APPENDICES FOR CHAPTER 10

APPENDIX 10.4-1

PRESENT CONDITION AND SCOPE OF WORK FOR EACH BRIDGE

APPENDIX 10.3-1

PRESENT CONDITION OF EXISTING BRIDGE AND SCOPE OF WORKS

PKG. NO.	BRIDGE NO.	BRIDGE NAME	EXISTING BRIDGE TYPE AND LENGTH (m)	PRESENT CONDITION OF EXISTING BRIDGE	SCOPE OF WORKS
1	1 - 01	Lipata	1 - Span Steel I Beam (L = 16.2 m)	• No appreciable defect/damage	(Maintenance by DPWH)
	1 - 02	Lamintao	1 - Span Steel I Beam (L = 25.6 m)	• Minor damage at abutment slope protection • No other appreciable defect/damage	(Maintenance by DPWH)
	1 - 03	Kinabutan I	1 - Span Steel I Beam (L = 16.2 m)	• No appreciable defect/damage	(Maintenance by DPWH)
	1 - 04	Kinabutan II	3 - Span Steel I Beam (L = 3 x 30.89 = 93.3 m)	• No appreciable defect/damage	(Maintenance by DPWH)
	1 - 05	Malico	3 - Span RCDG (L = 8.00 + 15.07 + 8.00 = 31.67 m)	• Wide cracks at bridge seat of Pier 2 • Damages at A2 abutment slope protection	• Rehabilitation - Repair Bridge Seat at P2 - Repair Abutment Slope Protection at A2 - Provide Approach Slabs
	1 - 06	Cagbayoc	1 - Span RCDG with Cantilever Spans (L = 3.50 + 13.90 + 3.50 = 20.90 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	1 - 07	Reyes	3 - Span RCDG (L = 8.25 + 11.92 + 8.01 = 28.78 m)	• Some cracks at deck slabs • Minor damage at abutment slope protection	(Maintenance by DPWH)
	1 - 08	Mabuhay	4 - Span RCDG (L= 9.92 + 14.02 + 14.04 + 9.93 = 48.51 m)	• Medium cracks at concrete girders • Some cracks at deck slabs • Heavy damage at A1 abutment slope protection • River bank at left side of A1 is being scoured	• Rehabilitation - Repair of Abutment Slope Protection at A1 & A2 - River Bank Protection at left side of A1 - Cracks sealing of concrete girder/slab cracks
	1 - 09	Payao	3 - Span RCDG (L = 9.92 + 10.00 + 9.93 = 30.45 m)	• Local scouring at P1 & P2 is progressing • Insufficient abutment slope protection at A2	• Rehabilitation - Provide pier foundation protection at P1 & P2 - Add abutment slope protection at A2
	1 - 10	Timamana	1 - Span RCDG (L = 15.53 m)	• Wide cracks at concrete beams and deck slabs • Damages at abutment slope protection at A1 & A2 • Pavement adjacent to abutment backwall settled	• Partial Reconstruction (Superstructure) - Reconstruct superstructure (1-Span RCDG) with standard roadway and sidewalk width - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	1 - 11	Motorpool	1 - Span RCDG (L = 8.87 m)	• No appreciable defect/damage, except thin cracks at concrete girders and deck slabs	(Maintenance by DPWH)
	1 - 12	Pingaping	1 - Span RCDG (L = 15.51 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	1 - 13	Marga	1 - Span RCDG (L = 14.50 m)	• Thin cracks at concrete girder • Popouts at deck slab concrete, preferably overlayed	(Maintenance by DPWH)
	1 - 14	Tubod	1 - Span Steel I Beam (L = 25.54 m)	• Minor damage at abutment slope protection	(Maintenance by DPWH)
	1 - 15	Siana	1 - Span RCDG (L = 15.54 m)	• Thin cracks at concrete girder • Some cracks at deck slabs • Minor damage at abutment slope protection	(Maintenance by DPWH)
	1 - 16	Magpayang I	3 - Span RCDG (L = 7.62 + 10.00 + 7.50 = 25.77 m)	• Thin cracks at concrete girder and deck slabs	(Maintenance by DPWH)
	1 - 17	Magpayang II	1 - Span Precast Slab (L = 6.55 m)	• Wide gaps between precast channel beams • No sidewalks	• Partial Reconstruction (Superstructure) - Reconstruct superstructure (1-Span RC Slab) with standard sidewalk width - Extend abutment slope protection at A1 & A2 - Provide approach slabs at A1 & A2
	1 - 18	Pongtod	3 - Span RCDG (L = 11.96 + 11.96 + 11.90 = 35.42 m)	• Thin cracks at concrete girders and deck slabs	(Maintenance by DPWH)
	1 - 19	Alimpatayan	1 - Span Steel I Beam (L = 22.40 m)	• Expansion joint at A1 needs to be repaired • Re-painting of steel members needed • Some cracks at deck slabs	(Maintenance by DPWH)
	1 - 20	Alipao	1 - Span RCDG (L = 14.66 m)	• Thin cracks at concrete girder	(Maintenance by DPWH)
	1 - 21	Baloran	1 - Span RCDG with Cantilever Spans (L = 3.05 + 11.85 + 3.02 = 17.92 m)	• Thin cracks at concrete girders and deck slabs • Minor damage at abutment slope protection	(Maintenance by DPWH)
	1 - 22	Candiis	1 - Span Steel I Beam (L = 15.87 m)	• Re-painting of steel members needed • Some cracks at deck slabs	(Maintenance by DPWH)
	1 - 23	Tagbongon	1 - Span RCDG (L = 10.55 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	1 - 24	Magtiaco	6 - Span Steel I Beam (L = 31.16 + 30.89 + 30.86 + 30.84 + 30.87 + 30.90 = 186.07 m)	• Some cracks at deck slabs, particularly Spans 3 & 6	(Maintenance by DPWH)

Note: Bridge length includes width of backwalls, thus addition of span length does not tally with bridge length.

APPENDIX 10.3-1

PRESENT CONDITION OF EXISTING BRIDGE AND SCOPE OF WORKS

PKG. NO.	BRIDGE NO.	BRIDGE NAME	EXISTING BRIDGE TYPE AND LENGTH (m)	PRESENT CONDITION OF EXISTING BRIDGE	SCOPE OF WORKS
	1 - 25	San Pedro	1 - Span Ponny Truss (L = 45.47 m)	• Severe cracks at slabs • Due to sedimentation, free board is becoming insufficient • River bank at left side of A1 abutment scoured	• Partial Reconstruction (Slab) - Reconstruct slabs - Provide river bank protection - Dredging
2	2 - 01	Mamkas	4 - Span RCDG (L = 11.93 + 14.00 + 12.30 + 12.24 = 51.14 m)	• A portion of river bank protection was destroyed at left side of A1 • Local scouring at P1 • Thin cracks at concrete girders	• Rehabilitation - Reconstruct a portion of river bank protection which was destroyed - Provide pier foundation protection at P1 - Repair cracks of concrete girders - Provide approach slabs
	2 - 02	Lambog	1 - Span RCDG with Cantilever Spans (L = 3.92 + 16.01 + 3.98 = 23.91 m)	• Serious wide cracks at concrete girders • Many cracks at deck slabs	• Partial Reconstruction (Superstructure) - Reconstruct superstructure (1-span RCDG) with cantilever spans with standard roadway and sidewalk widths - Reconstruct abutment slope protection - Provide approach slabs
	2 - 03	Taytay-Oyos	1 - Span RCDG with Cantilever Spans (L = 3.44 + 14.03 + 3.44 = 20.91 m)	• Serious wide cracks at concrete girders • Located at sharp curve, but the bridge was constructed straight with no widening • Traffic accident prone bridge	• Total Reconstruction - Convert the existing bridge to a new RCBC to provide proper widening and superelevation
	2 - 04	Jaliobong	3 - Span RCDG (L = 8.00 + 13.96 + 8.00 = 30.56 m)	• Wide cracks at bridge seat of Pier 1 • Left side approach embankment protection at Surigao side is not sufficient in length	• Rehabilitation - Repair bridge seat of Pier 1 - Extend left side approach embankment protection at Surigao side
	2 - 05	New Camalig	3 - Span RCDG (L = 14.17 + 14.26 + 13.87 = 42.90 m)	• Located at sharp curve. Girders were constructed straight. No widening at curve provided. • Severe spalling at lower portion of girders. Main re-bars exposed and corroded. • Spalling will further expand to other portion	• Total Reconstruction - 3-span continuous RCDG (3 x 16 m = 48 m) - 2 spread footing abutments - 2 spread footing piers monolithic with superstructure
	2 - 06	Baligulan	3 - Span RCDG (L = 7.99 + 11.77 + 8.03 = 28.38 m)	• Serious wide cracks at concrete girders • Deck slab has seriously deteriorated	• Partial Reconstruction (Superstructure) - Reconstruct superstructure (3-Span RCDG) with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	2 - 07	Sayadion	1 - Span RCDG with Cantilever Spans (L = 2.95 + 11.87 + 3.11 = 17.93 m)	• Thin cracks at concrete girders • Minor damage at abutment slope protection	(Maintenance by DPWH)
	2 - 08	Puyo	4 - Span Steel I Beam (L = 30.89 + 31.45 + 30.38 + 31.07 = 124.39 m)	• Local scouring at piers	• Rehabilitation - Provide foundation protection at Piers 1, 2 & 3 - Provide approach slabs
	2 - 09	Bangonay	9 - Span Steel I Beam (L = 19.13 + 18.57 + 19.18 + 17.90 + 18.70 + 19.20 + 18.60 + 18.05 + 198.07 = 169.00 m)	• Abutment slope protection damaged at A1 & A2	• Rehabilitation - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
3	2 - 10	Paypay	1 - Span RCDG and 2 - Span Ponny Truss (L = 9.98 + 37.02 + 36.98 = 84.58 m)	• Slab concrete at one-span of Ponny Truss has been seriously deteriorated	• Partial Reconstruction (Slab) - Reconstruct deck slab of one-span of pony truss
	2 - 11	Jagupit	1 - Span RCDG with Cantilever Spans (L = 3.50 + 10.80 + 3.54 = 17.84 m)	• Due to heavy sedimentation, the river bed raised to the level of bottom of concrete girder • Thin cracks at concrete girders	• Rehabilitation - Repair cracks at concrete girders - Dredging of river bed for 2 km up and down stream sides
	2 - 12	Guinoyoran	1 - Span RCDG with Cantilever Spans (L = 3.50 + 14.00 + 3.50 = 21.00 m)	• The river has no definite current course, but frequently changes its course. Surigao side approach is in danger of being washed away. • Serious wide cracks at concrete girder • Deck slabs have deteriorated	• Total Reconstruction - 2 span PCDG (2 x 22.25 m) - 2 Abutments and 1 Pier with tubular steel pile (l = 28 ~ 32 m)
	2 - 13	Tagmamarkay	3 - Span RCDG (L = 8.10 + 10.00 + 8.10 = 26.80 m)	• About ½ of existing river bed scour protection was destroyed causing deep scouring • Thin cracks at concrete girders	• Rehabilitation - Repair river bed scour protection - Repair cracks of concrete girders
	2 - 14	Sta. Ana	4 - Span Steel I Beam (L = 25.10 + 24.75 + 24.78 + 24.79 = 99.92 m)	• Left side of approach embankment protection at Surigao side damaged • Due to siltation, free board will be insufficient in near future	• Rehabilitation - Reconstruct damaged approach slope protection at left side of first approach - Dredging of river bed for 1 km up and down stream sides

