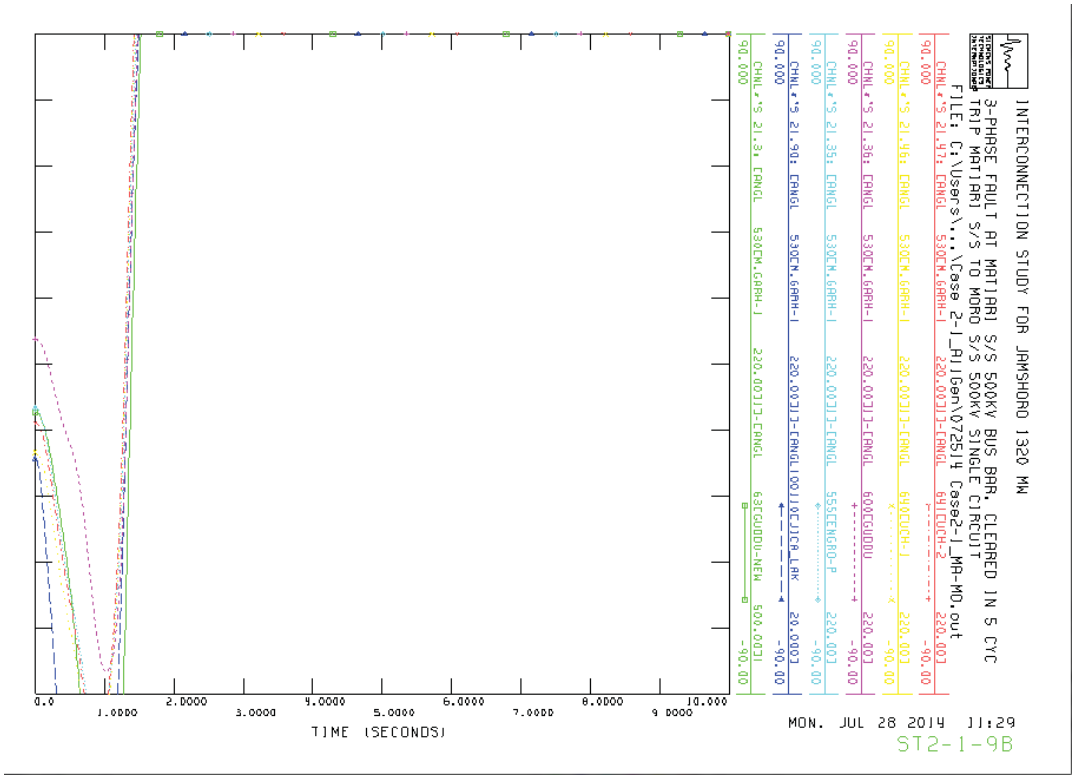


Fault Section: Matiari S/S – Gadani S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

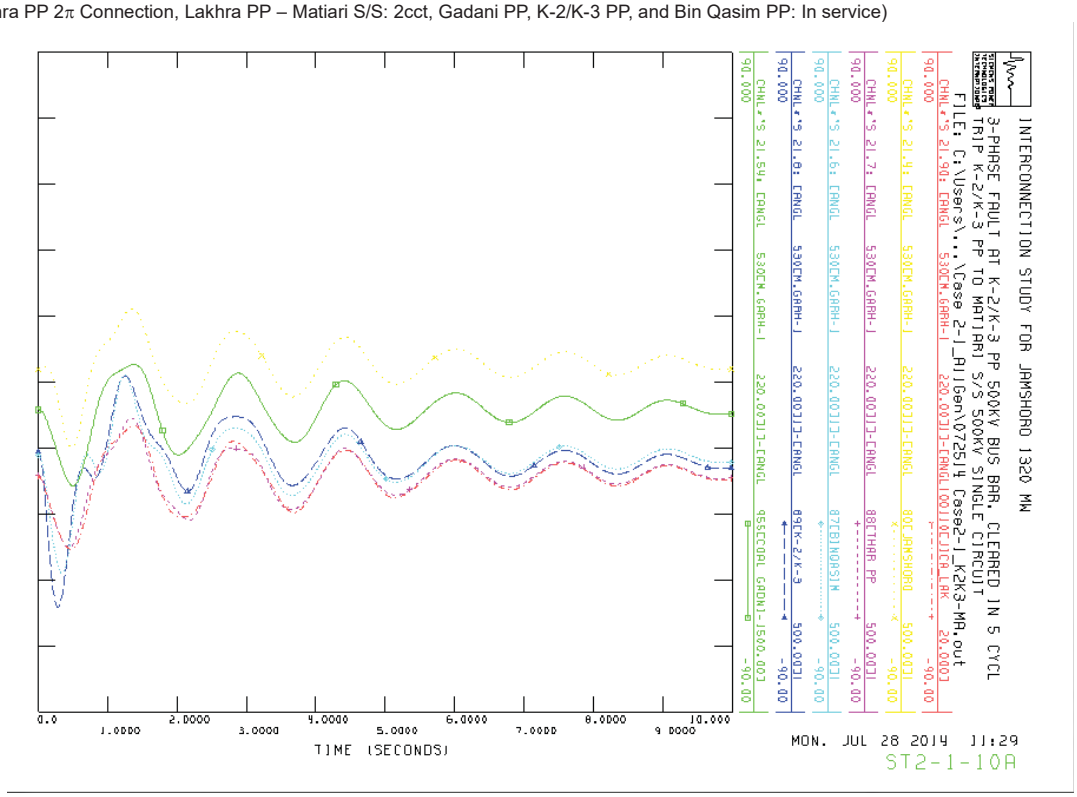


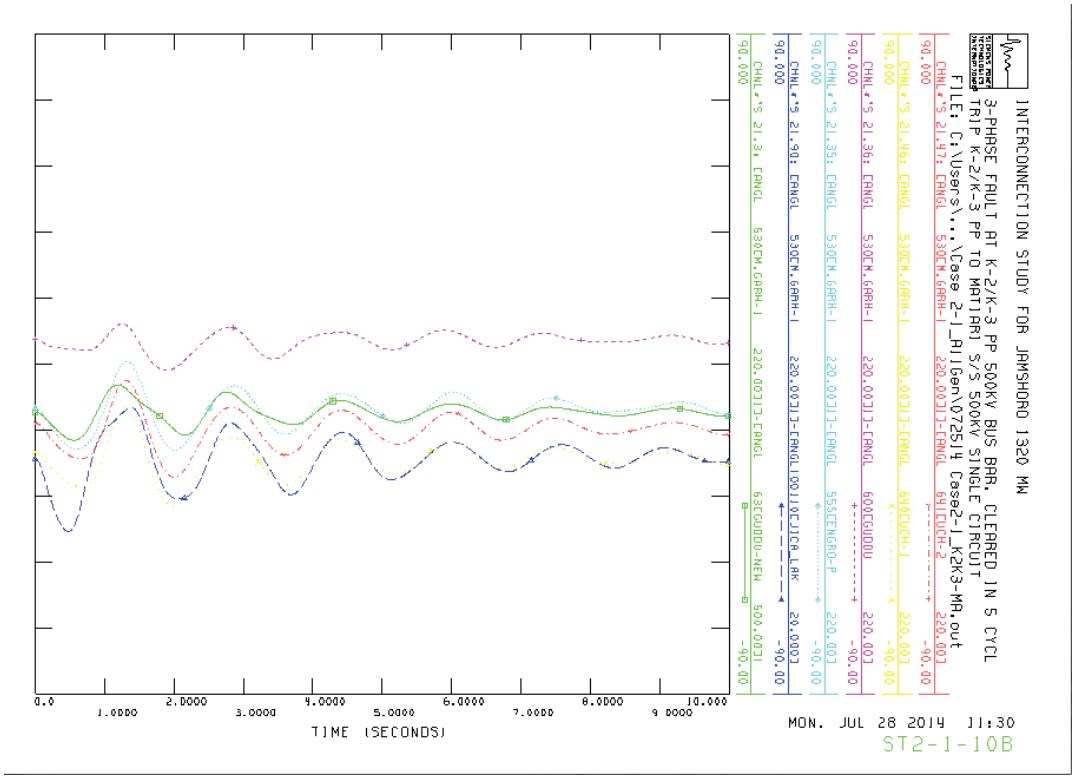


Fault Section: Matiari S/S – Moro S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

