

**Ministry of Communications
The Islamic Republic of Pakistan**

**PAKISTAN TRANSPORT PLAN STUDY
IN THE ISLAMIC REPUBLIC OF PAKISTAN (Phase II)**

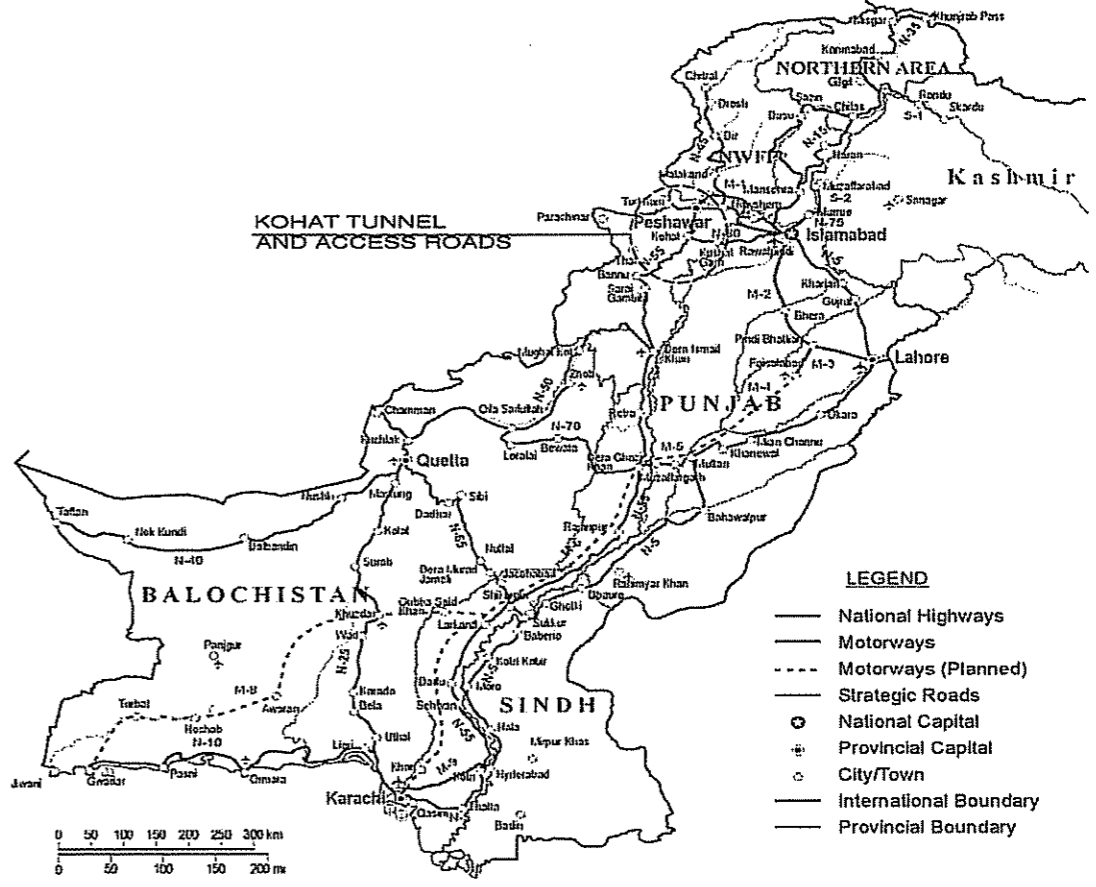
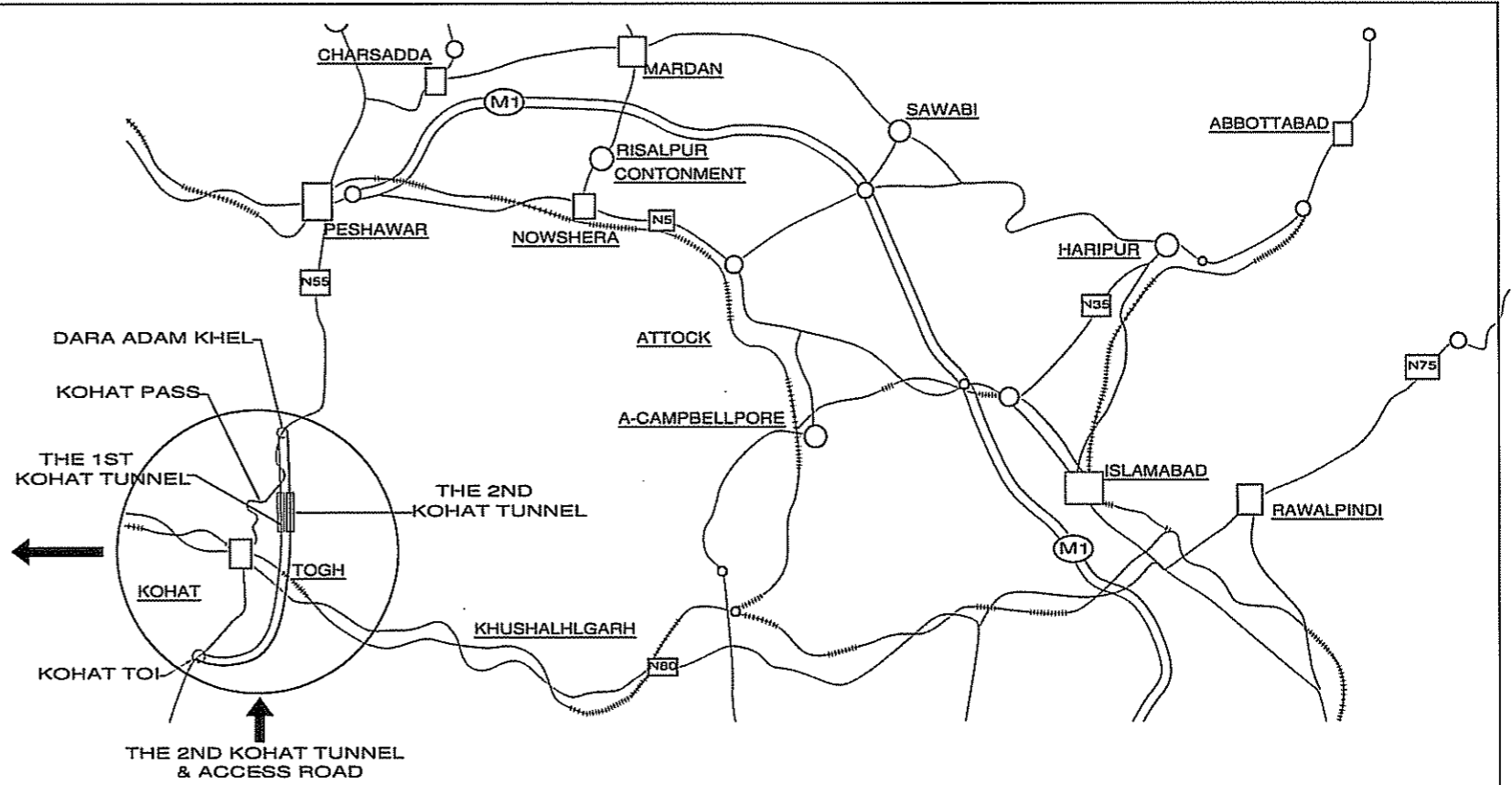