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APPENDIX 10.3-1

PRESENT CONDITION OF EXISTING BRIDGE AND SCOPE OF WORKS

PKG. NO.	BRIDGE NO.	BRIDGE NAME	EXISTING BRIDGE TYPE AND LENGTH (m)	PRESENT CONDITION OF EXISTING BRIDGE	SCOPE OF WORKS
	2 - 15	Calo-oy	1 - Span RCDG with Cantilever Spans (L = 3.50 + 13.95 + 3.50 = 20.95 m)	• Serious wide cracks	• Partial Reconstruction (Superstructure) - 1-Span RCDG with cantilever spans with standard roadway and sidewalk widths - Reconstruct abutment protection at 4 and 2 - Provide approach slabs
	2 - 16	Minusuang	3 - Span RCDG (L = 7.97 + 12.00 + 8.00 = 28.57 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	2 - 17	Maraput	3 - Span RCDG (L = 8.00 + 12.00 + 8.00 = 28.60 m)	• Thin cracks at concrete girders • Some cracks at deck slabs • Pier piles are exposed above river bed • Abutment slope protection is damaged at A1	• Rehabilitation - Provide pier foundation protection at P1 & P2 - Repair abutment slope protection
	2 - 18	Comagascas	3 - Span RCDG (L = 8.00 + 13.93 + 8.00 = 30.58 m)	• Minor damage at abutment slope protection • Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
4	2 - 19	Cabadberan	6 - Span PCDG (L = 36.83 + 37.03 + 36.98 + 36.85 + 36.93 + 36.95 = 222.17 m)	• Expansion joints at P4 and P5 damaged • Local scouring at Piers P3, P4 and P5 • Some wide cracks at deck slabs of Span 6	• Rehabilitation - Replace expansion joints at P4 & P5 - Provide pier foundation protection at P3, P4 and P5 - Repair deck slab cracks of Span 6
	2 - 20	Pandanon	3 - Span RCDG (L = 8.00 + 8.00 + 8.12 = 24.72 m)	• Thin cracks at deck slabs • No other appreciable defects/damage	(Maintenance by DPWH)
	2 - 21	Sanghan	2 - Span RCDG (L = 12.08 + 12.00 = 24.68 m)	• Serious wide cracks at concrete girders • Wide cracks at bridge seat of P1 • Deck slabs seriously deteriorated	• Total Reconstruction - 1-Span PCDG (1 x 26.10 m) - 2 Abutments with tubular steel pile (l = 32 ~ 38 m)
	2 - 22	Capudlosan	1 - Span RCDG with Cantilever Spans (L = 3.00 + 11.95 + 3.00 = 17.95 m)	• Thin cracks at concrete girders • Thin cracks at deck slabs	(Maintenance by DPWH)
	2 - 23	Hurnilog	1 - Span RCDG with Cantilever Spans (L = 3.38 + 11.79 + 3.33 = 18.50 m)	• Serious wide cracks at concrete girders • Deck slabs have deteriorated • No damage/defect at piers	• Partial Reconstruction (Superstructure) - Reconstruct 1-Span RCDG with cantilever spans with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	2 - 24	Mina-ano	2 Span RCDG (L = 8.11 + 8.15 = 16.86 m)	• Thin cracks at concrete girders • Thin cracks at deck slab	(Maintenance by DPWH)
	2 - 25	Panayfayon	2 - Span Precast Slab (L = 6.00 + 6.04 = 12.64 m)	• Very narrow sidewalks • Wide gap between precast channel beams	• Partial Reconstruction (Superstructure) - Reconstruct the bridge with RC slab providing wider sidewalks - Extend abutment slope protection at A1 & A2 - Provide approach slabs
	3 - 01	Agay	1 - Span Steel I Beam (L = 19.60 m)	• Heavy siltation. Not enough free board. Dredging is needed periodically. • Removal of paints at small areas	• Rehabilitation - Dredging riverbed 1 km up and down stream sides
	3 - 02	Minalum	1 - Span Steel I Beam (L = 22.64 m)	• Removal of paints at small areas	(Maintenance by DPWH)
	3 - 03	Ngilan	3 - Span Precast Slab (L = 6.00 + 6.00 + 6.15 = 18.75 m)	• No sidewalks • Serious cracks at precast channel beams • Wide gaps between precast channel beams	• Partial Reconstruction (Superstructure) - Reconstruct the bridge with RC slab providing with wider sidewalks - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	3 - 04	Los Angeles			(The bridge is being reconstructed by DPWH)
	3 - 05	Taguibo	1 - Span Steel I Beam, 1 - Span Steel Langer, 2 - Span Steel I Beam (L = 30.95 + 128.70 + 30.90 + 30.95 = 222.10 m)	• Bridge seat at Pier 1 (Steel I Beam side) has wide cracks • River rivetment work is being implemented by DPWH	• Rehabilitation - Repair bridge seat at P1
	3 - 06	Dalipdipan	1 - Span RCDG with Cantilever Span (L = 3.00 + 14.00 + 3.56 = 20.56 m)	• Thin cracks at concrete girders • Thin cracks at deck slabs	(Maintenance by DPWH)
	3 - 07	Ampayon	2 - Span Precast Slab (L = 6.03 + 6.00 = 12.63 m)	• Precast channel beams have seriously deteriorated, requiring DEO frequent repairs • Many pedestrians, but very narrow sidewalks	• Total Reconstruction - 1-Span PCDG (L = 1 x 22.10 m) with wide sidewalks - 2 Abutments with steel tubular pile (l = 47 m)
5	4 - 01	Alga	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 6.25 + 11.95 + 5.70 = 24.50 m)	• Thin cracks at concrete girders • Thin cracks at deck slab • Minor damage at abutment slope protection	(Maintenance by DPWH)
6	4 - 02	Hupas	1 - Span Steel I Beam (L = 36.38 m)	• Serious cracks at deck slabs	• Partial Reconstruction (Slab) - Reconstruct slabs - Provide approach slabs

Note: Bridge length includes width of backwalls, thus addition of span length does not tally with bridge length.

APPENDIX 10.3-1

PRESENT CONDITION OF EXISTING BRIDGE AND SCOPE OF WORKS

PKG. NO.	BRIDGE NO.	BRIDGE NAME	EXISTING BRIDGE TYPE AND LENGTH (m)	PRESENT CONDITION OF EXISTING BRIDGE	SCOPE OF WORKS
	4 - 03	Wawa	2 - Span Steel I Beam, 2 - Span Through Truss, 1 - Span Steel I Beam (L = 24.95 + 25.01 + 76.94 + 76.94 + 24.44 = 228.88 m)	• Serious cracks at deck slabs of steel I beam spans • Minor damages at steel truss members (sway bracing) • Sign of local scouring at Pier 3 • Excessive inclination of roker type bearing and removal of anchor bolts of steel I-beams	• Partial Reconstruction (Slab) - Reconstruct slabs of steel I beams (Span 1, 2 & 5) - Repair damaged steel truss members - Align roker type bearings - Provide pier foundation protection at P3 - Provide approach slabs
	4 - 04	Bayanacon	4 - Span RCDG (L = 14.00 + 13.97 + 13.97 + 13.98 = 56.52 m)	• Thin to medium wide cracks at concrete girders • Abutment slope protection damaged • Local scouring at piers	• Rehabilitation - Reconstruct abutment slope protection at A1 & A2 - Repair cracks of concrete girders - Provide pier foundation protection at P2 & P3
	4 - 05	Mambutay	1 - Span RCDG with Cantilever Spans (L = 3.50+ 14.04 + 3.50 = 21.04 m)	• Serious wide cracks at concrete girders • Many cracks at deck slabs	• Partial Reconstruction (Superstructure) - Reconstruct 1-Span RCDG with cantilever spans - Reconstruct abutment slope protection at A1 & A2
	4 - 06	Andanan	12 - Span RCDG (L = 12 x 15.00 = 180.91 m)	• Serious wide cracks at concrete girders • Deck slabs have deteriorated • Due to change of river course, piers are located at almost perpendicular to river course (or current directly hits piers at almost right angle) and local scouring is progressing at piers	• Total Reconstruction - 7-Span PCDG (7 x 25.70 m, Total L = 180.40 m) - 2 abutments with PC piles (l = 23 ~ 27 m) - 6 single column piers with PC piles (l = 14 ~ 17 m)
	4 - 07	Taglatawan	3 - Span RCDG (L = 7.98 + 9.96 + 7.98 = 26.52 m)	• Wide cracks at concrete girders • A lot of pedestrians and pedicabs, travel speed on this bridge is very slow, requiring widening	• Total Reconstruction - 1-Span 4-lane PCDG (1 x 22.10 m) - 2 abutments with RC piles (l = 14 ~ 15 m)
7	4 - 08	Sinadjap	4 - Span RCDG (L = 12.00 + 12.00 + 14.00 + 11.86 = 50.46 m)	• Serious wide cracks at concrete girders • Deteriorated deck slabs • Pier piles exposed at P2 & P3	• Partial Reconstruction (Superstructure) - Reconstruct 4-Span RCDG with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Provide pier foundation protection at Piers 2 & 3 - Provide approach slabs
	4 - 09	Bayugan Relief	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 5.95 + 8.06 + 5.95 = 20.56 m)	• Serious wide cracks at concrete girders • Deteriorated deck slabs	• Partial Reconstruction (Superstructure) - Reconstruct 2-Span RC Slabs and 1-Span RCDG with standard roadway and sidewalk width - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	4 - 10	Bayugan	4 - Span RCDG (L = 15.00 + 15.00 + 14.96 +14.88 = 60.44 m)	• Serious wide cracks at concrete griders • Deteriorated deck slabs • Local scouring at Pier 1	• Partial Reconstruction (Superstructure) - Reconstruct 4-Span RCDG with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs - Provide pier foundation protection at P1
	4 - 11	Maylibog	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 5.88 + 15.20 + 5.79 = 27.47 m)	• Serious wide cracks at concrete girders • Serious wide cracks at 2-way slab beams • Local scouring at Piers 1 & 2 • Left side river bank at A1 scoured	• Partial Reconstruction (Superstructure) - Reconstruct 2-Span RC Slab and 1-Span RCDG with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Provide pier foundation protection at P1 & P2 - Provide river bank protection - Provide approach slabs - Dredging near the bridge

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APPENDIX 10.3-1

PRESENT CONDITION OF EXISTING BRIDGE AND SCOPE OF WORKS

PKG. NO.	BRIDGE NO.	BRIDGE NAME	EXISTING BRIDGE TYPE AND LENGTH (m)	PRESENT CONDITION OF EXISTING BRIDGE	SCOPE OF WORKS
	4 - 12	Labao	1 - Span RCDG with Cantilever Spans (L = 3.12 + 13.23 + 3.12 = 19.47 m)	• Serious wide cracks at concrete girders • Siltation under/near the bridge	• Partial Reconstruction (Superstructure) - Reconstruct 1-Span RCDG with cantilever spans with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Dredging near the bridge
	4 - 13	Panaytay	1 - Span PCDG (L = 31.59 m)		(New bridge constructed by DPWH in 1996)
	4 - 14	Sianib	4 - Span RCDG (L = 15.00 + 15.04 + 14.94 + 7.82 = 53.40 m)	• Wide cracks at concrete girders • Deteriorated deck slabs	• Partial Reconstruction (Superstructure) - Reconstruct 4-Span RCDG with standard sidewalk width - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	4 - 15	Awa	1 - Span Steel Plate Girder (L = 41.24 m)	• No appreciable damage/defect	(Maintenance by DPWH)
8	4 - 16	Gibong	2 - Span RCDG, 2 - Span RC Box, 2 - Span RCDG (L = 14.53 + 15.04 + 31.19 + 31.00 + 14.87 + 14.46 = 121.69 m)	• Wide cracks at bridge seat at Piers 2 & 4 • Cracks at concrete girders of Spans 1, 5 & 6	• Rehabilitation - Repair bridge seat at Piers 2 & 4 - Repair cracks at concrete girders of Spans 1, 5 & 6
	4 - 17	Patin-ay I	1 - Span RCDG (L = 15.69 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	4 - 18	Patin-ay II	3 - Span RCDG (L = 8.26 + 7.92 + 7.76 = 24.64 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
9	4 - 19	Hubang	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L= 6.22 + 9.95 +5.63 = 22.40m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	4 - 20	Adlayan	1 - Span RC Slab 2 - Span RCDG (L = 5.83 + 14.00 + 9.96 = 30.39 m)	• Thin cracks at concrete girders • Abutment slope protection at A1 damaged • Left side river bank at A1 scoured • Local scouring at P1	• Rehabilitation - Repair girder cracks - Reconstruct abutment slope protection at A1 - Provide river bank protection - Provide pier foundation protection at P1
	4 - 21	Tagconayon	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 6.04 + 12.03 + 5.87 = 24.54 m)	• Wide cracks at concrete girders and 2-way slab beams • Deteriorated deck slabs	• Partial Reconstruction (Superstructure) - Reconstruct 2-Span RC Slab and 1-Span RCDG with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	4 - 22	Bayugan II	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 5.97 + 9.93 + 6.01 = 22.56 m)	• Thin cracks at concrete girders • Pier piles exposed	• Rehabilitation - Pier foundation protection at P1 & P2 - Repair girder cracks - Provide approach slabs
	4 - 23	Anagasian	3 - Span RCDG (L = 9.95 + 12.01 + 9.95 = 32.51 m)	• NIA dam down stream side collapsed and river bed lowered • Pier piles at P1 & P2 exposed • Thin cracks at concrete girders	• Rehabilitation - Pier foundation protection at P1 & P2 - Repair girder cracks - Provide approach slabs
	4 - 24	Lagcogangan	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 6.03 + 9.93 + 5.96 = 22.52 m)	• Both abutments settled • Thin cracks at concrete girders • Deck slab seriously deteriorated	• Total Reconstruction - 1-Span PCDG (1 x 21.3 m, L = 22.90 m) - 2 abutment with steel tubular pile (l =)
	4 - 25	Tagbayagan	3 - Span RCDG (L = 10.00 + 9.93 + 9.92 = 30.53 m)	• Uneven settlement at abutments and piers • Wide cracks at concrete girders • Deck slab seriously deteriorated	• Total Reconstruction - 1-Span PCDG (1 x 25.3 m, L = 26.96 m) - 2 abutment with steel tubular pile (l =)
10	4 - 26	Sulibao	5 - Span RCDG (L = 14.97 + 15.00 + 15.00 + 14.97 + 14.93 = 75.47 m)	• Concrete girders of Span 2 at P1 have serious shear cracks at the bearing • Concrete girders of Span 5 have wide shear cracks • DEO widened bridge seat of Pier 1 (Span 2 side)	• Partial Reconstruction (Superstructure) - Reconstruct Spans 2 & 5 with RCDG - Repair girder cracks of Spans 1, 3 & 4 - Provide approach slabs