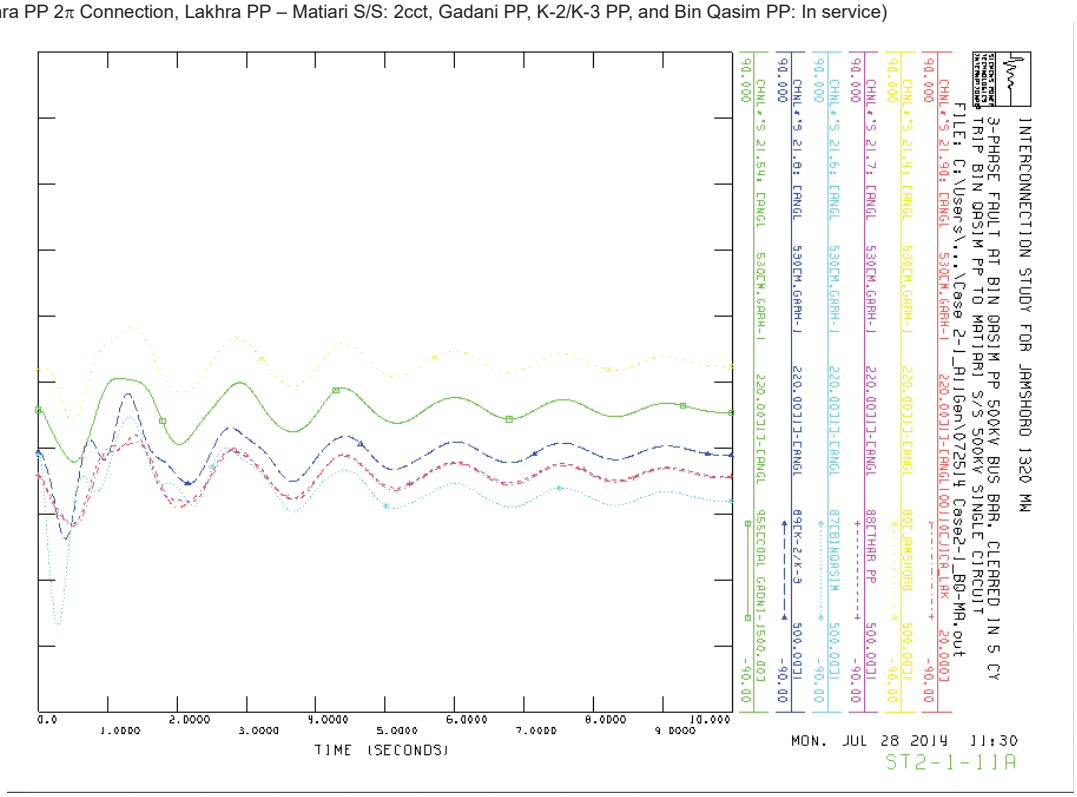


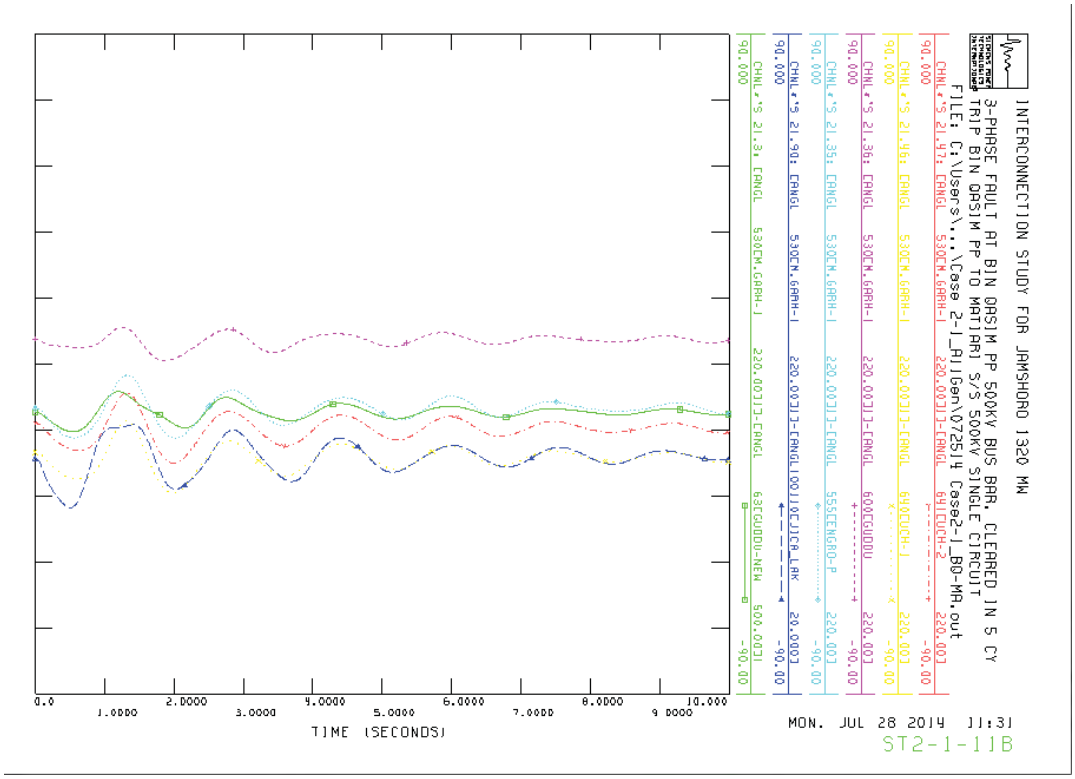


Fault Section: K-2/K-3 PP – Matiari S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

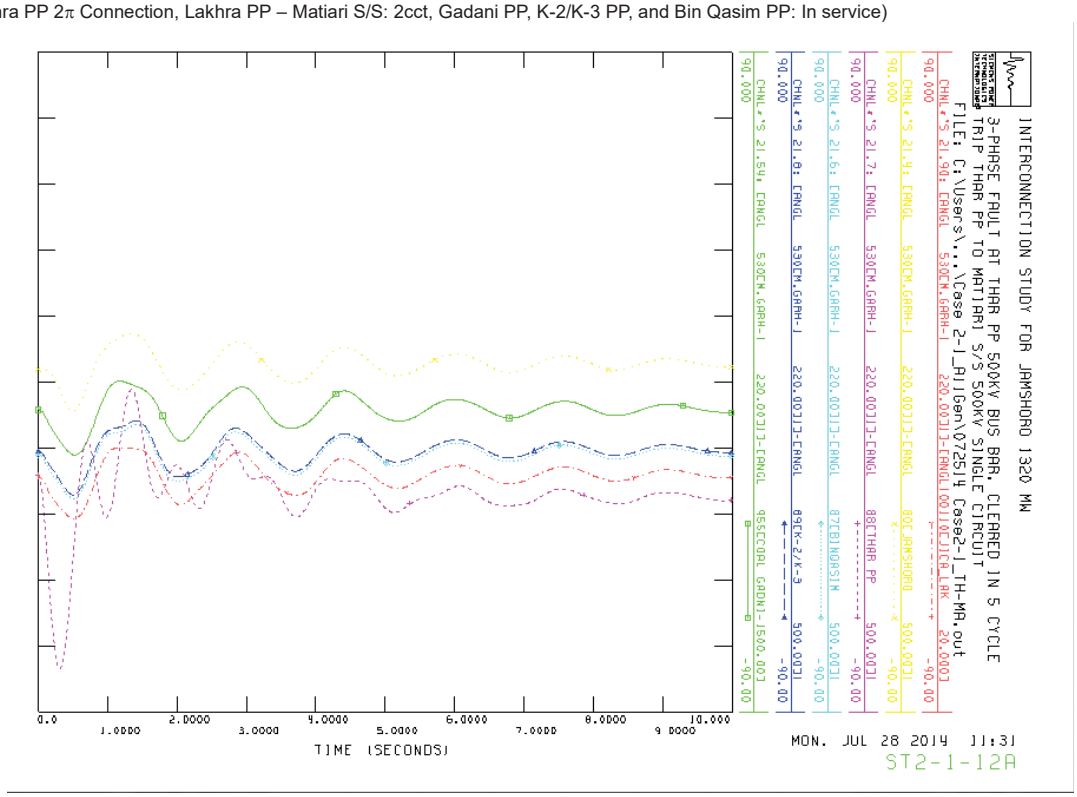


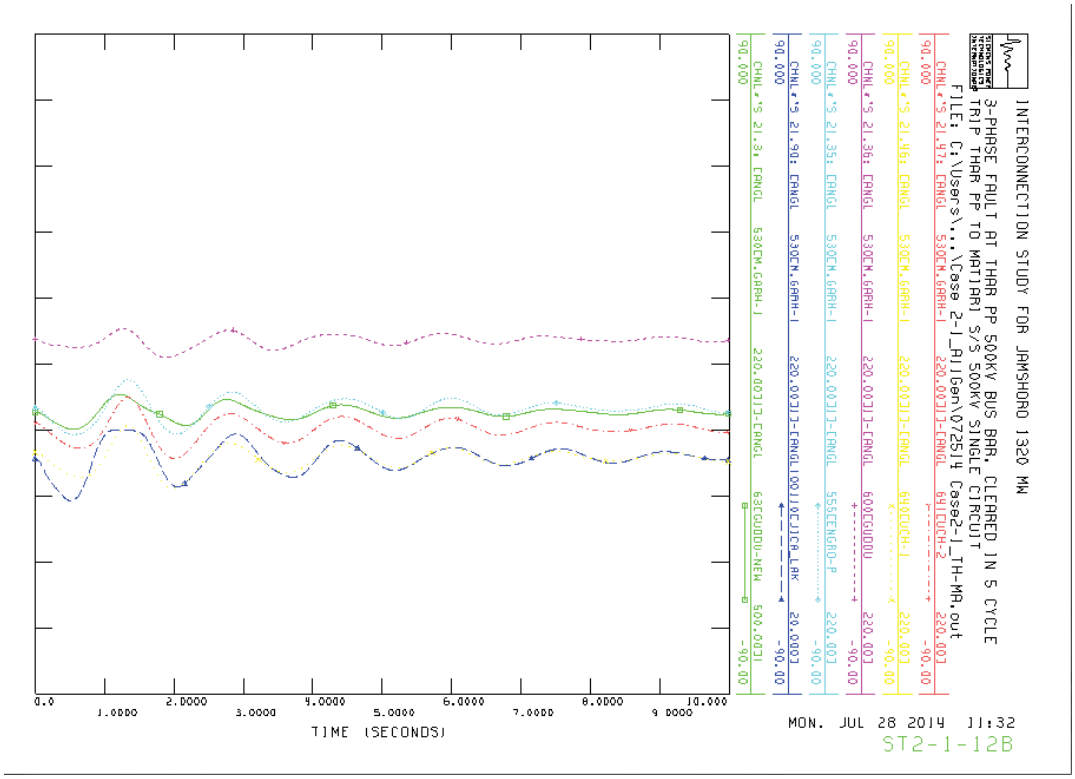


Fault Section: Bin Qasim S/S – Matiari S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