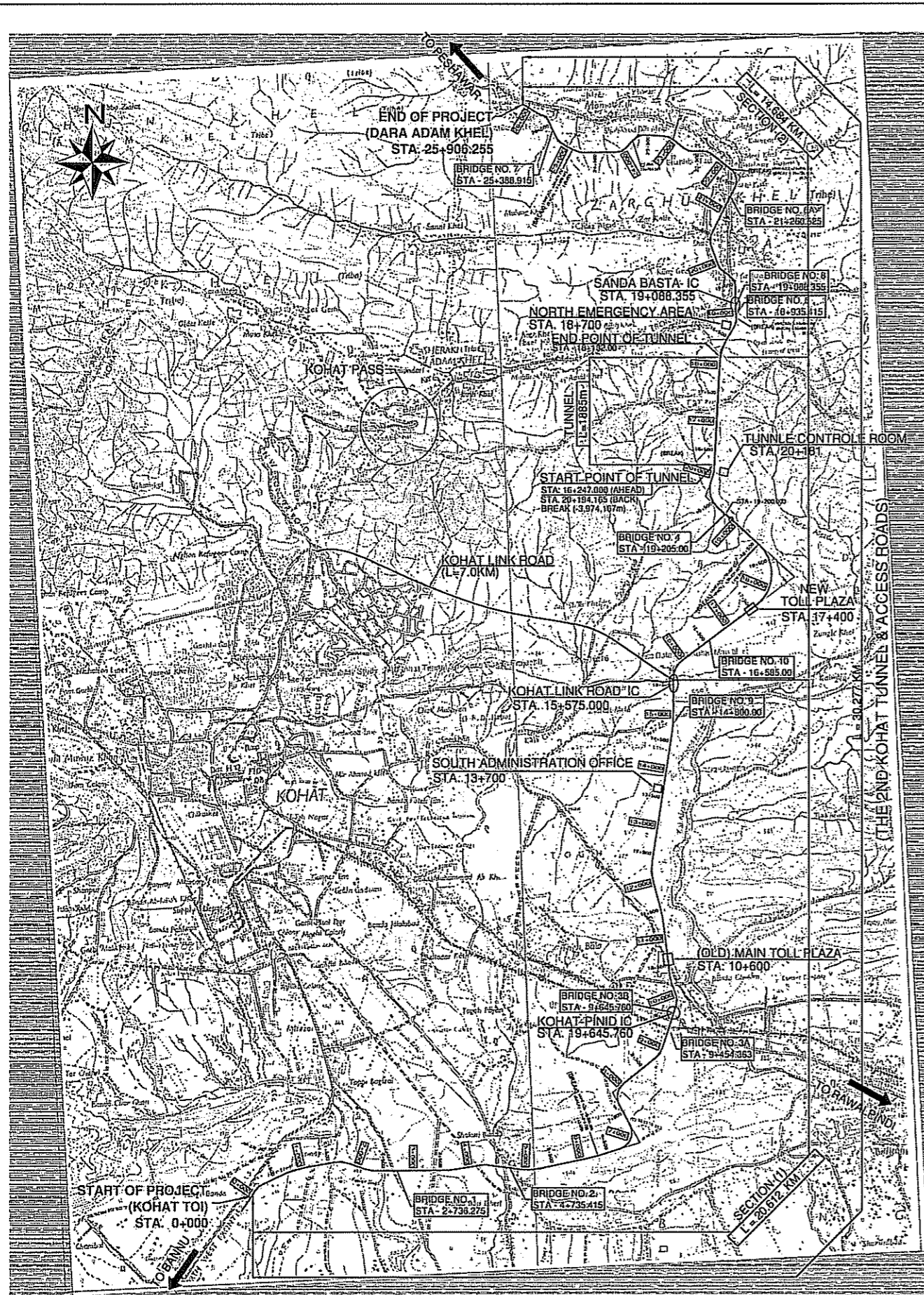
**Final Report
(Volume II: Preliminarily Design Drawing)**