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APPENDIX 10.3-1

PRESENT CONDITION OF EXISTING BRIDGE AND SCOPE OF WORKS

PKG. NO.	BRIDGE NO.	BRIDGE NAME	EXISTING BRIDGE TYPE AND LENGTH (m)	PRESENT CONDITION OF EXISTING BRIDGE	SCOPE OF WORKS
	4 - 27	Padigusan	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 5.97 + 9.93 + 6.00 = 22.50 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	4 - 28	Lahi	3 - Span RCDG (L = 7.98 + 11.90 + 8.00 = 28.48 m)	• Wide cracks at concrete girders • Deck slabs have deteriorated	• Partial Reconstruction (Superstructure) - Reconstruct 3-Span RCDG with standard roadway and sidewalks widths - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	4 - 29	Wasian	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 6.00+ 9.97 + 6.01 = 22.58 m)	• Abutment A2 has settled • Thin cracks at concrete girders • Deck slabs have deteriorated	• Total Reconstruction - 1-Span PCDG (1 x 25.30 m, L=26.90 m) - 2 Abutment with steel tubular pile (l = 40 m)
	4 - 30	Boan	1 - Span RCDG (L = 15.80 m)	• Abutment slope protection collapsed • River bank near the bridge scoured	• Rehabilitation - Reconstruct abutment slope protection at A1 & A2 - Provide river bank protection - Provide approach slabs
	4 - 31	Bayugan III	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 5.96 + 9.96 + 6.05 = 22.57 m)	• Thin cracks at concrete girders and 2-way slab beams • Some cracks at deck slabs	(Maintenance by DPWH)
	4 - 32	Ko - o	1 - Span RC Slab 1 - Span RCDG 1 - Span RC Slab (L = 5.98 + 15.00 + 5.92 = 27.50 m)	• Thin to medium cracks at concrete girders and 2-way slab beams • Local scouring at P1 • No abutment slope protection at A2	• Rehabilitation - Repair girder cracks - Provide pier foundation protection at P1 - Provide abutment slope protection at A2 - Provide approach slabs
	4 - 33	Singanan	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 6.00 + 11.90 + 6.05 = 24.55 m)	• Medium to wide cracks at girders and 2-way slab beams • Deteriorated deck slabs	• Partial Reconstruction (Superstructure) - Reconstruct 2-Span RC Slab & 1-Span RCDG with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
11	4 - 34	Bunawan	3 - Span RC Box Girder (L = 23.16 + 27.00 + 23.06 = 73.82 m)	• Thin to medium cracks at box girders • Expansion joints are damaged	• Rehabilitation - Repair cracks - Replace expansion joints - Provide approach slabs
	4 - 35	Simufao	3 - Span Steel Plate Girder (L = 45.50 + 45.40 + 45.71 = 137.41 m)	• No appreciable defect/damage • Old bridge still remains	(Maintenance by DPWH)
12	4 - 36	Magalibobo	1 - Span Steel Plate Girder (L = 26.08 m)	• No appreciable defect/damage	(Maintenance by DPWH)
	4 - 37	Onoman	3 - Span RCDG (L = 8.12 + 7.96 + 7.95 = 24.63 m)	• No appreciable defect/damage	(Maintenance by DPWH)
	4 - 38	Langkilaan	1 - Span Steel Plate Girder (L = 41.20 m)	• Minor damage at abutment slope protection at A2	(Maintenance by DPWH)
13	5 - 01	Maitum	1 - Span RCDG with Cantilever Spans (L = 3.05 + 12.30 + 3.05 = 18.40 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	5 - 02	Pasian	1 - Span Steel Plate Girder (L = 36.45 m)	• No appreciable defect/damage	(Maintenance by DPWH)
	5 - 03	Haguimitan	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 6.00 + 15.03 + 5.94 = 27.57 m)	• Serious wide cracks at concrete girders and 2-way slab beams • Deteriorated deck slabs	• Partial Reconstruction (Superstructure) - Reconstruct 2-Span RC Slab and 1-Span RCDG with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	5 - 04	Gabanan	3 - Span RCDG (L = 15.30 + 14.95 + 14.62 = 45.57 m)	• Serious wide cracks at girders • Deck slabs seriously deteriorated • Local scouring at piers and piles exposed	• Total Reconstruction - 2-Span PCDG (2 x 26.10, L= 53.12 m) - 2-diaphram type abutment with steel tubular piles (L = 5 ~ 7 m)
	5 - 05	Buay	3 - Span PCDG (L = 3 x 21.34 = 66.40 m)		(New bridge constructed by DPWH in 1996)
	5 - 06	Liboton	3 - Span RCDG (L = 8.10 + 11.88 + 8.05 = 28.63 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)

Note: Bridge length includes width of backwalls, thus addition of span length does not tally with bridge length.

APPENDIX 10.3-1

PRESENT CONDITION OF EXISTING BRIDGE AND SCOPE OF WORKS

PKG. NO.	BRIDGE NO.	BRIDGE NAME	EXISTING BRIDGE TYPE AND LENGTH (m)	PRESENT CONDITION OF EXISTING BRIDGE	SCOPE OF WORKS
14		Monkayo Bypass No. 1 Bridge			• New Bridge Along New Alignment - 3-Span PCDG (3 x 19.5, L = 61.60 m) - 2 Abutments with steel tubular piles (l = 16 ~ 27 m) - 2 piers with steel tubular piles (l = 11 ~ 18 m)
		Monkayo Bypass No. 2 Bridge			• New Bridge Along New Alignment - 4-Span PCDG (2 x 35.45 + 2 x 35.60, L=146.40m) - 2 Abutments with steel tubular piles (l = 9 ~ 13 m) - 3 piers with steel tubular piles (L = 6 m)
	5 - 07	Kalaw	2 - Span RCDG 3 - Span Pony Truss (L = 15.00 + 15.00 + 21.83 + 22.00 + 21.89 + 15.10 = 111.47 m)	• Some cracks at slabs • The bridge submerged by about 1 meter during heavy rain. (Monkayo Bypass will provide alternative access)	(Maintenance by DPWH)
15	5 - 08	Tina	3 - Span RCDG (L = 9.70 + 11.93 + 9.75 = 31.98 m)	• During heavy rains, the bridge submerges to a depth of about 10 cm	• Total Reconstruction - 1-Span PCDG (1 x 31.30, L = 32.90 m) - 2-Abutment with RC piles (l = 9 ~ 14 m)
	5 - 09	Banlag	3 - Span RCDG (L = 6.00+ 15.00 + 6.12 = 27.72 m)	• During heavy rains, the bridge submerges to a depth of about 10 cm	• Total Reconstruction - 1-Span PCDG (1 x 31.30, L = 32.92 m) - 2-Abutment with RC piles (l = 11~ 13 m)
	5 - 10	Olaycon	2 - Span RCDG (L = 14.70 + 15.12 = 30.46 m)	• Located at curve section • Serious wide cracks at concrete girders • Butuan side approach is being scoured	• Partial Reconstruction (Superstructure) - Reconstruct 2 span RCDG - Reconstruct abutment slope protection at A1 & A2 - Provide river bank protection - Provide approach slabs - Dredging near the bridge
	5 - 11	Bankerohan	1 - Span RCDG (L = 15.55 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	5 - 12	Guyon	2 - Span RCDG (L = 11.79 + 9.66 = 22.05)	• Thin to medium cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	5 - 13	Tigbawan	1 - San RCDG with Cantilever Spans (L = 3.45 + 14.02 + 3.45 = 20.92 m)	• Serious wide cracks at concrete girders • Deteriorated deck slabs	• Partial Reconstruction (Superstructure) - Reconstruct 1-Span RCDG with cantilever spans with standard roadway and sidewalk widths - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	5 - 14	Casangay	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 5.96 + 14.04 + 5.96 = 26.56 m)	• Thin to medium cracks at concrete girders and 2-way slab beams • Some cracks at deck slabs	(Maintenance by DPWH)
	5 - 15	Nabunturan	1 - Span RCDG (L = 15.61 m)	• Approach road sections are 4-lane	(Widening to 4-lane bridge is being implemented by DPWH)
16	5 - 16	Pongtod	1 - Span RCDG (L = 15.59 m)	• Thin cracks at concrete girders • Some cracks at deck slabs	(Maintenance by DPWH)
	5 - 17	Linda	3 - Span RCDG (L = 9.35 + 15.10 + 9.34 = 34.39 m)	• Thin to medium cracks at concrete girders and diaphrams • Local scouring at P2 & piles are exposed	• Rehabilitation - Repair cracks - Provide pier foundation protection at P2
	5 - 18	Mawab	1 - RC Slab, 1 - Span RC Box Girder 1 - Span RC Slab (L = 5.90 + 20.25 + 5.77 = 32.52 m)	• Thin to medium cracks at box girders • Wide cracks at bridge seats of P1 & P2 • Some damages at abutment slope protection of A2 • River bank scoured	• Rehabilitation - Repair cracks - Repair bridge seat cracks at P1 & P2 - Reconstruct abutment slope protection at A2 - Provide river bank protection
	5 - 19	Tagmanok	1 - Span RC Slab, 1 - Span RCDG, 1 - Span RC Slab (L = 5.94 + 13.76 + 5.92 = 26.22 m)	• Some spalling of concrete at 2-way slab beam (support side) • Exposed piles at P1 & P2	• Rehabilitation - Repair of spalled portion of 2-way slab beam - Pier foundation protection at P1 & P2

Note: Bridge length includes width of backwalls, thus addition of span length does not tally with bridge length.

APPENDIX 10.3-1

PRESENT CONDITION OF EXISTING BRIDGE AND SCOPE OF WORKS

PKG. NO.	BRIDGE NO.	BRIDGE NAME	EXISTING BRIDGE TYPE AND LENGTH (m)	PRESENT CONDITION OF EXISTING BRIDGE	SCOPE OF WORKS
17	5 - 20	Liboganon	3 - Span RCDG (L = 10.03 + 12.00 + 10.04 = 32.57 m)	• Load limit is 10 tons • Severe cracks at concrete girders • Temporary shoring was constructed at P1 & P2	• Total Reconstruction - 1-Span PCDG (1 x 31.30 m, L=32.90 m) - 2-Abutment with steel tubular piles (l = 47 m)
	5 - 21	Gov. Miranda	1 - Span RC Box Girder, 2 - Span Through Truss, 1 - Span RC Box Girder (L = 23.17 + 49.60 + 49.60 + 23.15 = 146.12 m)	• After construction of Liboganon River dikes, approach road will be submerged during heavy rain	• To be removed
		New Gov. Miranda		• In conjunction with construction of Liboganon River Dikes, new bridge is required	• New Bridge Along New Alignment - 18-Span PCDG (12 x 35.15 + 6 x 35.30, L = 650 m) - 2-Abutment with cast-in-place concrete pile (l = 39 ~ 49 m) - 15-pier with cast-in-place concrete piles (l = 40 ~ 48 m) - 2-pier with steel tubular piles (l = 38 m)
18	5 - 22	Tuganay	1 - Span Through Truss (L = 50.38 m)	• Slab concrete seriously deteriorated • Some of steel railings damaged	• Partial Reconstruction (Slab) - Reconstruct slabs - Replace damaged railings
	5 - 23	Ising	1 - Span Steel I Beam 1 - Span RCDG (L = 15.55 + 9.35 = 25.50 m)	• Slab on Steel I Beam deteriorated • Severe cracks at concrete girders	• Partial Reconstruction (Superstructure/Slab) - Reconstruct slabs of Span 1 - Reconstruct RCDG of Span 2 - Reconstruct abutment slope protection at A1 and A2 - Provide approach slabs
	5 - 24	Lasang	3 - Span RCDG (L = 18.21 + 17.56 + 16.95 = 53.32 m)	• Thin cracks at concrete girders	(Maintenance by DPWH)
	6 - 01	Bunawan	1 - Span RCDG 1 - Span Steel I Beam 1 - Span RCDG (L = 9.00 + 24.10 + 8.97 = 42.67 m)	• Wide cracks at concrete girders • Deck slab of all spans deteriorated	• Partial Reconstruction (Superstructure/Slab) - Reconstruct 2-Span RCDG - Reconstruct slab of Span 2 - Reconstruct abutment slope protection at A1 & A2 - Provide approach slabs
	6 - 02	Ilang	2 - Span RCDG (L = 12.05 + 5.95 = 18.60 m)	• Davao side approach was widened to 4-lane • Thin cracks at concrete girders	• Total Reconstruction - 1-Span PCDG with 4-lane (1 x 22.25 m, L = 23.95 m) - 2-Abutment with steel tubular piles (l = 32 m)
	6 - 03	Awad	1 - Span RC Slab (L = 6.60 m)		(DPWH has converted this bridge to RCBC)
19	6 - 04	Panacan	RCDG with Cantilever Spans (L = 3.50 + 11.55 + 3.50 = 18.55 m)	• Bridge approaches are 4-lane road	(DPWH has widened to a 4-lane bridge)
	6 - 05	Davao River	5 - Span PCDG (L = 24.85 + 24.50 + 25.05 + 24.60 + 24.80 = 124.40 m)	• Local scouring at P1, P2, P3 and P4	• Rehabilitation - Provide pier foundation protection at Piers 1, 2, 3 & 4
	6 - 06	Pangi	4 - Span PCDG (L = 24.92 + 24.92 + 24.96 + 24.76 = 100.16 m)	• Local scouring at P3	• Rehabilitation - Provide pier foundation protection at P3

Note: Bridge length includes width of backwalls, thus addition of span length does not tally with bridge length.