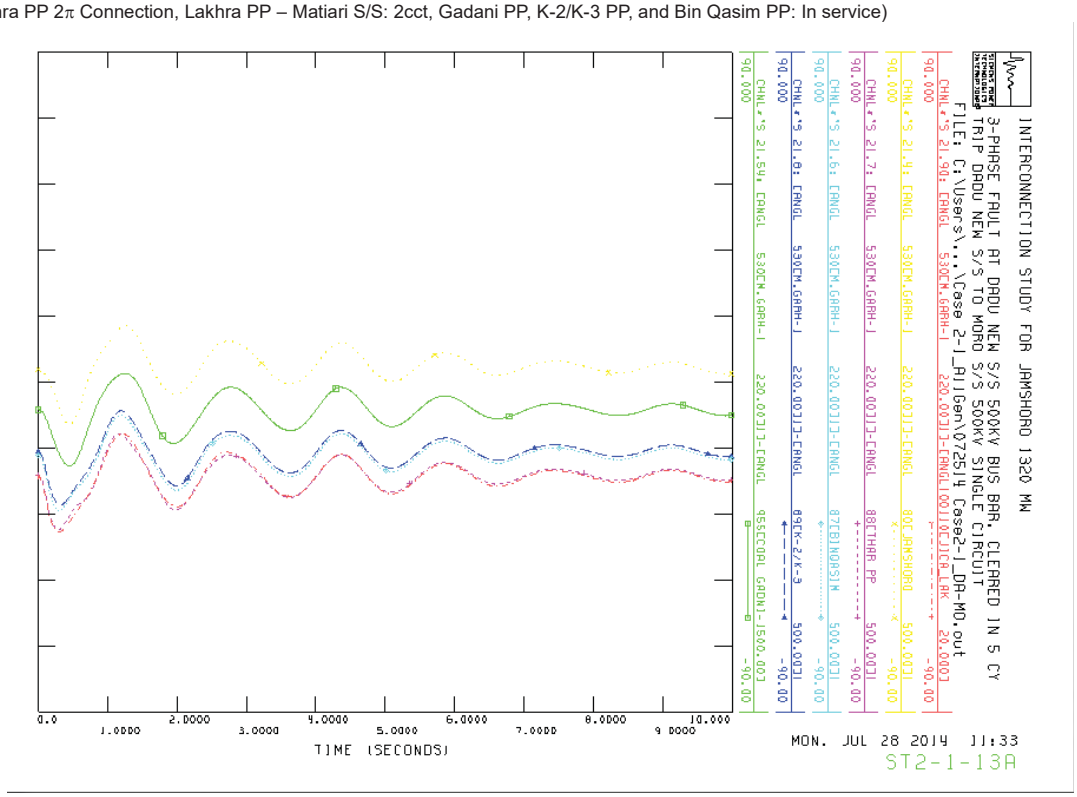


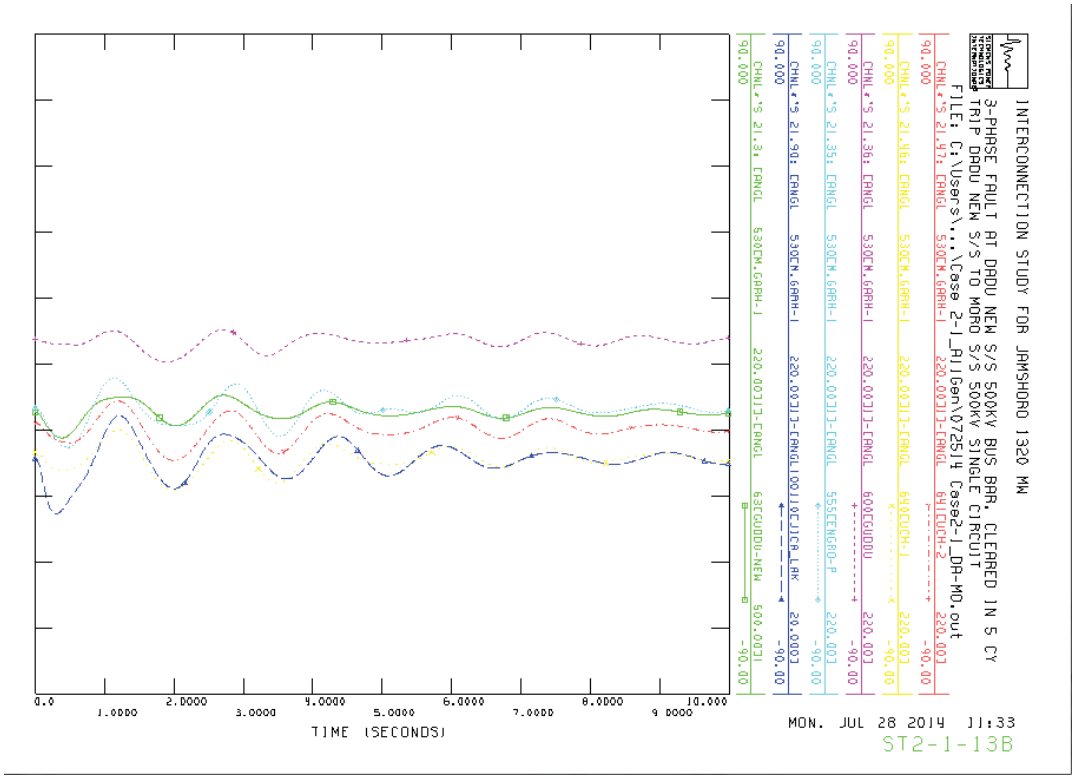


Fault Section: Thar PP – Matiari S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

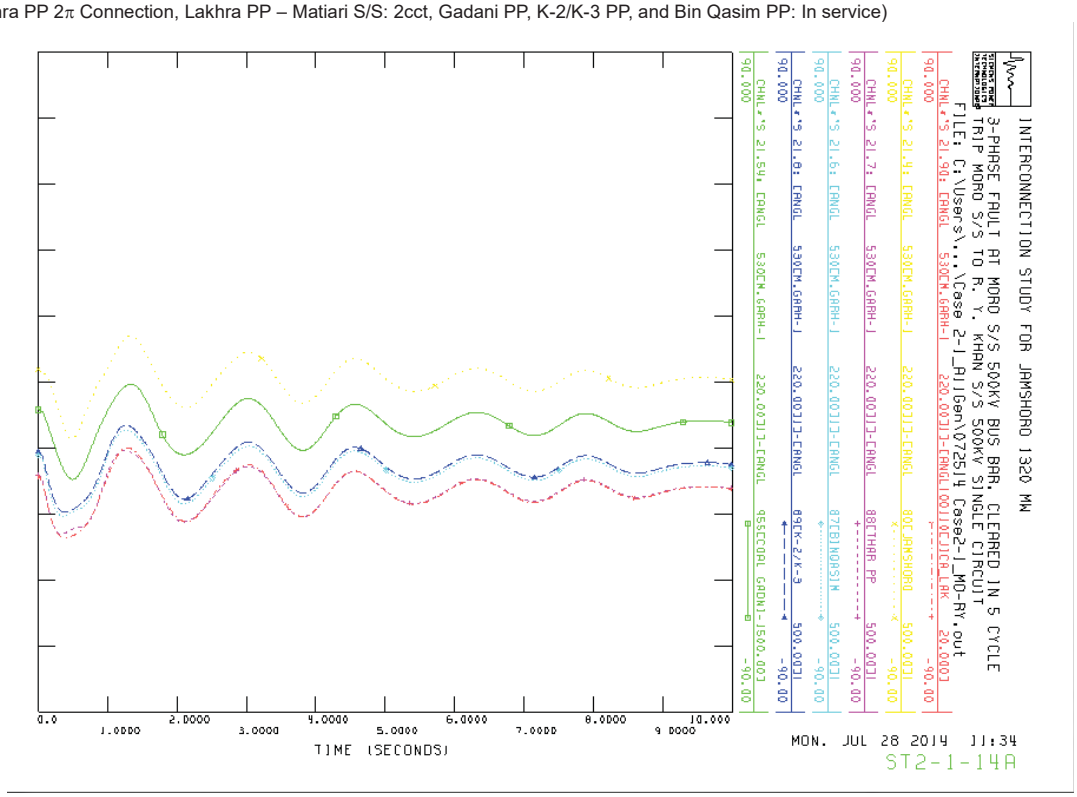


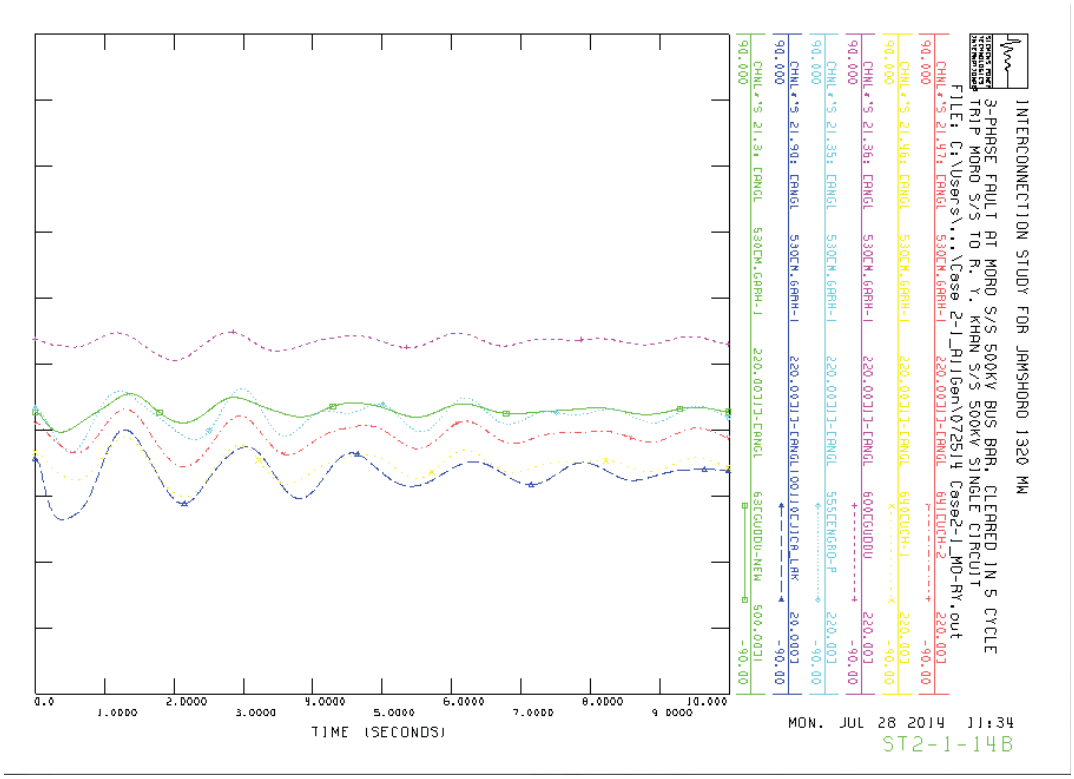


Fault Section: Dadu New S/S – Moro S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