January 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD. & ALMEC CORPORATION

GENERAL



NATIONAL HIGHWAYS / MOTORWAYS NETWORKS

PROJECT NAME	CLIENTS	CONSULTANTS	DRAWING TITLE	SCALE	DWG NO
FEASIBILITY STUDY ON THE 2ND KOHAT TUNNEL AND ACCESS ROADS PROJECT	 GOVERNMENT OF PAKISTAN MINISTRY OF COMMUNICATIONS NATIONAL HIGHWAY AUTHORITY	 JAPAN INTERNATIONAL COOPERATION AGENCY	NIPPON KOEI CO., LTD AND ALMEC CORPORATION	NTS	G-2

ABBREVIATIONS

LEGENDS

GENERAL NOTES

A	AREA	m.	METER
ABUT.	ABUTMENT	MAX.	MAXIMUM
AVE.	AVERAGE	MIN.	MINIMUM
BEG.	BEGINNING OR BEGIN	M.O.	MIDDLE ORDINATE CURVE)
BIT.	BITUMINOUS	MON.	MONUMENT
CL.	CENTER LINE	N.C	NORMAL CROWN
COMB.	COMBINATION	NO.	NUMBER
CONC.	CONCRETE	P.C.	POINT CURVATURE
CONSTR.	CONSTRUCTION	P.C.C.	POINT OF COMPOUND CURVE
CORR.	CORRECTION	P.G.L	PROPOSED GRADE LINE
CULV.	CULVERT	P.G.E.	PROPOSED GRADE ELEVATION
DIA PR Ø	DIAMETER	P.I.	POINT OF INTERSECTION
DIST.	DISTANCE	P.O.C.	POINT OF CURVE
DWG.	DRAWING	P.O.T.	POINT OF TANGENT
Δ	DELTA OR DEFLECTION ANGLE	P / R	POINT OF ROTATION
VAR.	VARIES OR VARIABLE	P.R.C.	POINT OF REVERSE CURVATURE
V.C.	VERTICAL CURVE	P.R.V.C.	POINT OF REVERSE VERTICAL CURVE
E.G.E.	EXISTING GROUND ELEVATION	R.T.	POINT OF TANGENCY
ELE.	ELEVATION	Lc.	LENGTH OF CIRCULAR CURVE
EXIST.	EXISTING	TS.	BEGENNING OF TRANSTITION CURVE
E	EXTERNAL DISTANCE (CURVE DATA)	SC.	BEGINNING OF CIRCULAR CURVE
F.R.E.	FINISHED ROAD ELEVATION	CS.	END OF CIRCULAR CURVE
Y	VERTICAL OFFSET	ST.	END OF TRANSITION CURVE
GR.	GRAVEL	P.V.C.	POINT OF VERTICAL CURVE
H.W.L.	HIGH WATER LEVEL	P.V.I.	POINT OF VENIAL INTERSECTION
H.F.L.	HIGH FLOOD LEVEL	P.V.T.	POINT VERTICAL TANGENCY
H	HEIGHT	R	RADIUS
H.P	HIGH POINT	R.C.	REMOVE ADVERSE CROWN, SUPPER ELEVATION AT NORMAL CROWN SLOPE
HORIZ.	HORIZONTAL	R.C.C.P.	REINFORCED CEMENT CONCRETE PIPE
INT.	INTERSECTION	RD.	ROAD
I.L	INVERT LEVEL	REF.	REFERENCE
L	LENGTH OF SUPPER ELEVATION RUNOFF	REQ.D.	REQUIRED
LC.	LENGTH OF HORIZONTAL CURVE	RET.	RETAINING
LM	LINER METERS	R.M.T	REFERENCE MARK POINT
LT	LEFT	R.O.W.	RIGHT OF WAY
L.V.C.	LENGTH OF VERTICAL CURVE	RT.	RIGHT
T.	TANGENT	SE.	SUPPER ELEVATION
D.S.T.	DOUBLE SURFACE TREATMENT	SECT.	SECTION
TRAV.	TRAVERSE	S.D.	SIGHT DISTANCE
TYP.	TYPICAL	SHT.	SHEET
		S.S.D.	STOPPING SIGHT DISTANCE
		STA.	STATION
		STD.	STANDARD

PROPOSED CARRIAGE WAY	
PROPERTY LINE	
FENCE/ R.O.W. LIMIT	
HOUSE	
MOSQUE	
TOMB	
TREES	
GRAVE YARD	
NATIONAL GRIDS COORDINATES	
TRAVERSE STATIONS	
POINT OF INTERSECTION	
TUBE WELL	
DRAINAGE / WATER COURSE	
CANAL	
NALLAH (RIVER)	
SLAB / BOX CULVERT	
PIPE CULVERT	
BRIDGE	
KILN	
POWER LINE (L.T)	
POWER LINE (H.T)	
TELEPHONE LINE	
EXISTING R.O.W. BOUNDARY	
SURVEY OF PAKISTAN BENCH MARK	
ROAD SIDE DITCH	
PROPOSED TUNNEL	
START / END OF CURVE	
GRouted RIP RAP	
TRACK (KUTCHA)	