APPENDIX 10.4-2

BASIC CONSIDERATION FOR PLANNING TOTAL RECONSTRUCTION/NEW BRIDGES

NEW CAMALIG BRIDGE (PACKAGE 2)

The existing New Camalig Bridge is a 3-span RCDG structure on a curve, over a deep waterway, 42.90m long. If centerline of New Bridge would be adopted as same as existing bridge, as the cost of constructing a detour would be prohibitive in view of the deep and wide channel to be bridged. A new alignment which would provide a bigger radius (from 76.24m to 83.00m) would improve the horizontal alignment, and also provide the necessary widening on the inside of the curve. This would result in a bridge that would be about 5.80m longer but this is offset by the advantages that would result.

The proposed new bridge is a 3-span of 16.00m. RCDG for a total length along it's centerline, of 48.732m from back to back of backwall. As to curved bridge with straight girder, the use of longer spans was avoided in view of the limitation of the cantilever length of the slab and sidewalks that would result, and also in order to have shorter heights of the pier than if the number of spans would be reduced to two. This span length and number of spans was arrived at by the following calculations:

On a small radius curved bridge, the span length is restricted by the cantilever length of the slab/sidewalk and this is about 20m.

Hence, the number of spans $= \frac{48}{20} = 2.4$ spans, say 3

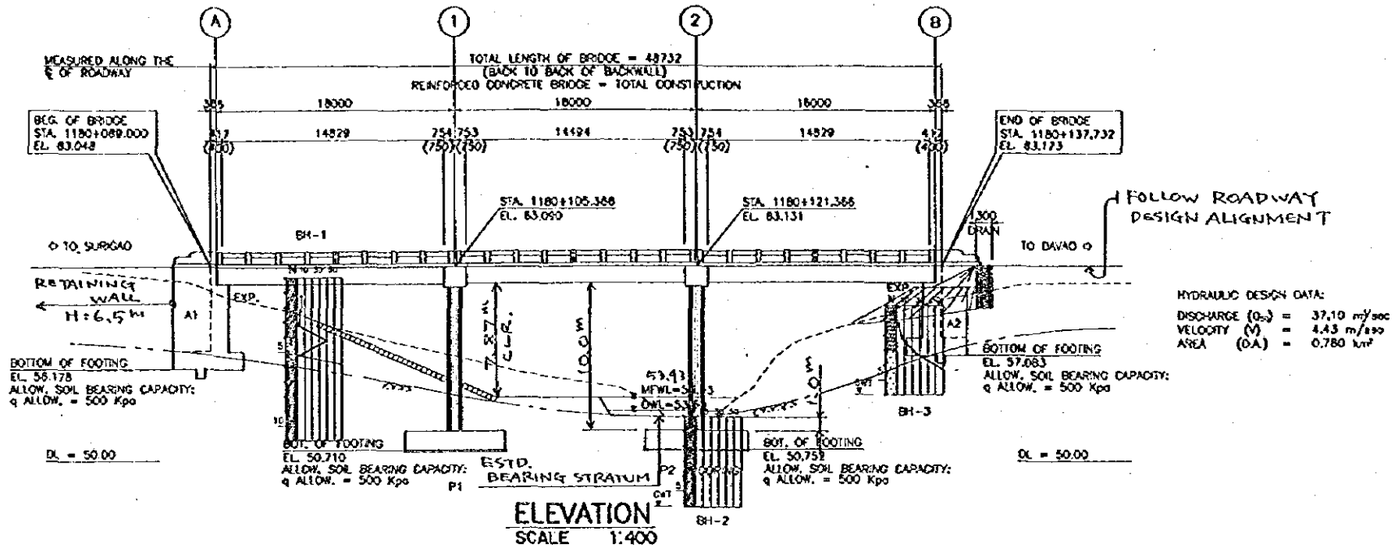
and span length $= \frac{48}{3} = 16.00$ m.

The bridge being located on a mildly rolling topography the bridge elevation is dictated by the roadway, hence the flood level which is way below the level of the girder was not considered. The locations of the abutments and piers was determined froth topography of the proposed new alignment, and this resulted in setting back Abutment "A" and Abutment "B" almost in line with the old abutment.

At the location of the new Abutment "A" construction of an embankment with usual slopes would cause the toe to fall in the river channel so, retaining wall on the right side is proposed in lieu of the embankment.

As corings proved that the foundation soil in this area is stable, spread footings for the substructures was designed, providing embedment of the top of footings inside stable material, of at least one (1) meter. As the excavation for Pier 1 would result in an elevation at approximately where the river bed elevations is, a re-direction of the channel will be incidentally accomplished, so protection works for Pier 1 was also designed.

NEW CAMALIG BRIDGE

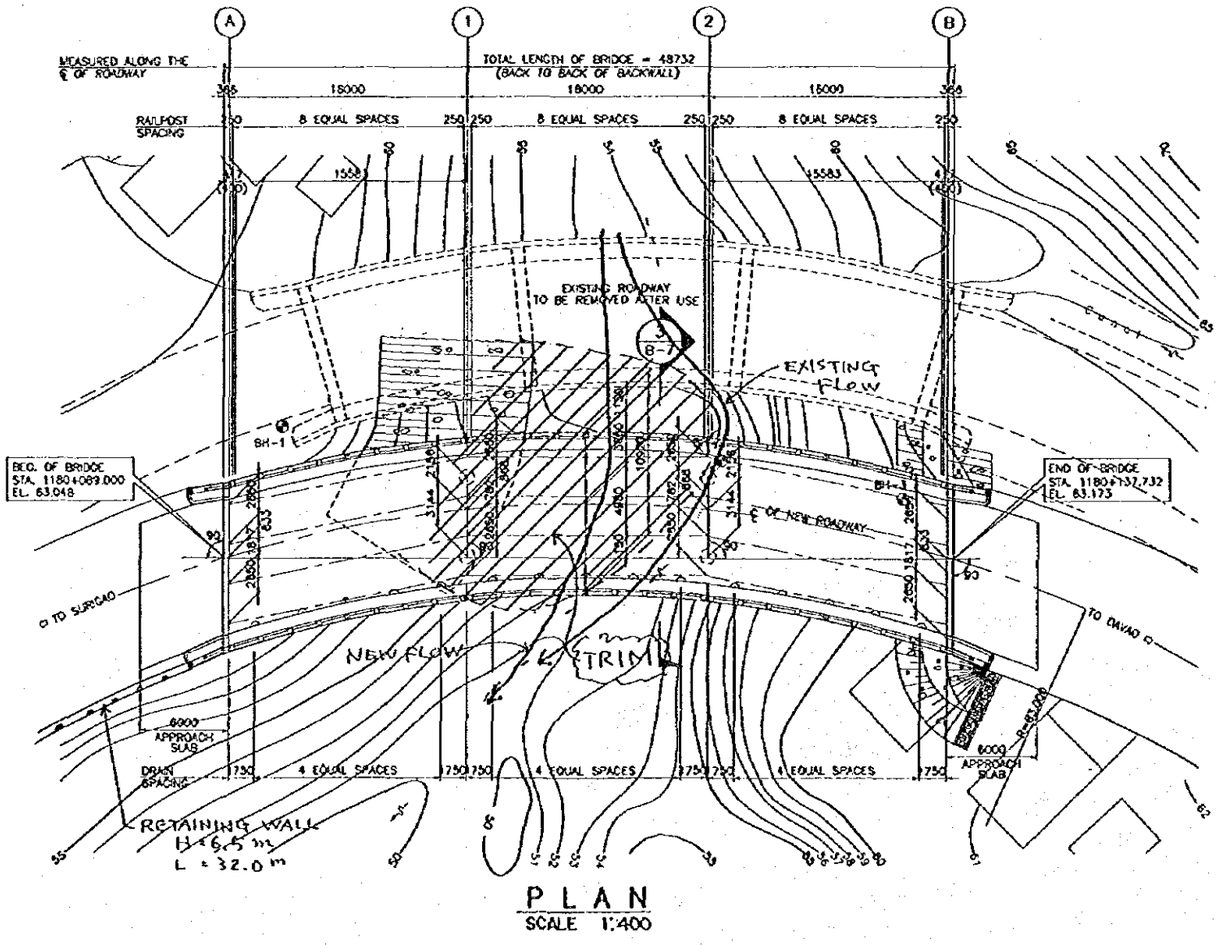


ELEVATION
SCALE 1:400

HYDRAULIC DESIGN DATA:
DISCHARGE (Q_D) = 37.10 m³/sec
VELOCITY (V) = 4.43 m/sec
AREA (DA) = 0.780 km²

Required Top of Roadway Elevation :

MFWL	=	54.24 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.20 m
Top Elevation	=	56.94 m or more



PLAN
SCALE 1:400

NEW CAMALIG BRIDGE

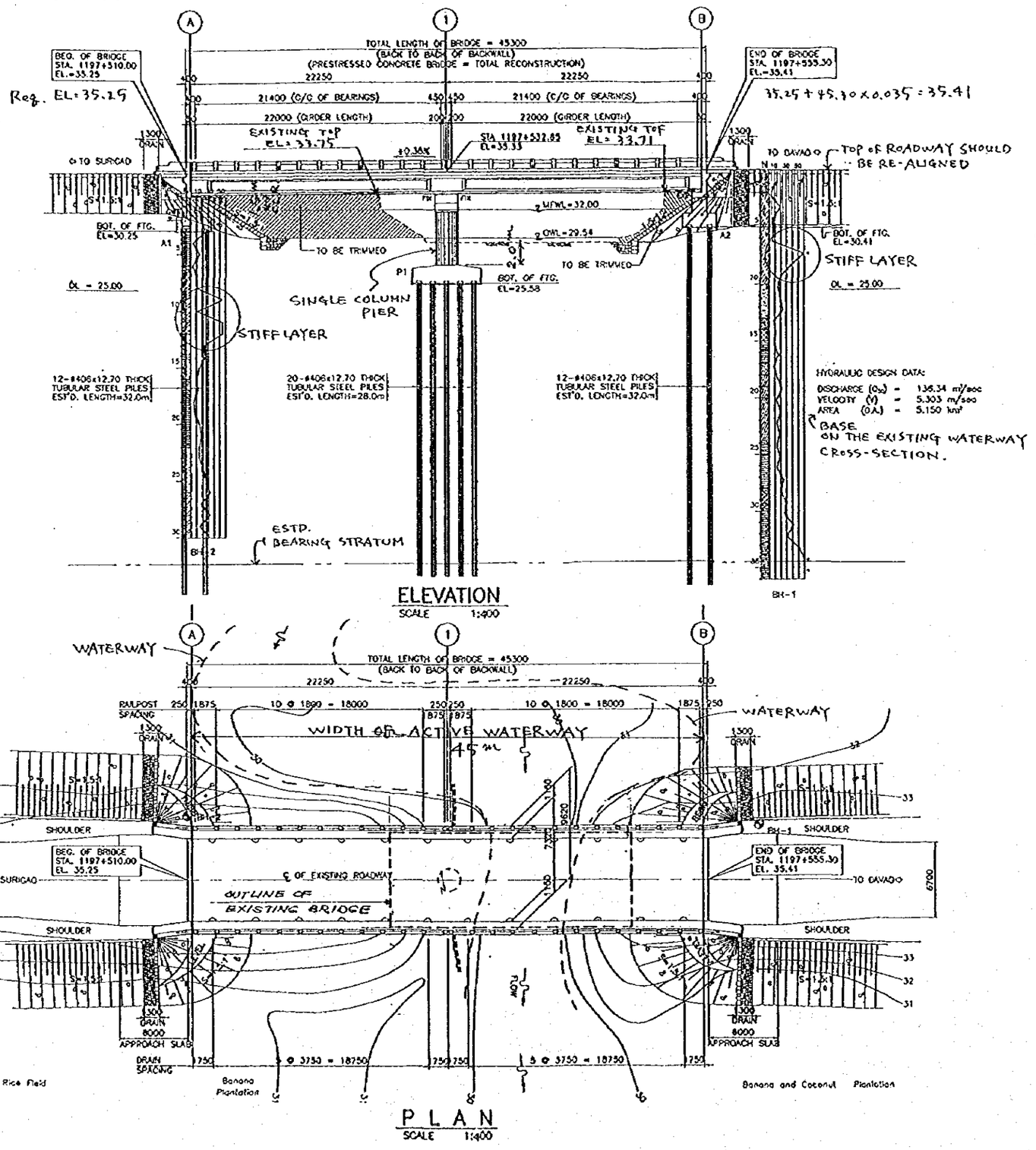
GUINOYORAN BRIDGE (PACKAGE 3)

The existing bridge at this location is a cantilever type RCDG 21.00m. long (3.50-14.00-3.50). A new bridge is proposed as it is now functionally insufficient, and the scouring of the bank protection and approaches are a yearly occurrence due to the insufficient area of waterway provided, and shifting of the waterway channel upstream of the bridge. As there is no proposed change in the roadway alignment, the existing bridge will have to be demolished to give way to the construction of the new bridge.