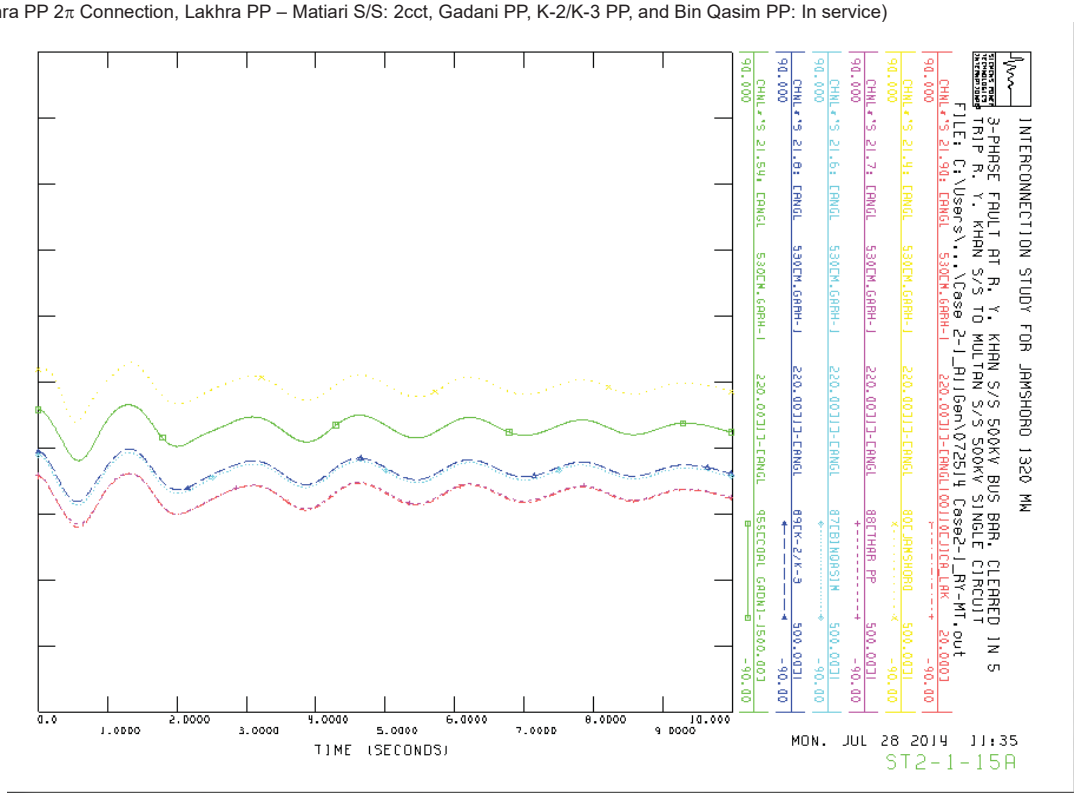


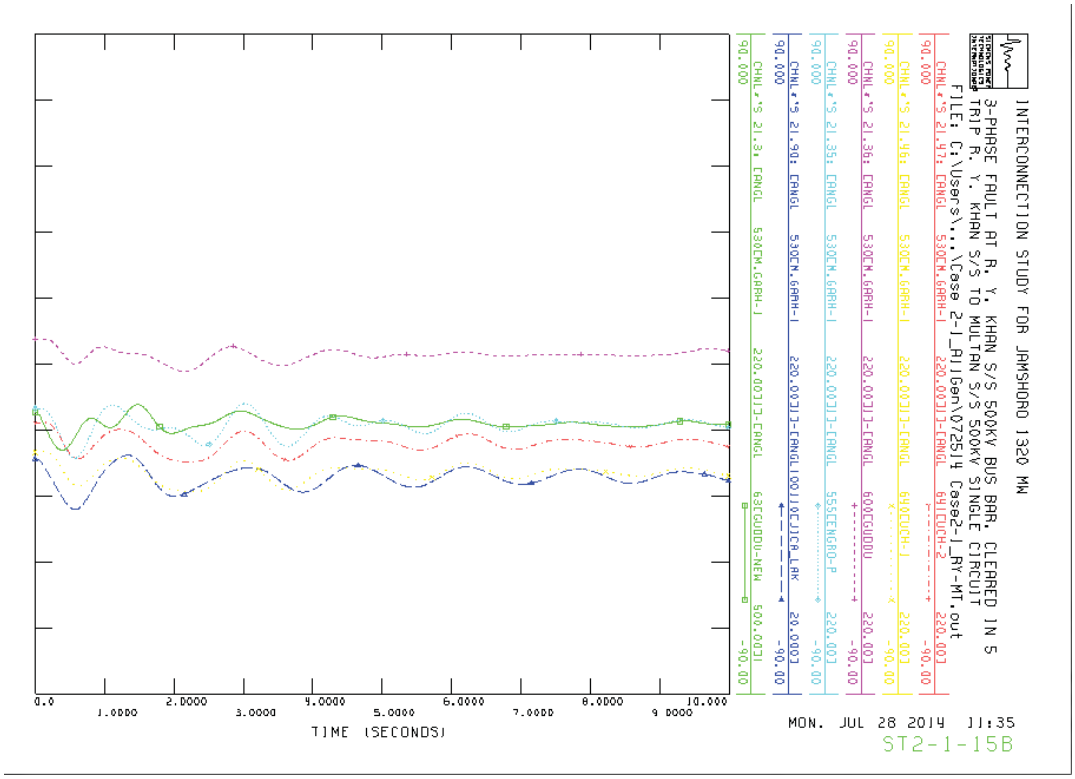


Fault Section: Moro S/S – R. Y. Khan S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

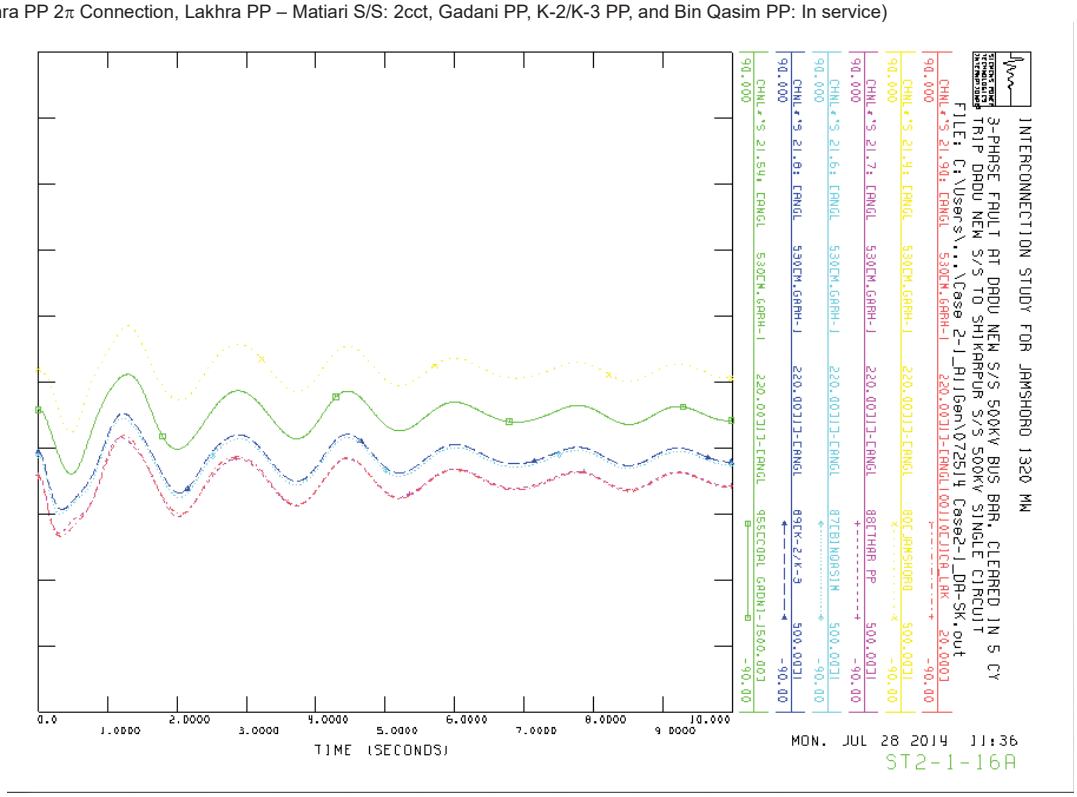


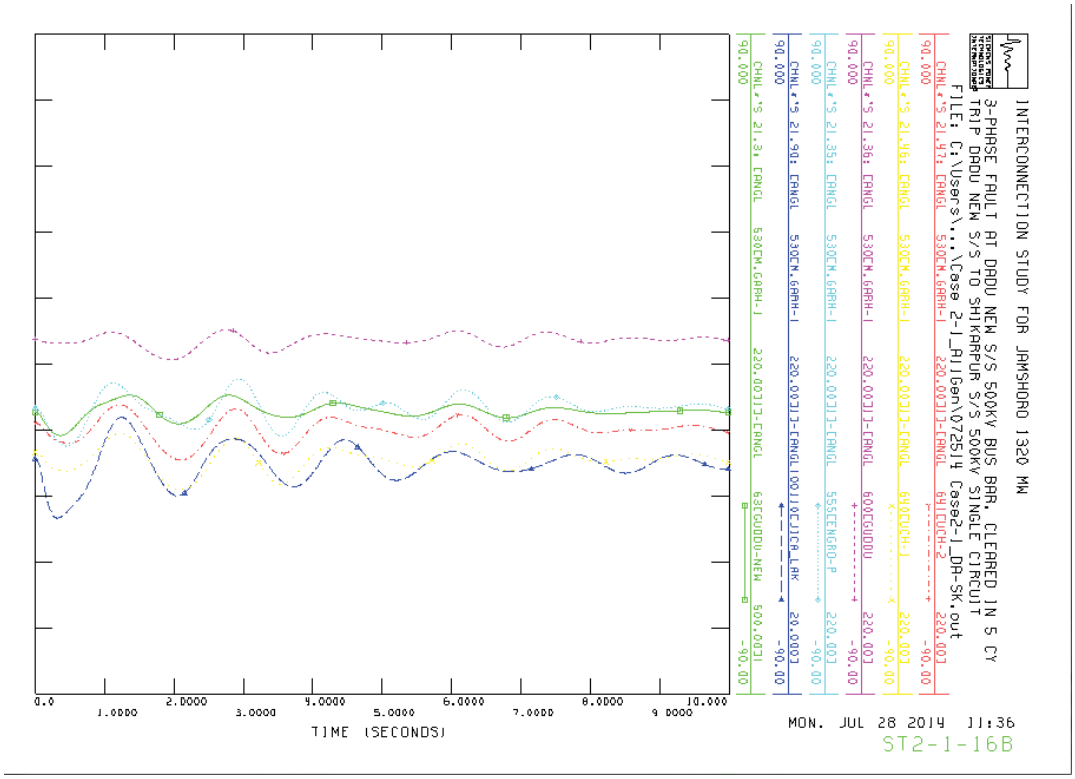


Fault Section: R. Y. Khan PP – Multan S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