- FIELD SURVEY WAS CARRIED OUT FROM MAY TO JUNE 2006. ALL STRUCTURES WITHIN 10m FROM RIGHT OF WAY WIDTH ON THE EAST SIDE. AT THE TIME SURVEY HAVE BEEN IDENTIFIED AND SHOWN ON DRAWINGS.
- SURVEY OF PAKISTAN TRIANGULATION STATION LOCATED IN THE COMPOUND OF KOHAT RAILWAY STATION HAVING COORDINATES N=1038112.190 METERS, E=3063023.120 METERS AND REDUCED LEVEL = 491.925 METERS AS OBTAINED FROM S.O.P WAS REFERENCED AS DATUM FOR FIELD WORK AND OFFICE COMPUTATIONS RELATING TO DESIGN OF ROAD.
- ALL DIMENSIONS AND DISTANCES SHOWN ON DRAWINGS PERTAINING TO TYPICAL DETAILS AND ROAD PLANS AND PROFILES ARE IN METERS UNLESS OTHERWISE NOTED.
- THE ROAD HAS BEEN PLANNED AS A PART OF THE FOUR LANE ROAD. (DUAL ROAD SYSTEM). THE FIRST STAGE OF WORK WAS COMPLETE IN JUNE 2003. AS TWO-LANE ROAD (SINGLE CARRIAGEWAY) INCLUDING A MAJOR AT-GRADE INTERSECTIONS BY 4-LANE.
- THE CONSTRUCTION UNDER THE 2ND KOHAT TUNNEL AND ACCESS ROADS PROJECT IS THE 2ND STAGE BY CONSTRUCTION OF A NEW TWO LANE CARRIAGEWAY.
- WHERE R.O.W. LINES SHOWN ON THE DRAWINGS ARE THOSE ALREADY PURCHASED AND FENCED BY NHA.

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GENERAL NOTES

7. Background of the Study

The scope of the 2nd Kohat Tunnel and Access Roads construction is to provide two additional lanes to the existing road to create a dual carriageway road. NHA already acquired the Right-of-Way (ROW) on the east side (right hand side) for the 2nd Kohat Access Road during the 1st Kohat Tunnel and Access Road construction. As there are no advantageous alternative routes, the preliminary design was carried out based the road and tunnel alignments recommended in Chapters 9 and 10 and in accordance with the design standards established in Chapter 8. The design results are reflected in Volume II (Preliminary Design Drawings) of the Feasibility Study Report.

8. Applied Design Standard

The Project aims at providing a dual carriageway by construction of two additional lanes on the east side (right-hand side towards Peshawar) of land in parallel to the existing road. The design standards applied for the Project road are as follows:

- Roadway and Structures: AASHTO and NHA
- Tunnel: Japanese Standard for Tunnel and Tunnel Facility Design
- Materials: Standard Construction Specifications, NHA.

9. Road Geometry

The geometric design standards applied for the Project road are as shown in the following table.

Item	Unit	Design Standards			
		1st Kohat Access Road		2nd Kohat Access Road	
Section		South	North	South	North
Design Section	Km/h	90	80	90	80
Cross Section Elements:					
- Lane width	m	3.65	3.65	3.65	3.65
- Outer Shoulder Width	m	3.00	3.00	3.00	3.00
- Inner Shoulder Width	m	1.00	1.00	1.00	1.00
		(future 4-lanes)			
- Median Width	m	6.00	3.00	6.00	3.50
		(future 4-lanes)			
- Climbing Lane Width	m	3.00	-	-	-
- Crossfall of Traveled Way	%	2	2	2	2
- Crossfall of Shoulder	%	4	4	4	4
- Vertical Clearance	m	5.03	5.03	5.03	5.03
Horizontal & Vertical Alignment:					
Circular Curve:					
- Min. Radius	m	270	220	275	210
- Max. Superelevation Rate	%	10	10	10	10
Transition Curve:					
- Type of transition curve		-	-	Spiral Curve	-
- Min. Transition Curve Length	m	-	-	50	-
- Max. Radius for Use of a Spiral Curve Transition *	m	-	-	480	-
				(1200)	-
- Max. Grade	%	7	7	4	5

Note: * recommended max. radius for use of a transition curve if site condition allows.