The proposed new bridge is a two-span prestressed concrete bridge, 22.25m. length, back to back of backwalls of 45.300m. This bridge length and location of substructures were determined from the profle at the bridge site, the area of waterway and freeboard required and the behaviour of the river during floods, i.e, the maximum flood level and direction of flow. As shown in the plans, the river waterway is not fixed and as the actual channels upstream and downstream are narrow, the Maximum Flood Water Level (MFWL) depended on the existing waterway cross-section at the centerline. Following the guidelines established in the DPWH Design Guidelines, the bridge deck elevation was calculated and when this was correlated with the slopes of the abutment protection, the bridge length was determined.

The borings at the bridge site dictated the use of substructures consisting of abutments on footigs supported by steel tubular piles and a single-column pier was selected because of the nature of the river which does not have a fixed waterway and the direction of flow during floods is unpredictable.

GUINOYORAN BRIDGE



ELEVATION
SCALE 1:400

PLAN
SCALE 1:400

Required Top of Roadway Elevation :

MFWL	=	32.00 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.75 m
Top Elevation	=	35.25 m or more

GUINOYORAN BRIDGE

AMPAYON BRIDGE (PACKAGE 4)

The existing Ampayon bridge (2-spans Precast slab elements) has abutments with vertical shafts, which act as retaining walls with almost vertical grouted riprap at the sides to confine the embankment material. This arrangement tends to restrict the water flow and makes the structure look unstable.

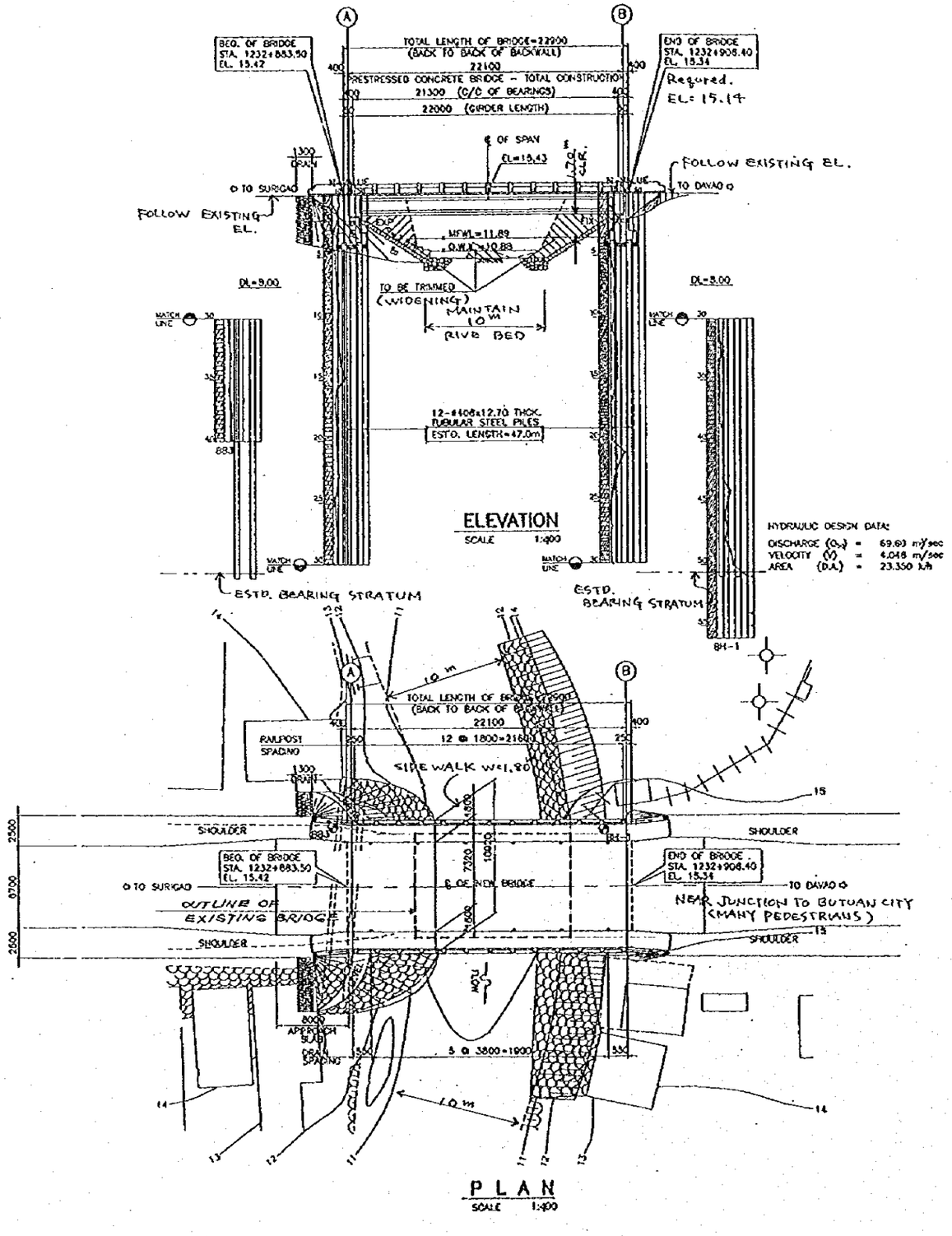
In the determination of the proposed new structure at the same alignment, the present river bed width of 10.00m was maintained and following the normal lay-out of a bridge with abutment slope protection of 1.5:1 slope, the bridge length alsmost doubled. The existing roadway elevations which could not be changed, also contributed to the lengthening of the bridge because the Max. Flood Water Level is so low that it was not considered in determining the bridge deck elevation.

The abutment locations were derived from the location of the existing river bed (and abutments) as it was at the location where the abutment slope protections emanated. This projection resulted in a design of a single span PCDG, 22.90m bridge length. As there are many pedestrians over the bridge, the width of the sidewalks were increased from the normal 1.15m to 1.80m.

The borings indicated that the hard bearing stratum is about 47m below the existing ground level with intermittently distributed, thin, stiff layers in-between. This was instrumental in the decision to use steel tubular piles to support the abutments, the footings of which, were situated lower than the surrounding original ground. This resulted in the design of 4.00m high abutments supported by two rows of the tubular piles.

AMPAYON BRIDGE/OGE

AMPAYON BRIDGE



Required Top of Roadway Elevation :

MFWL	=	11.89 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.75 m
Top Elevation	=	15.14 m or more

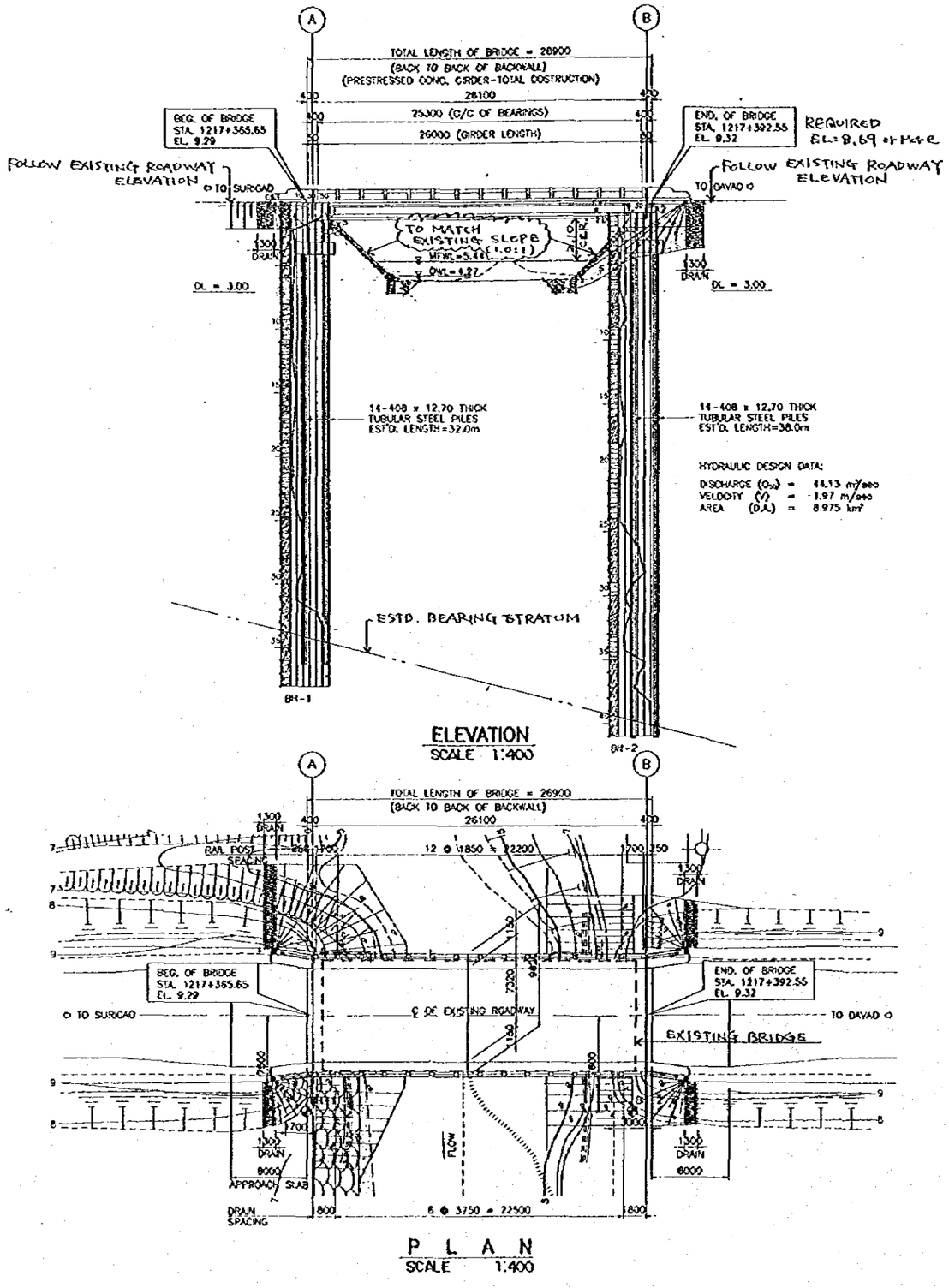
SANGHAN BRIDGE (PACKAGE 4)

The existing bridge consists of two spans of 12.00m RCDG with river bank protection upstream and downstream. As the proposed new structure would have to conform to the limits of this existing bank protection, the proposed slope protection surfaces should match the existing slope protection, and as the existing top of roadway elevations also have to be maintained, the resulting structure should have about the same length as the existing bridge. However, as the proposed structure was provided with longer bridge seats, thicker backwalls and wider berms (0.65m) infront of the abutments, the new bridge became 2.22m. longer.

The replacement of the 2-span RCDG with a single-span 26.00m. PCDG eliminated the need for a pier at the middle, but also resulted in deeper girders of the superstructure. This change, however, did not affect the bridge deck elevation because the required free board above the MFWL was still satisfied.