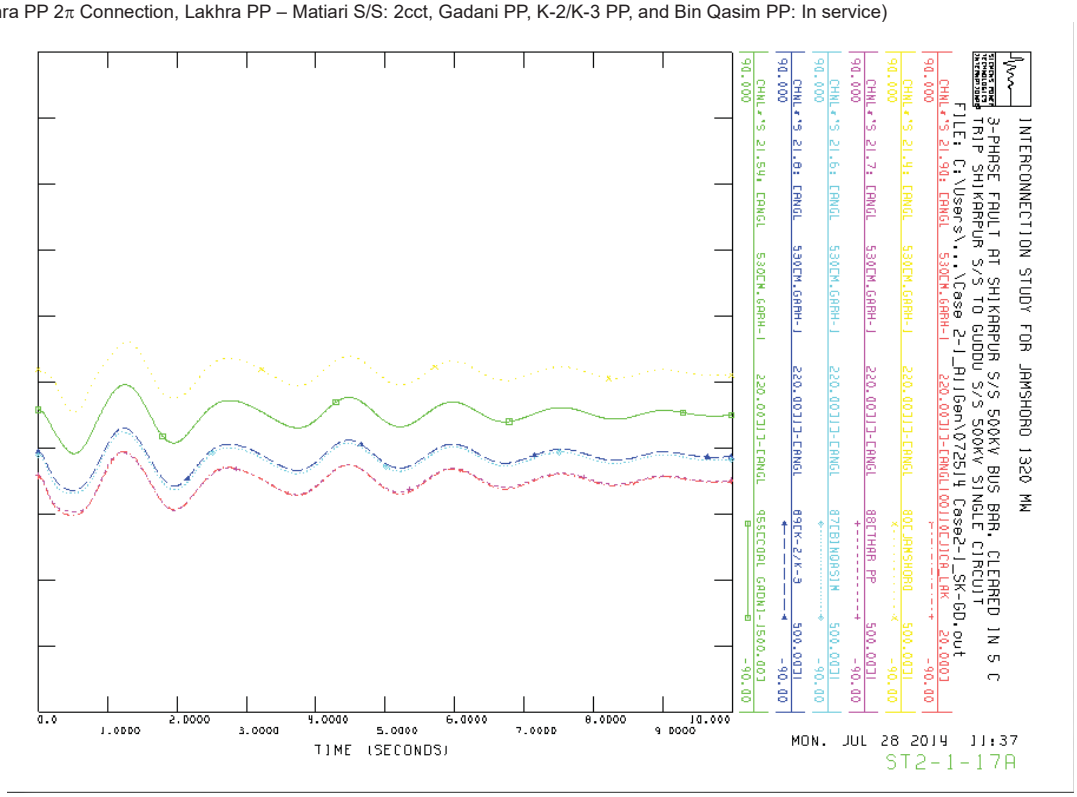


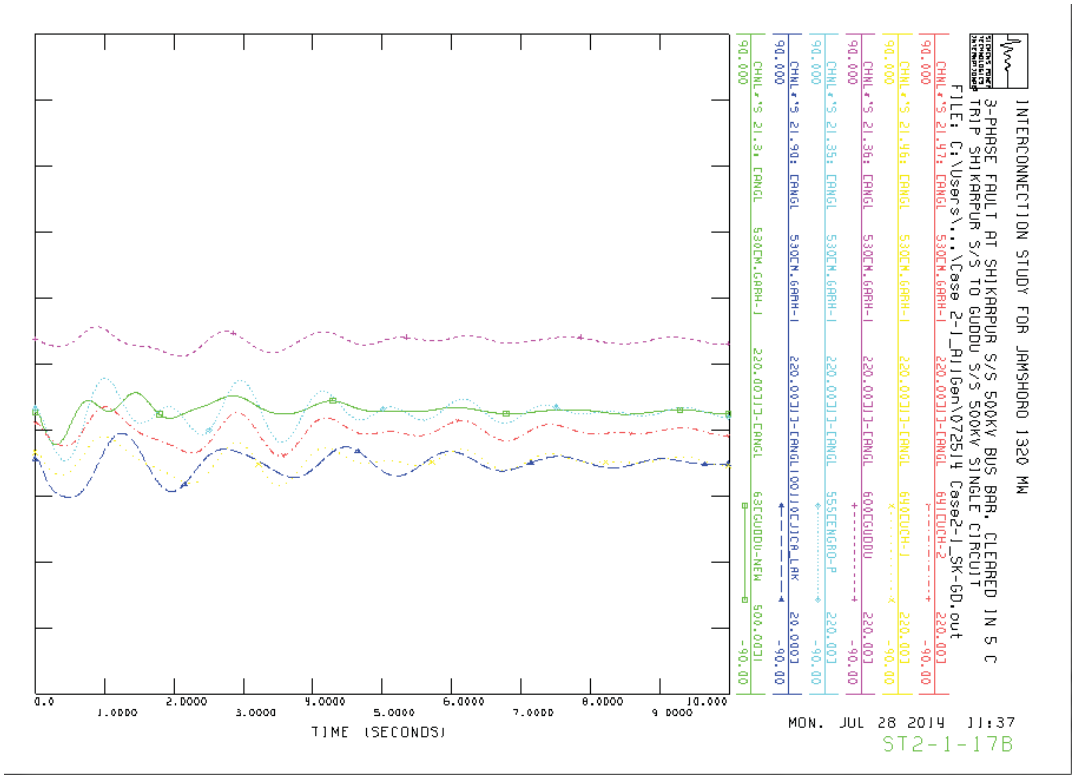


Fault Section: Dadu New S/S – Shikarpur S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

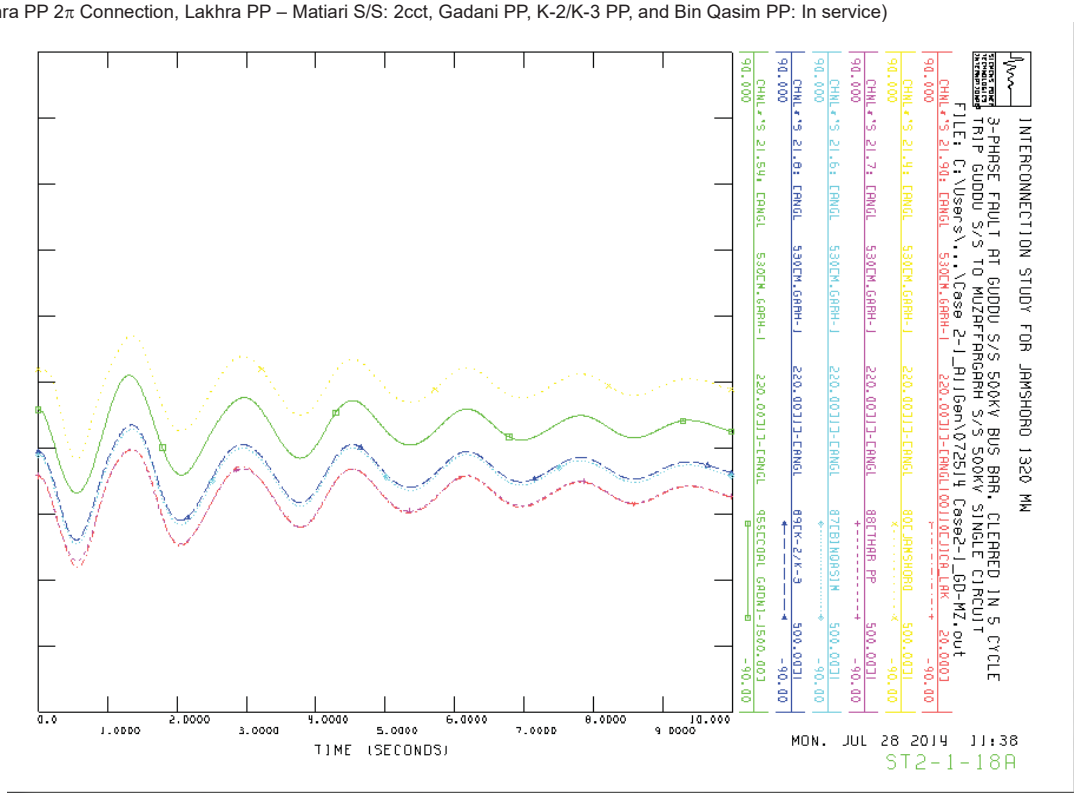


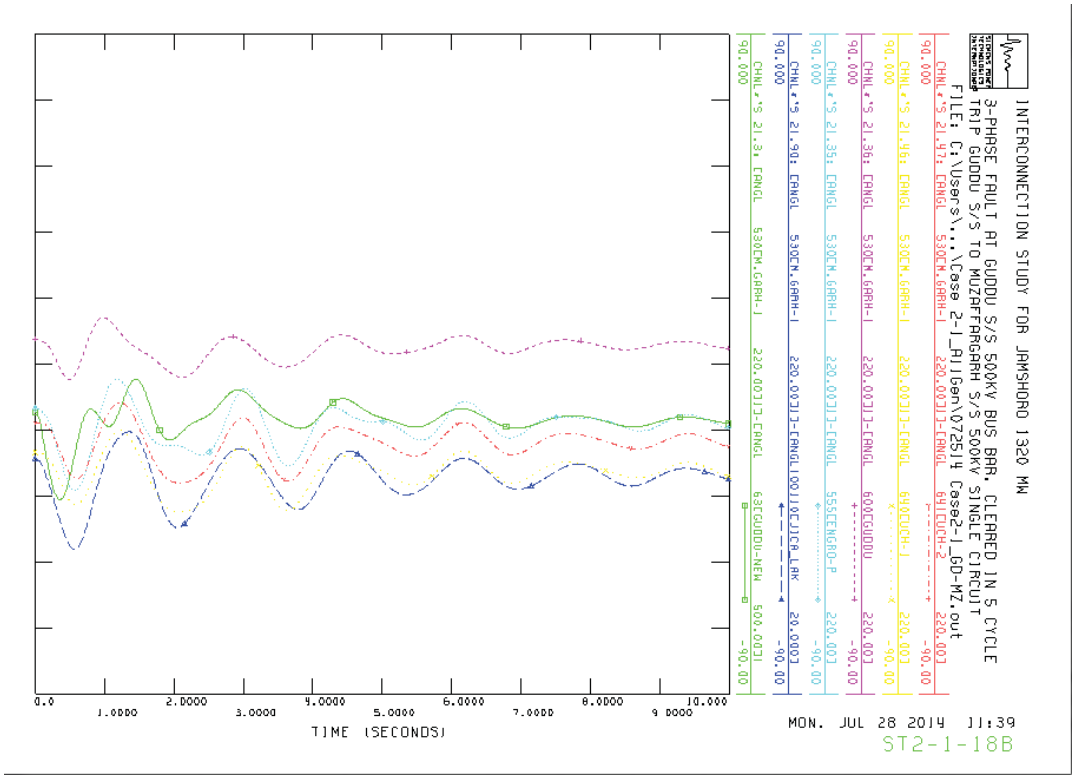


Fault Section: Shikarpur S/S – Guddu S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