10. Road Length and Breaks

The total Project length is 30.271 km from Sta.0+000 to Sta.25+906.255. Several breaks were inserted in the road alignment of the 1st Kohat Tunnel Access and Roads. These breaks are retained in principle as is necessary to ensure consistency between the two roads for cross drainages, bridges, tunnel and other structures.

Section	From Sta.	To Sta.	Break Length (m)	Distance (m)
Section 1 Access Road	Start Point 0+000.000	Kohat Link IC 15+000.000		15,000.000
Section 2 Access Road	Kohat Link IC 15+000.000	South Portal 20+186.738 16+247.000	-4,359.650	5,606.650
Tunnel	South Portal 16+247.000	North Portal 18+132.000		1,885.000
Access Road	North Portal 18+132.000	End Point 25+906.255	-5.502	7,779.757
Sub-Total for Section 2			-4,365.153	15,271.408
Total Length				30,271.408

Notes: * Break at Sta. 20+186.738 /Sta.16+247.000 (-3,939.738)

11. Road Length and Breaks



The "Standardization of Bridge Superstructures, NHA, 2005", "West Pakistan Code of Practice for Highway Bridges (WPCHB)" and the bridge design for the 1st Kohat Tunnel and Access Road are referred for bridge design. The live load of "Class A loading" specified in WPCHB, Article 2.4 is used for the design. WPCHB specifies the highway live loads on roadway bridges and incidental structures.

The design of the bridges for the 1st Kohat Tunnel Access Road was conducted in 1990 and the applied seismic force was 0.05g - 0.07g (see Figure 8.1) in Zone III. NHA has reviewed the Peak Ground Acceleration (seismic force) and seismic zone after the earthquake at Muzaffarabad on October 8, 2005. The new PGA (0.26g for the Project area) was used for the design of bridges under the 2nd Kohat Tunnel and Access Roads Project.

12. Tunnel

The following table shows the standard support patters used for the tunnel design.

Grade of Ground	Excavation method	Standard round length (Upper half) (m)	Rock bolt			Steel arch supporting			Shotcrete thickness (cm)	Lining Thickness (cm)		Over cut designed to allow ground deformation (cm)		
			Length (m)	Installation pitch		Upper half	Lower Half	Standard pitch (m)		Arch and side wall	Invert	Upper half	Lower half	Invert
				Circumferential (m)	Longitudinal (m)									
B	Full face method with auxiliary bench and upper half method	2.0	3.0	1.5 (upper half only)	2.0	None	None	-	5	30	0	0	0	0
CI	Full face method with auxiliary bench and upper half method	1.5	3.0	1.5	1.5	None	None	-	10	30	0	0	0	0
CII	Full face method with auxiliary bench Upper half method	1.2	3.0	1.5	1.2	H-125 or U-21	None in Principle	1.2	10	30	0	0	0	0
DI	Full face method with auxiliary bench and upper half method	1.0	4.0	1.2	1.0	H-125 or U-21	H-125 or U-21	1.0	15	30	45	0	0	0
DII	Full face method with auxiliary bench Upper half method	1.0 or less	4.0	1.2	1.0 or less	H-125 or U-29	H-125 or U-21	1.0 or less	20	30	50	10	10	0
												10	0	0