The borings indicate that the hard bearing stratum is about 30~36m. below the existing ground levels with a mildly stiff layer midway, so the use of steel tubular piles to support the substructure was selected. As the abutment footings have to be situated at about original ground level, the use of abutment heights of 5.00m was designed.

SANGHAN BRIDGE



ELEVATION
SCALE 1:400

P L A N
SCALE 1:400

Required Top of Roadway Elevation :

MFWL	=	5.44 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.75 m
Top Elevation	=	8.69 m or more

SANGHAN BRIDGE

ANDANAN BRIDGE (PACKAGE 6)

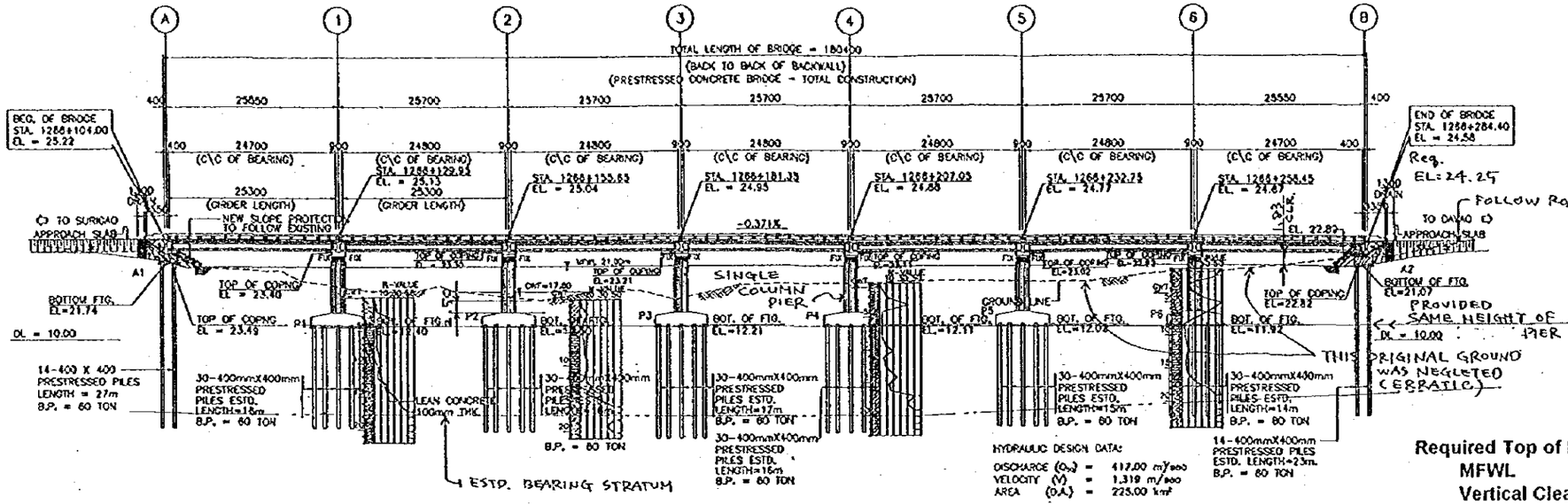
The existing Andanan Bridge is 12 spans of 15.00m RCDG, 20° R.F. Skew which was constructed in 1957. It is possible that when this bridge was originally designed, the structure fitted the then existing conditions at the bridge site, but with the passage of 40 years, the bridge site conditions has thoroughly changed. The river flow has shifted almost perpendicular to the previous water course and the river bed has gone down so much that the existing R.C. piles supporting the pier footings are now exposed by as much as 1.50m. Whereas the river channel at that time was probably permanent, there is no defined channel at this time, and the river behavior during floods is erratic and unpredictable.

This being the case, a new bridge to fit the existing site conditions is proposed. From the profile of the existing river bed, and the recorded maximum flood water elevations, it was determined that the new bridge would consist of seven (7) spans continuous PCDG with the approach spans at 25.55m. each and the five (5) interior spans at 25.70m for a total length of bridge from back to back of backwalls of 180.40m. which is almost the same length of the existing bridge of 180.90m. Froth existing river bed profile and the calculated maximum flood level alone, it would have been possible to make the bridge shorter, but in view of the erratic behavior of the river, it was decided to maintain an almost equal length of bridge. It was also for this reason, that single-column piers were adopted.

As the river bed elevations had lowered so much due to the effects of scouring, the maximum flood level consequently went down such that, for the sake of economy, it was possible to lower the existing bridge deck from an average elevation of 26.425m. to an average elevation of 24,900m. The top of pier footings were embedded 2.50m. below the river bed elevation, and, again, due to the uncertainty of where scouring may occur, the existing lowest river bed was made the basis and the higher river bed elevations were ignored. This also resulted in only one design of all the piers for the bridge. The lengths of prestressed concrete piles for the support of the pier footings. However, varied according to the boring data obtained from four (4) locations along the centerline of the proposed bridge location which was made 12.00m. parallel to, and downstream of the existing bridge. This shifting of the centerline was made so that the existing bridge could serve as a detour during the construction of the new bridge.

In the determination of span lengths to be used, alternative schemes were studied utilizing spans of 20.000m., 22.500m and 25,700m. The 25,700m. spans proved to be more economical and easier to construct so this was the one adopted.

ANDANAN BRIDGE

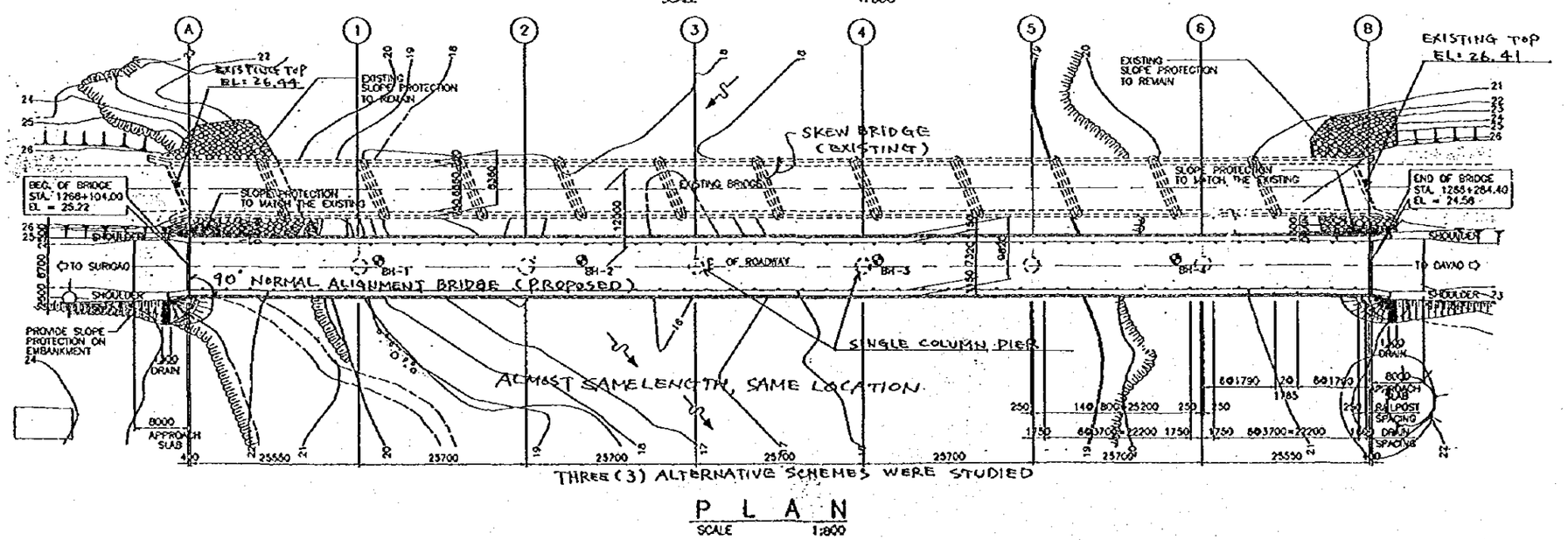


GENERAL ELEVATION
SCALE 1:800

Required Top of Roadway Elevation :

MFWL	=	21.00 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.75 m
Top Elevation	=	24.25 m or more

ANDANAN BRIDGE



PLAN
SCALE 1:800

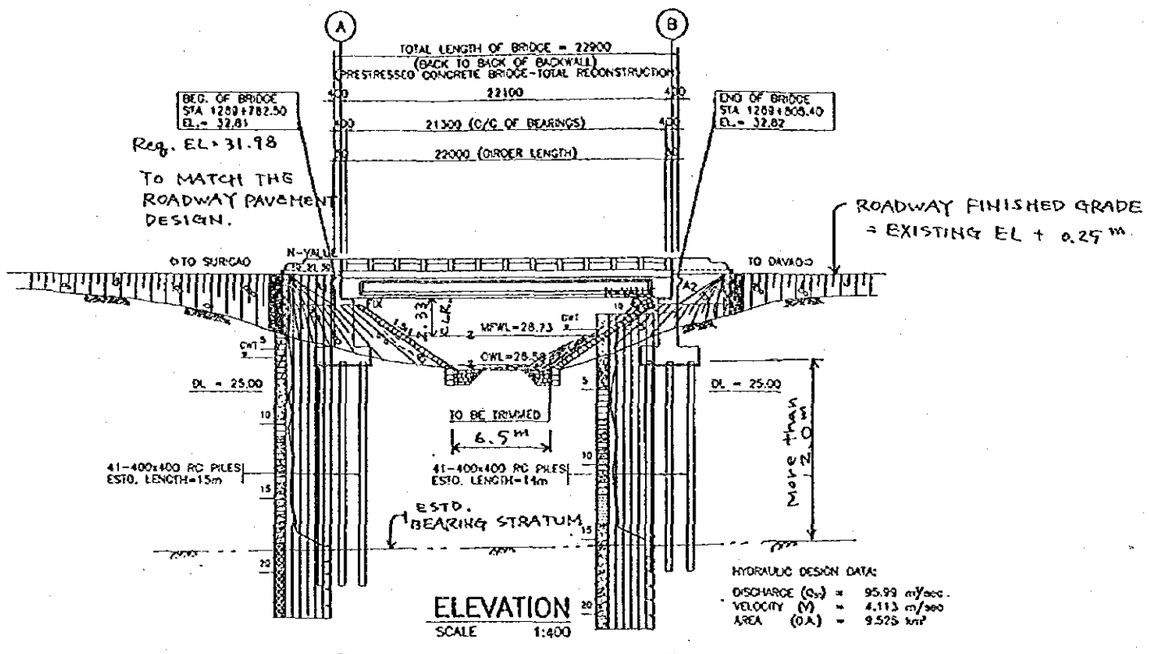
TAGLATAWAN BRIDGE (PACKAGE 6)

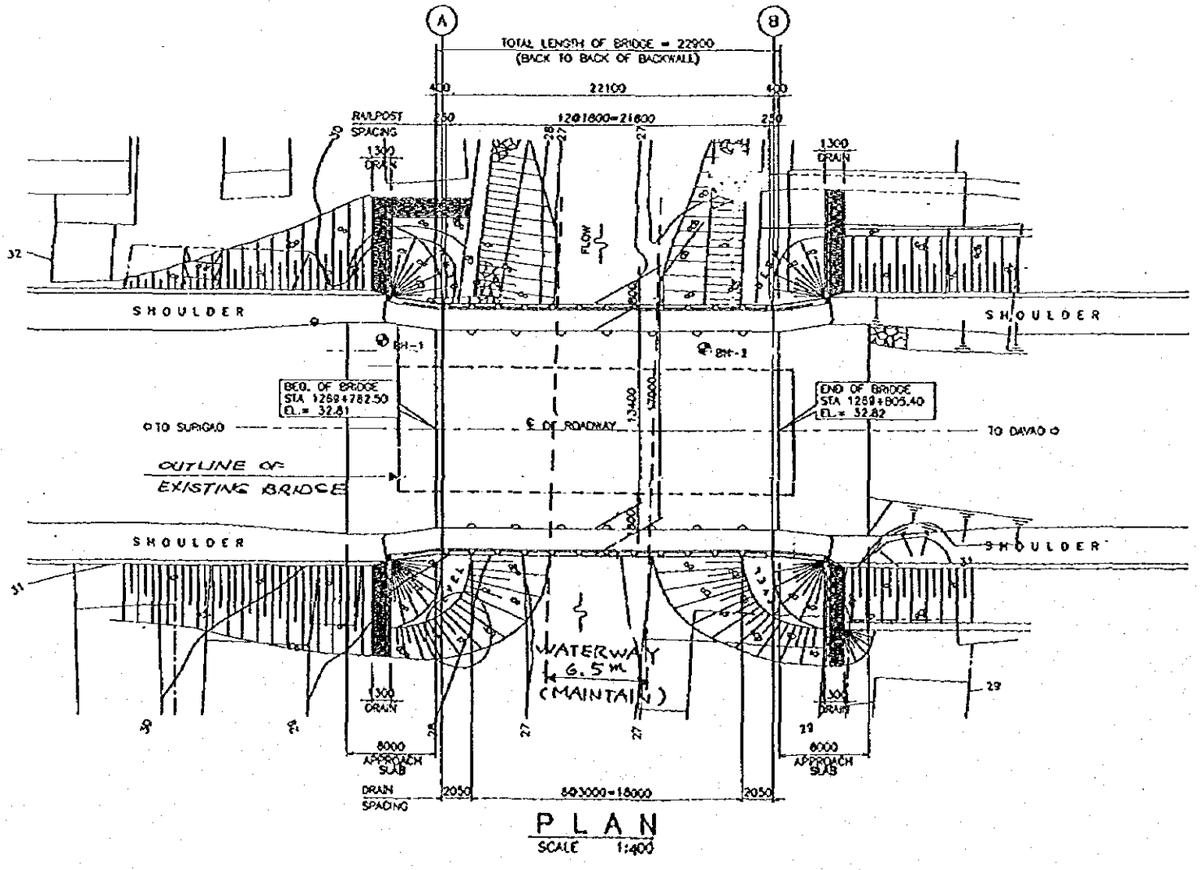
The bridge now existing is 26.52m long (RCDG) with 3 spans and two roadway lanes; the proposed bridge will be a single-span PCDG with four (4) lanes and widened sidewalks to match the roadway design and to accommodate the many pedestrians using the bridge.