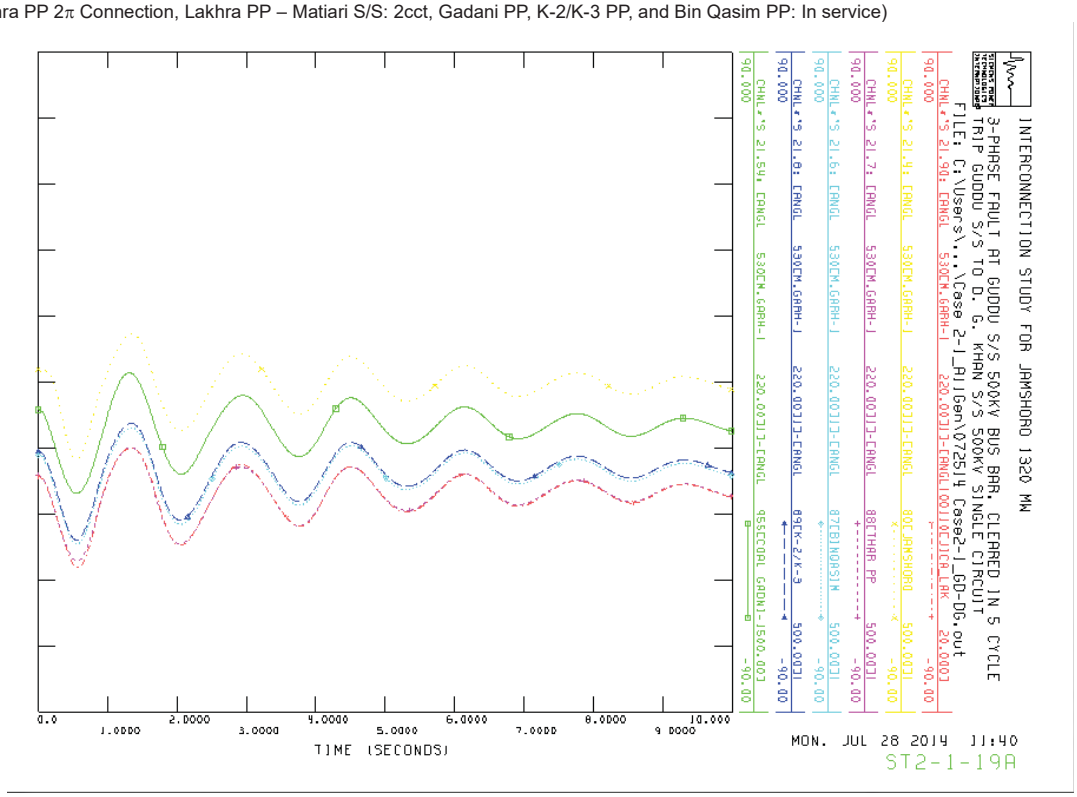


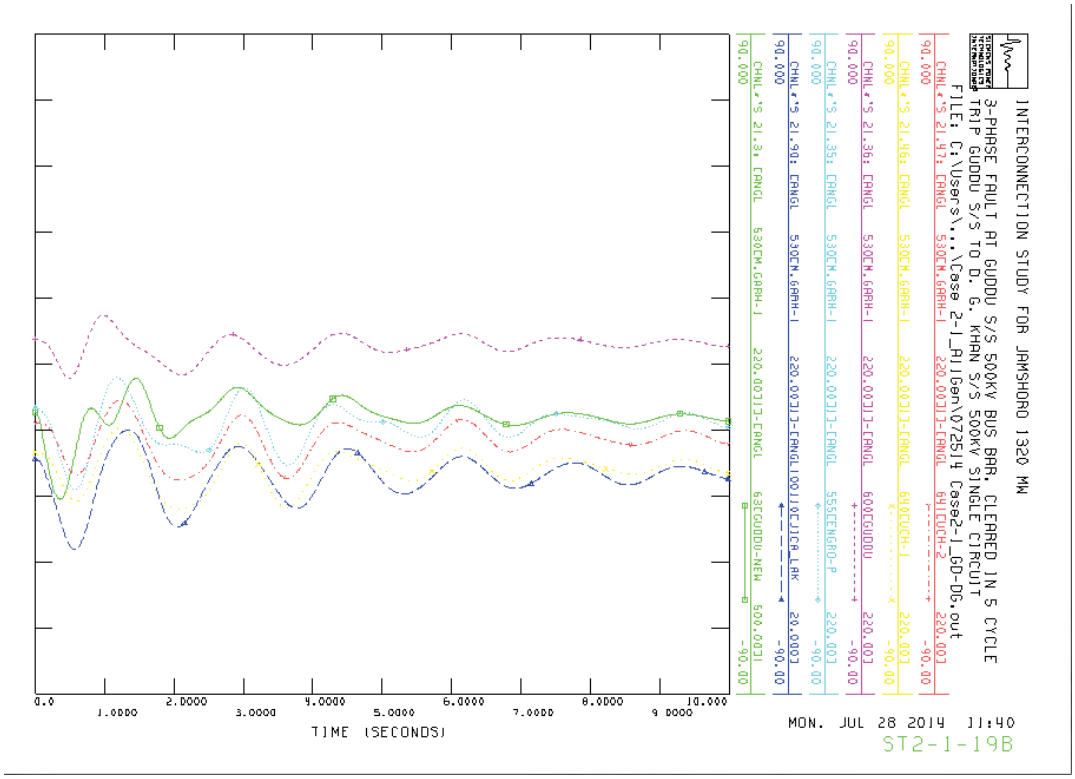


Fault Section: Guddu S/S – Muzaffargarh S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

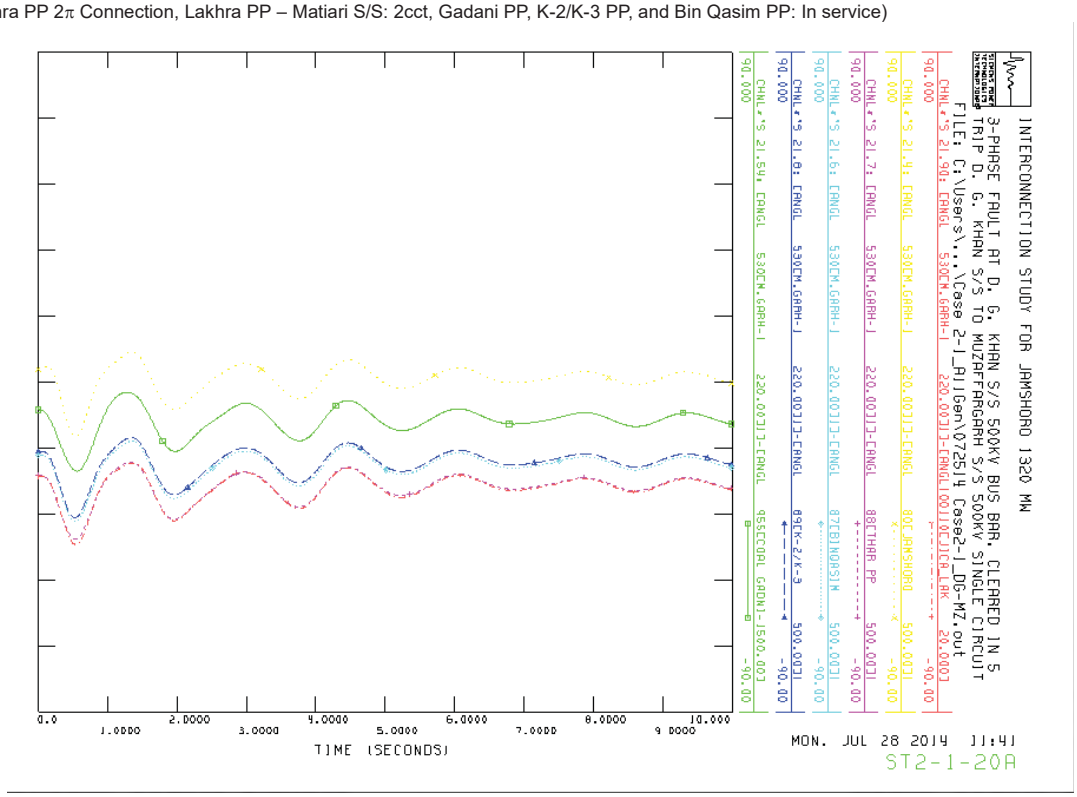


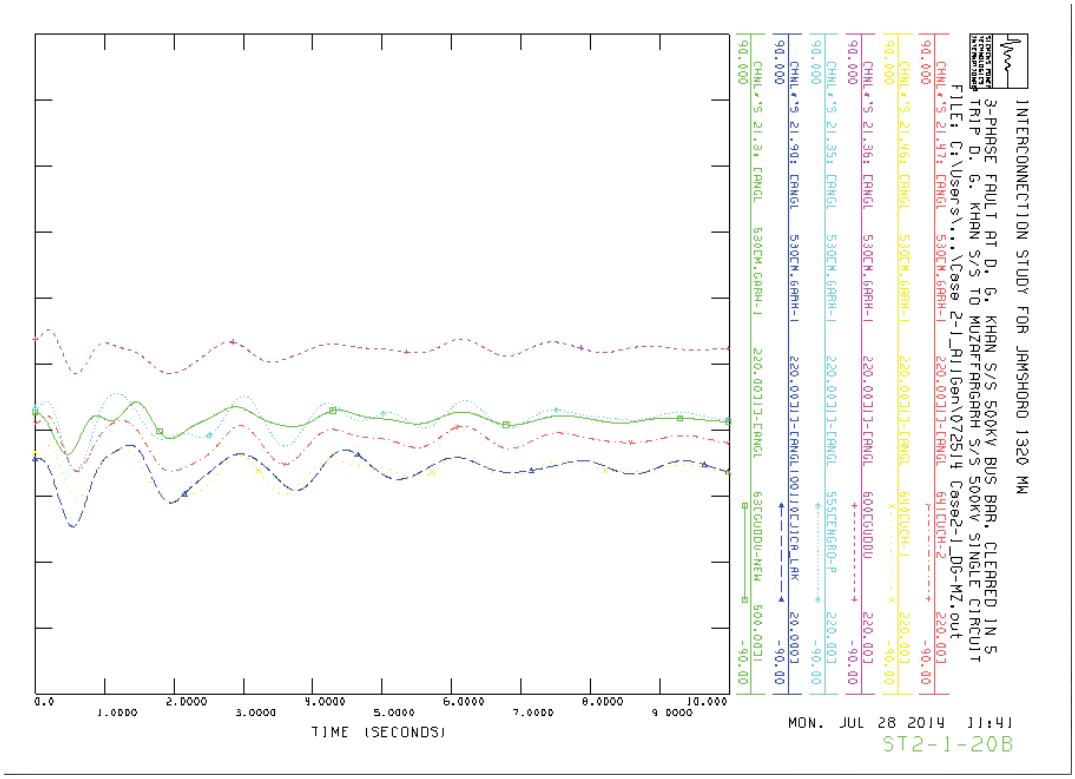


Fault Section: Guddu S/S – D. G. Khan S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