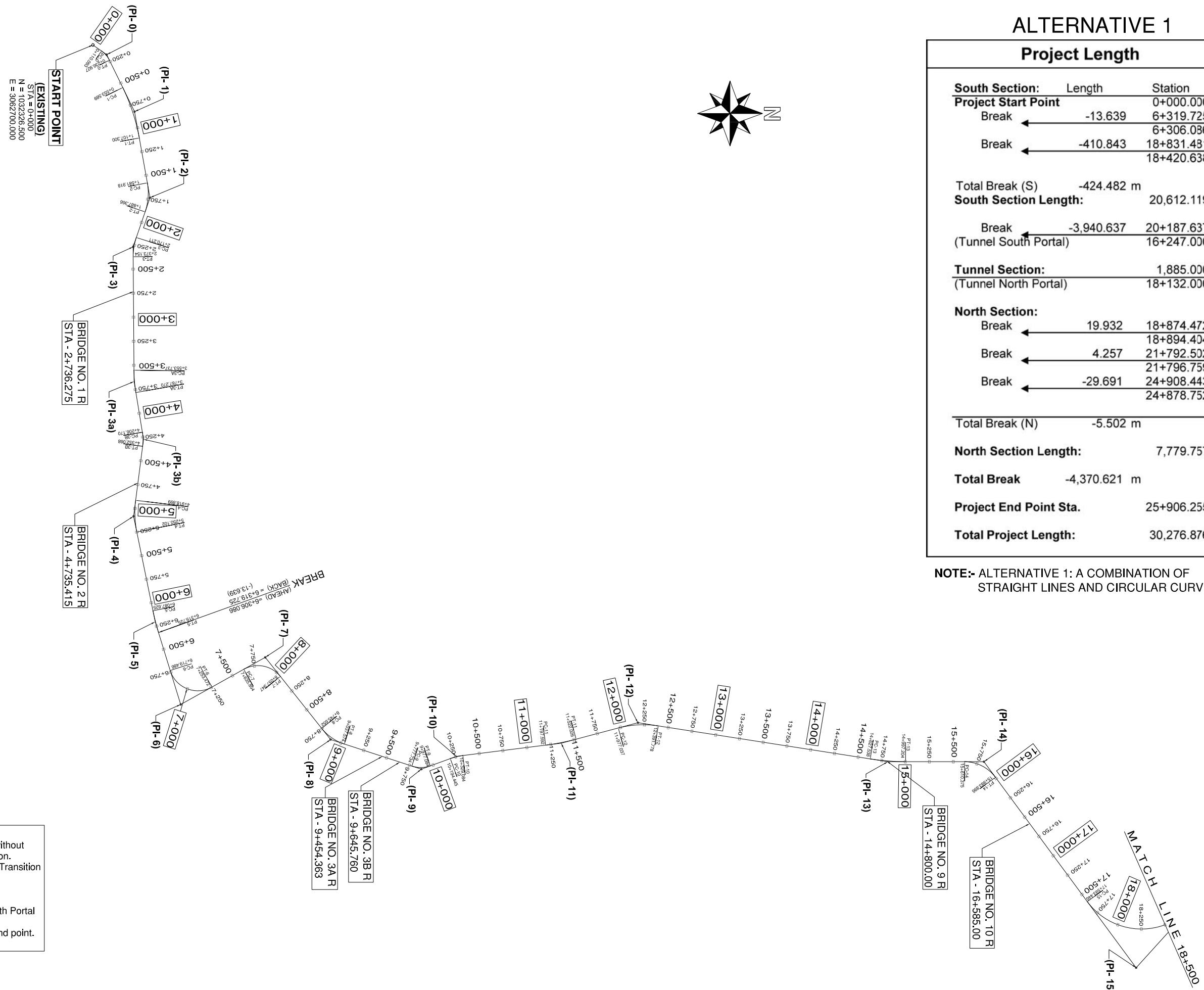
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ALTERNATIVE 1