In the determination of the bridge location and length, the existing bridge and roadway alignment and elevations were considered. Using the design top of roadway elevation of 32.81m, the river bed width of 6.50m, abutment slope protection of 1.5:1 and the increased widths of level berms, bridge seats and backwalls, a bridge length of 22.90m was designed. If the design would be based on the MFWL, the required freeboard and girder depth, the bridge deck elevation would only be 31.98m, but as the highway pavement vertical alignment had to be matched, the bridge deck elevation of 32.81 ~ 32.82m was adopted.

As the abutment footings had to be located below the existing original ground lines, abutment height of 6.00m was designed. These abutments will be supported by 15m. long R.C. piles as the borings indicate the hard bearing strata at depths less than 15 meters.

TAGLATAWAN BRIDGE





TAGLATAWAN BRIDGE

Required Top of Roadway Elevation :

MFWL	=	28.73 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.75 m
Top Elevation	=	*31.98 m or more*

TAGBAYAGAN BRIDGE (PACKAGE 9)

- **HORIZONTAL ALIGNMENT**

  Proposed new bridge was shifted 12.00m leftside/upstream from the existing bridge with 20° skew to be parallel with river flow & that the latter can be used as detour bridge during construction period.

- **VERTICAL ALIGNMENT/FINISH ELEVATION**

  Finish grade elevation of the proposed new bridge is almost same with existing bridge which was base on the vertical roadway alignment design. Adequacy of free board from Maximum Flood Water Level (MFWL) of proposed new bridge was above minimum of 1.50m.

- **SPAN LENGTH**

  Proposed new bridge is a single span Type V AASHTO Girder with almost same length of the existing bridge which composed of three spans RCDG & two piers. Proposed new bridge is more advantageous not only shortening construction period but also free from obstruction of stream flow.

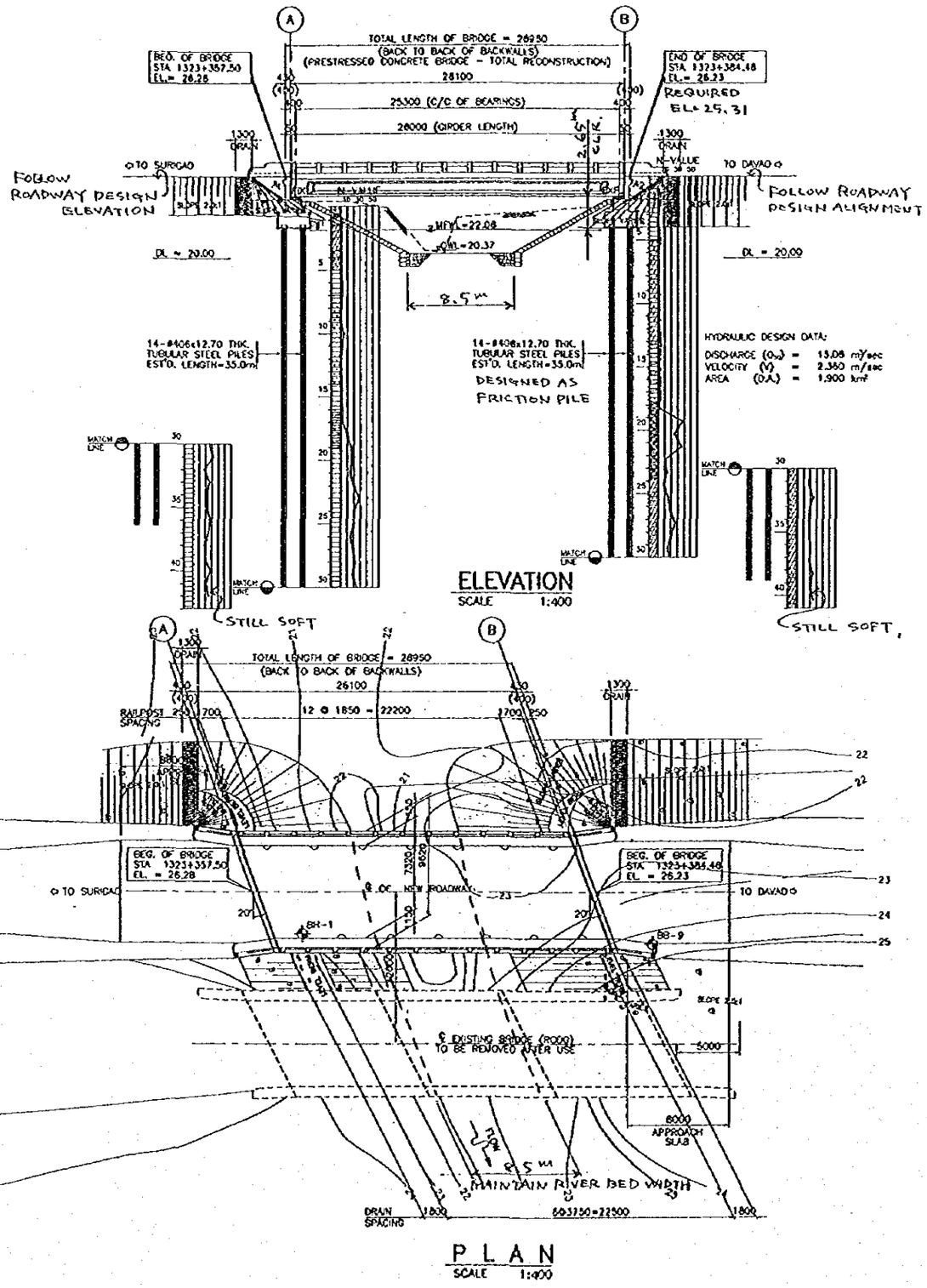
- **ABUTMENT/FOUNDATION**

  Steel Tubular Piles Pile Foundation (Design as Friction Piles) is more appropriate for these kind of underneath soil as shown on the geotechnical investigation of subsurface of soil. A 4.00m height of Seat Type Abutment was adopted.

- **PROTECTION WORKS**

  Trimming of river bed & construction of abutment grouted riprap slope protection with slope of 2.00:1 to suit field condition.

TAGBAYAGAN BRIDGE



Required Top of Roadway Elevation :

MFWL	=	22.06 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.75 m
Top Elevation	=	25.31 m or more

TAGBAYAGAN BRIDGE

LAGCOGANGAN BRIDGE (PACKAGE 9)

- **HORIZONTAL ALIGNMENT**

  Proposed new bridge was shifted 12.00m rightside/downstream from the existing bridge so that the later can be used as detour bridge during construction period. Centerline of the center span of proposed new bridge lies with centerline of center span of existing bridge.

- **VERTICAL ALIGNMENT/FINISH ELEVATION**

  Finish elevation of the proposed new bridge was base on the roadway design which is lower than existing one Free board was checked on Maximum Flood Water Level (MFWL) & turned out to be adequate.

- **SPAN LENGTH**

  Proposed new bridge had almost same length of the existing one (22.90m), but the new one is consist of single span of AASHTO Type IV Girder while the existing consist of three spans with two piers. Proposed new bridge had many advantageous not only shortening construction period but also free from obstruction of stream flow.

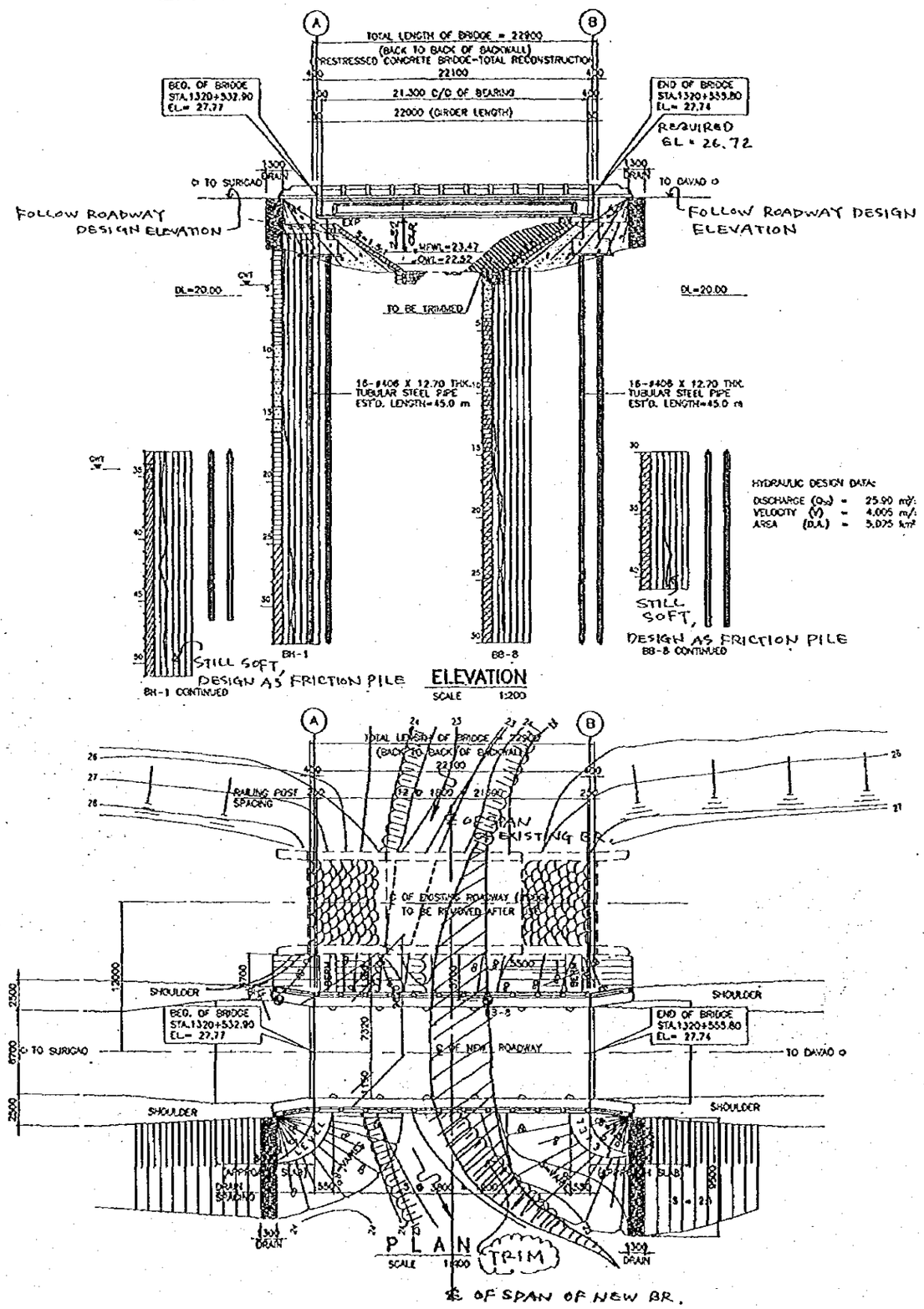
- **ABUTMENT/FOUNDATION**

  From geotechnical investigation of subsurface, Steel Tubular Piles were appropriate in this condition. A Ø400mm by 45.00m length Steel Tubular Piles were designed as friction piles. Abutment height was 4.50m to ensure embedment of footing.

- **PROTECTION WORKS**

  Trimming of river bed is necessary to have smooth flow of river and a slope of 2.00:1 for abutment grouted riprap slope protection.