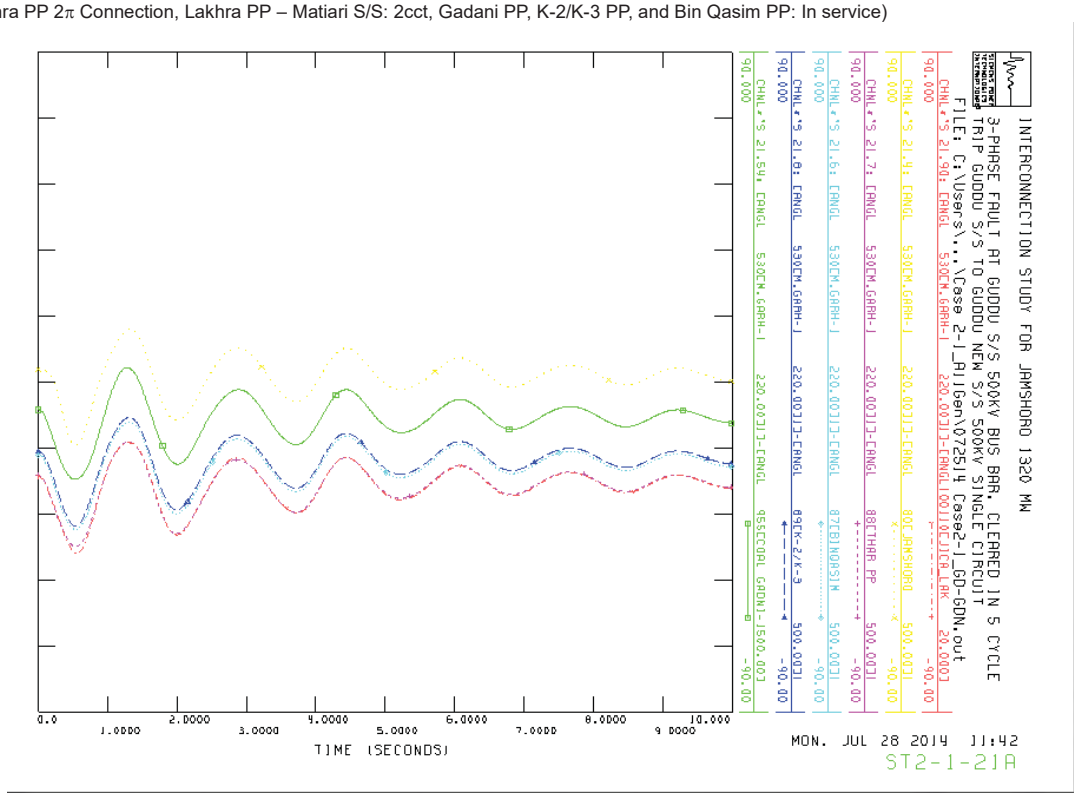


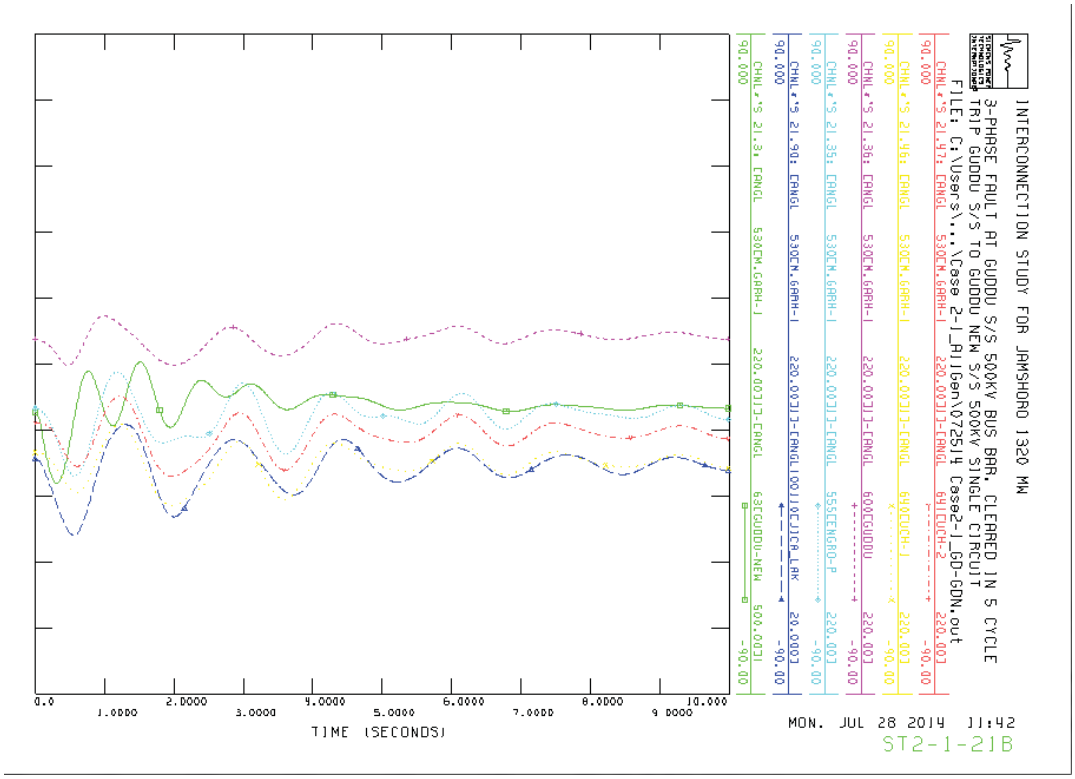


Fault Section: D. G. Khan S/S – Muzaffargarh S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