Project Length

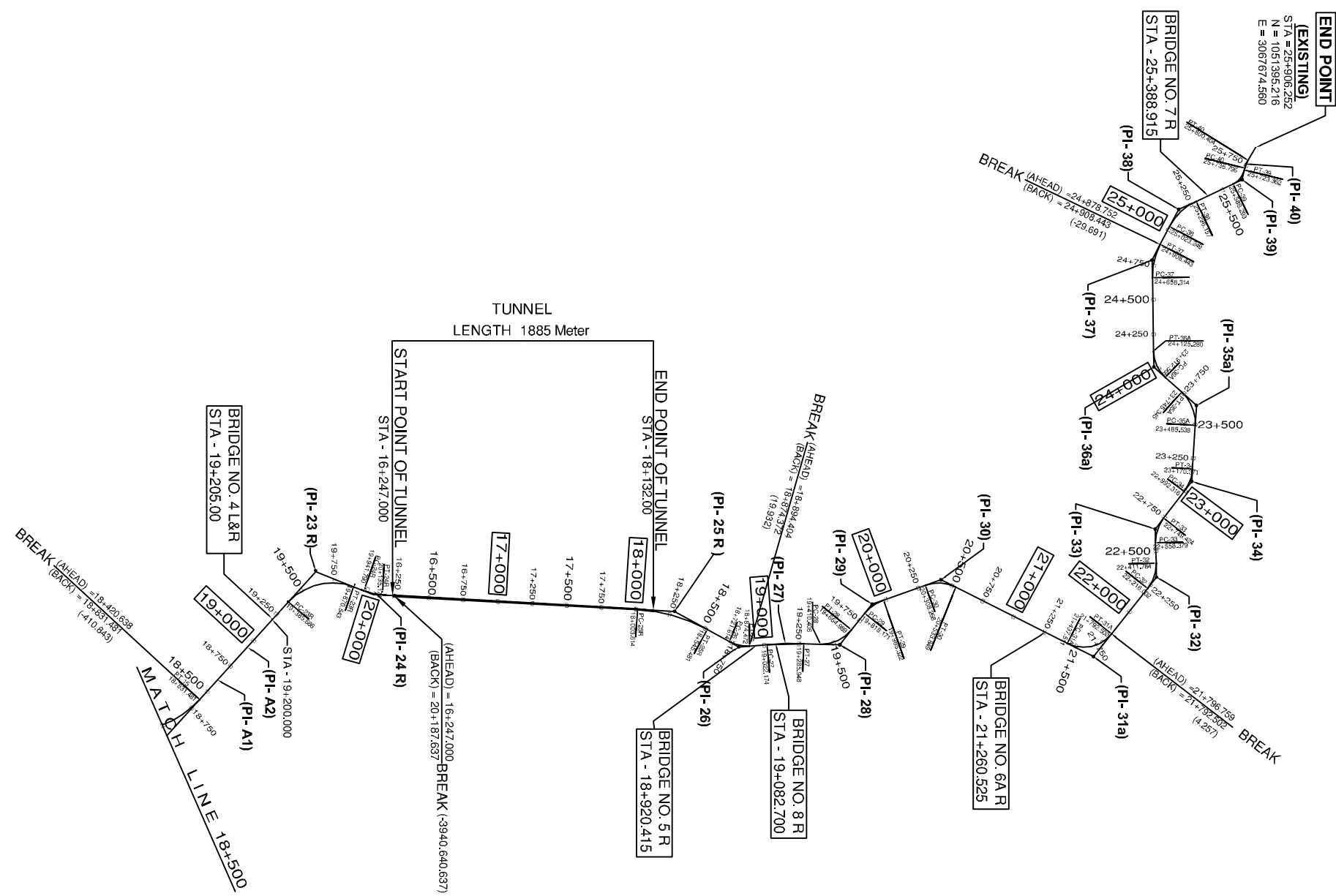
South Section:	Length	Station
Project Start Point		0+000.000
Break ←	-13.639	6+319.725 (B)
Break ←	-410.843	18+831.481 (B)
		18+420.638 (A)
Total Break (S)	-424.482 m	
South Section Length:		20,612.119 m
Break ←	-3,940.637	20+187.637 (B)
(Tunnel South Portal)		16+247.000 (A)
Tunnel Section:		1,885.000 m
(Tunnel North Portal)		18+132.000
North Section:		
Break ←	19.932	18+874.472 (B)
Break ←		18+894.404 (A)
Break ←	4.257	21+792.502 (B)
Break ←		21+796.759 (A)
Break ←	-29.691	24+908.443 (B)
Break ←		24+878.752 (A)
Total Break (N)	-5.502 m	
North Section Length:		7,779.757 m
Total Break	-4,370.621 m	
Project End Point Sta.		25+906.255
Total Project Length:		30,276.876 m

NOTE:- ALTERNATIVE 1: A COMBINATION OF STRAIGHT LINES AND CIRCULAR CURVES



- NOTES**
- Alternative-(1) is Geometric alignments without Transition Curves for Tunnel South Section. Alternative-2 is geometric alignment with Transition Curves.
 - No Alternative-2 for North Section.
 - Recommended Application.
 - Alternative 2 = Start point to Tunnel South Portal (STA. 0+000 to STA. 20+186.738)
 - Alternative 1 = Tunnel South Portal to End point. (STA. 16+247.000 to STA. 25+906.255)

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