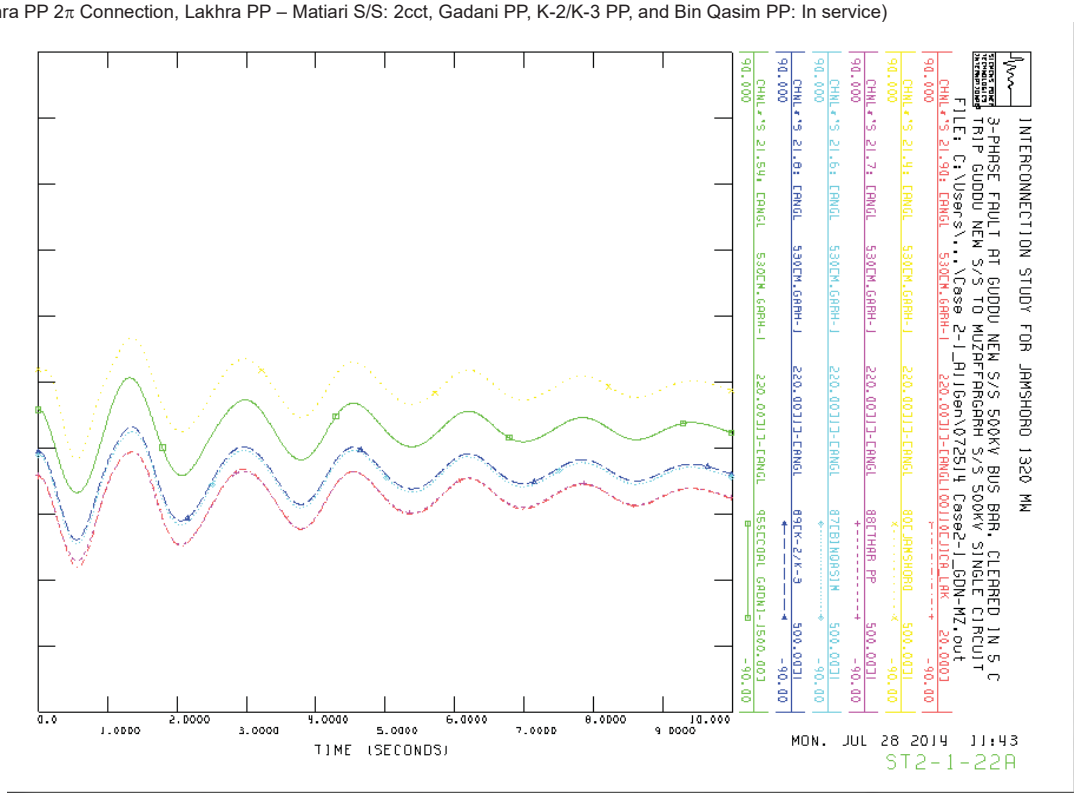


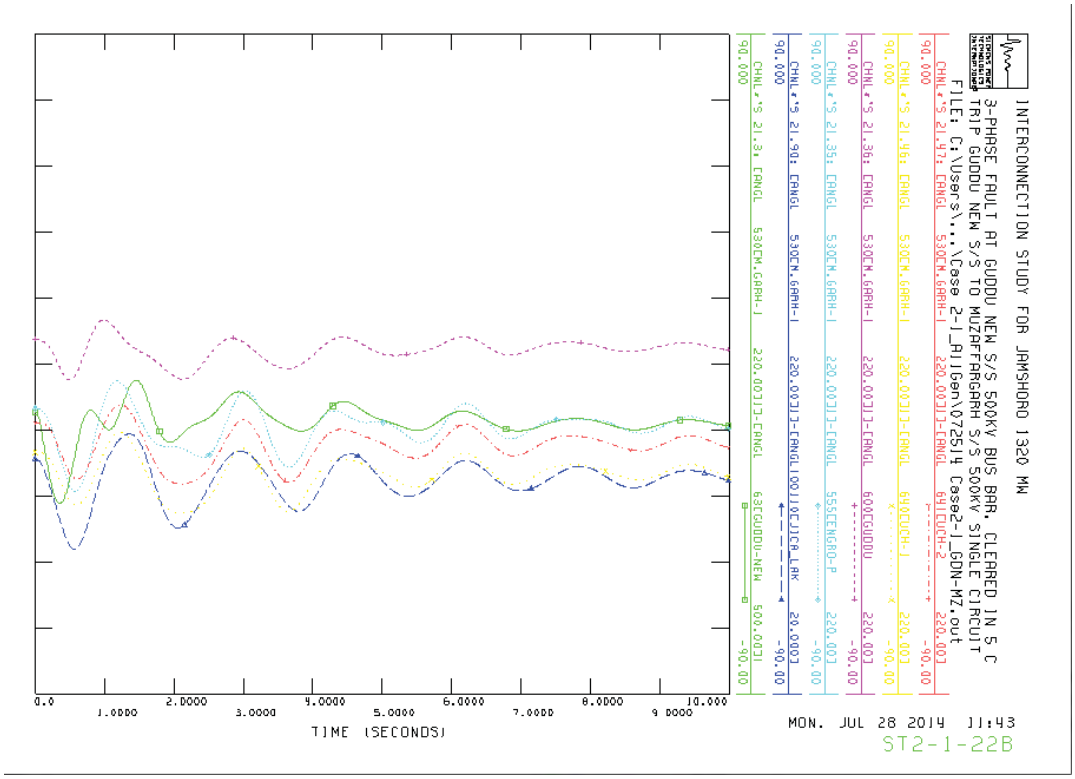


Fault Section: Guddu S/S – Guddu New PP

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

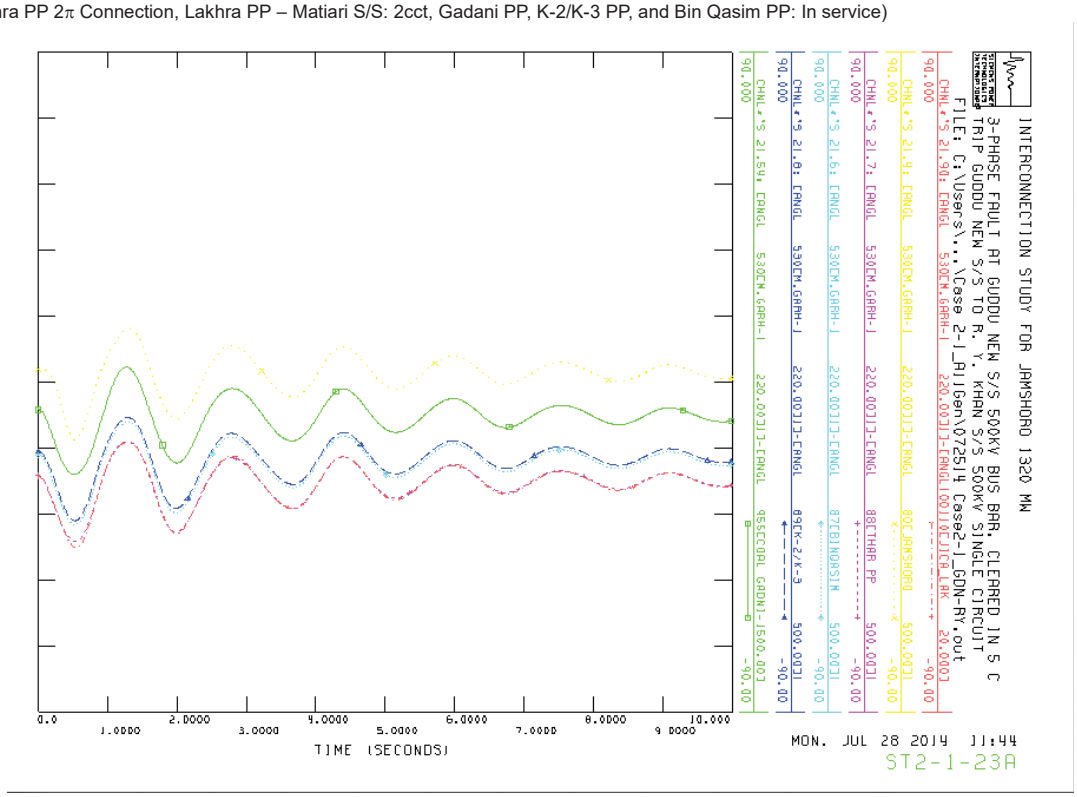


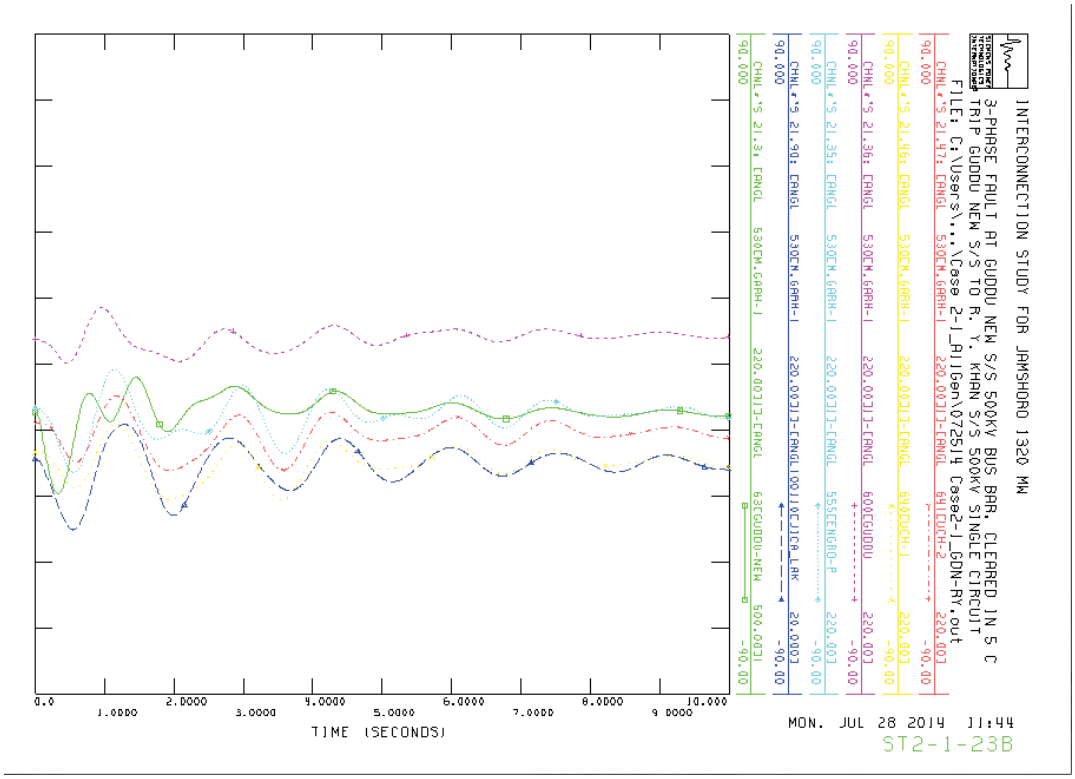


Fault Section: Guddu New PP – Muzaffargarh S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)

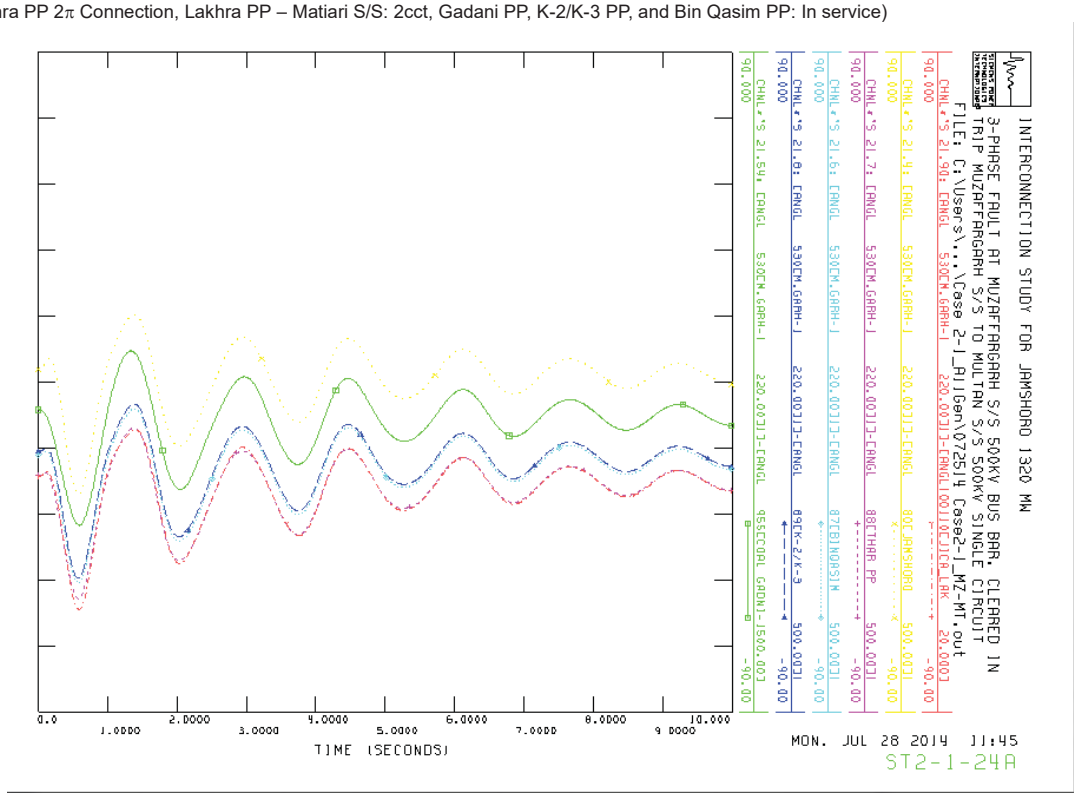


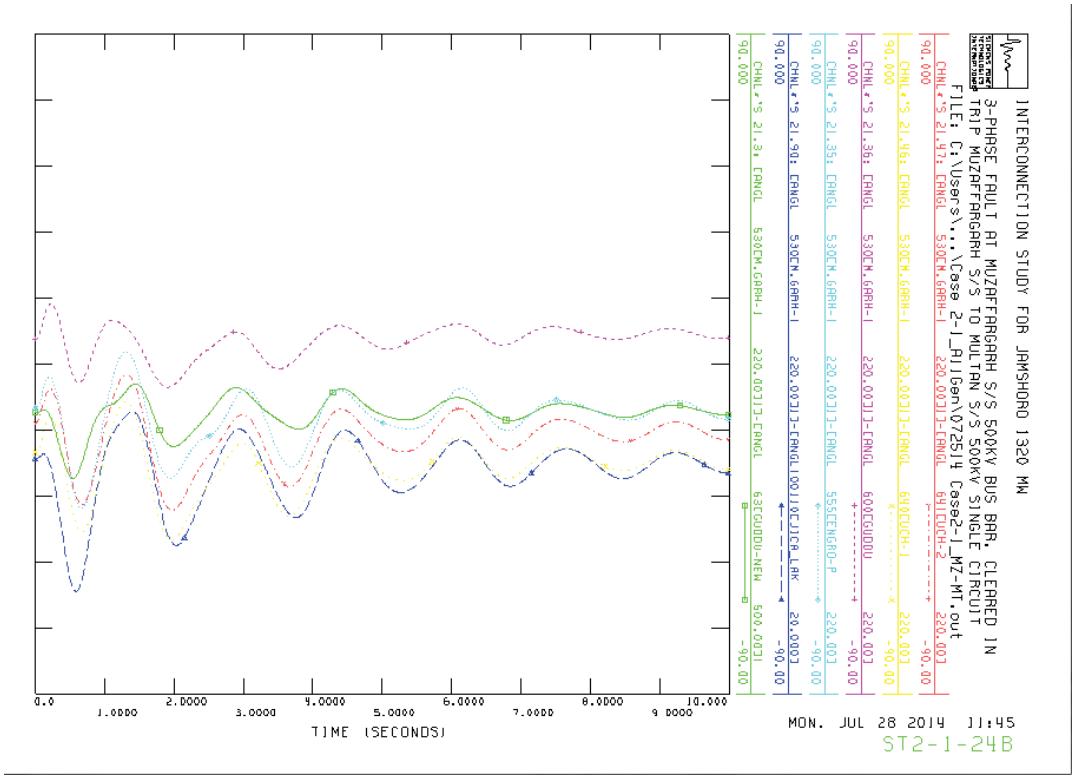


Fault Section: Guddu New PP – R. Y. Khan S/S

Stability Analysis Result Case ST-2-1

(Lakhra PP 2π Connection, Lakhra PP – Matiari S/S: 2cct, Gadani PP, K-2/K-3 PP, and Bin Qasim PP: In service)





Fault Section: Muzaffargarh S/S – Multan S/S