LAGCOGANGAN BRIDGE



Required Top of Roadway Elevation :

MFWL	=	23.47 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.75 m
Top Elevation	=	26.72 m or more

LAG CO GANGAN BRIDGE

WASIAN BRIDGE (PACKAGE 10)

- **HORIZONTAL ALIGNMENT**

  Horizontal alignment of Proposed New Bridge was shifted 12.00m rightside/downstream of existing bridge which the latter to serve as detour bridge during construction.

- **VERTICAL ALIGNMENT/TOP OF ROADWAY ELEVATION**

  The top of roadway elevation was raised to have the minimum allowable clearance/free board of 1.50m between the bottom of girder of proposed new bridge to hydraulic calculated Maximum Flood Water Level (MFWL).

- **BRIDGE/SPAN LENGTH**

  The Proposed New Bridge is a single span of Type V AASHTO Girder with a bridge length of 26.10m longer than the existing bridge to maintain the river bed width of 8.00m and can provide good slope for grouted riprap slope protections.

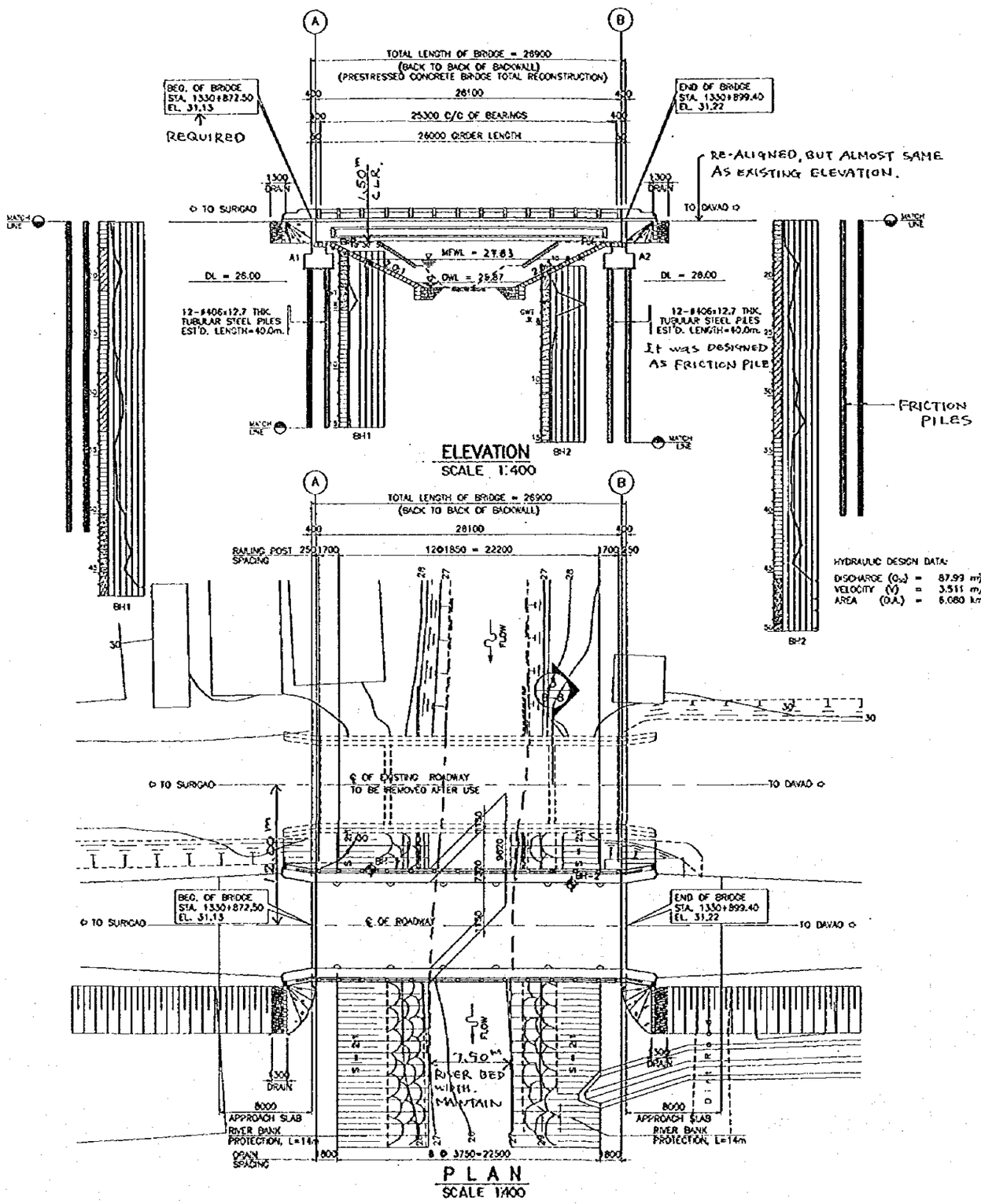
- **ABUTMENT/PILE FOUNDATION**

  Abutment is a Seat Type with a total height of 4.00m to have reasonable embedment of footing original ground. Base on subsurface investigation data, bearing strata location was so deep (46.00m). Use of 400mm x 400mm Precast or Prestressed Concrete Pile is not advisable because of various splicing (casted length is limited to short length) which takes more time and occurrence of buckling of pile will be expected because of longer unsupported length and also during driving when the pile will hit stiff layer. Cast-in-Place Piles or Bored Piles is also suitable but construction may take longer period and Abutment Footing may enlarge so it is considerably expensive. Steel Tubular Piles is best for these type of underneath soil because of it's durability. Splicing of piles is so easy and it can penetrate hard layer with no considerable pile buckling during driving.

- **PROTECTION WORKS**

  Trimming of river bed to smooth then the stream flow and construction of grouted riprap slope protection of maximum side slope of 2.0:1 is required.

WASIAN BRIDGE



Required Top of Roadway Elevation :

MFWL	=	27.83 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.80 m
Top Elevation	=	31.13 m or more

WASIAN BRIDGE

GABANAN BRIDGE (PACKAGE 13)

- **HORIZONTAL ALIGNMENT**

  Proposed new bridge is with the same alignment of the existing bridge thus provision of detour road/bridge is needed during construction. River channel/water flow is 45° skew with roadway centerline but even skew bridge is not applicable. Normal bridge with Single Column Pier & Arrange Slope Protection was adopted.

- **VERTICAL ALIGNMENT/FINISH ELEVATION**

  Top of roadway or finished elevation of proposed new bridge is same with existing bridge. Free board allowance for Maximum Flood Water Level (MFWL) is above minimum of 1.50m.

- **BRIDGE LENGTH**

  Proposed new bridge is composed of two span of Type IV AASHTO Girder with Single Column Pier longer than the existing bridge. The increase of bridge length is due to the use of normal bridge instead of skew bridge (parallel with stream flow) which is inapplicable but we can provide better protection works for the proposed new bridge.

- **ABUTMENT**

  Diaphragm Type of Abutment is sufficient on both approach because of sufficient embedment (Abutment is sufficiently away from river bank).

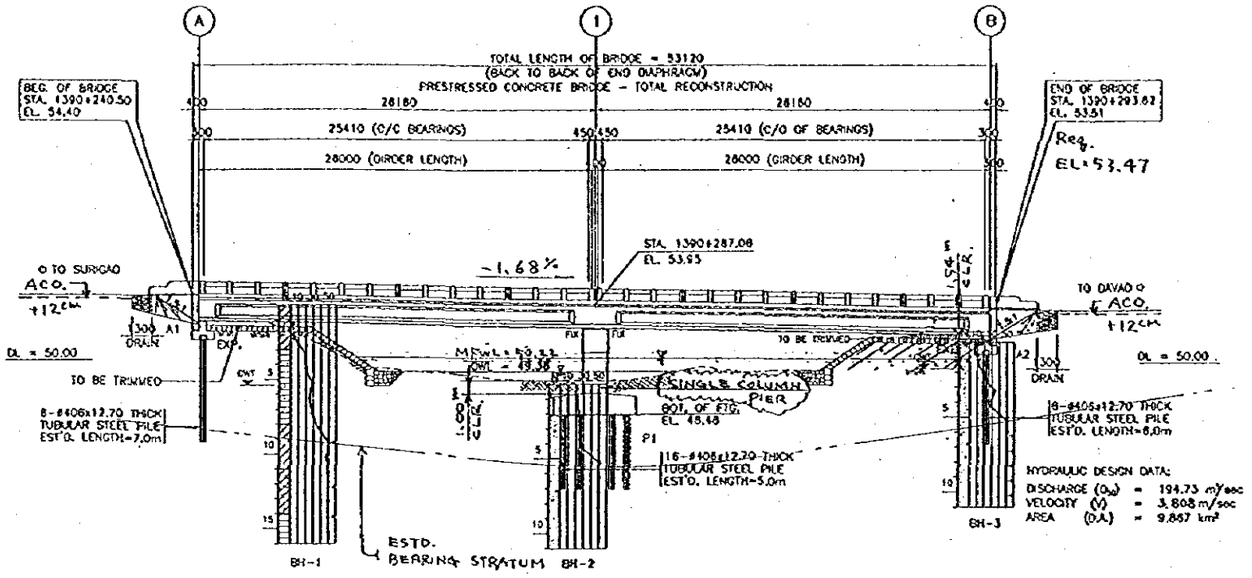
- **PILE FOUNDATION**

  From geotechnical investigation, bearing stratum is not so depth which is 5.50m from river bed near proposed pier. Spread footing is not recommended because it will result to very high column and difficult for foundation construction. Use of Steel Tubular Piles Pile Foundation to insure embedment to hard stratum is recommended.

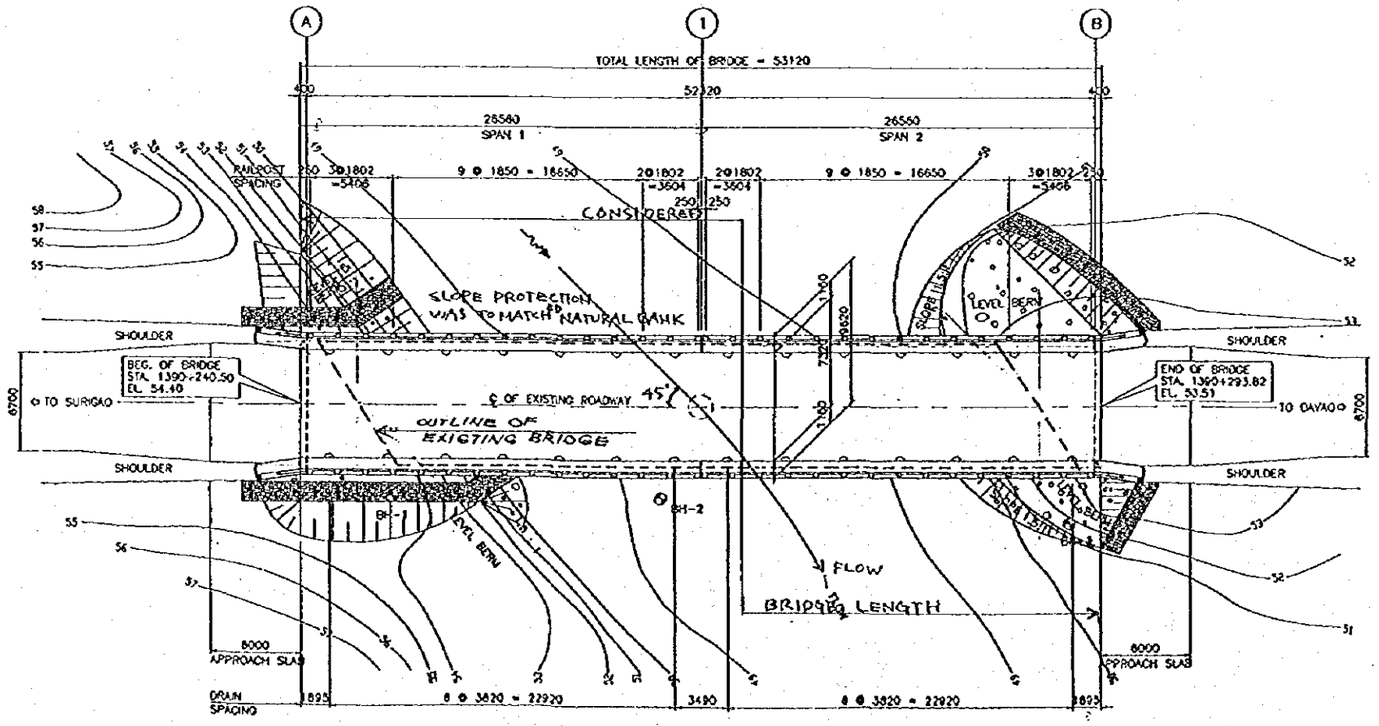
- **SLOPE PROTECTION**

  Trim river bed near both abutment & grouted riprap slope protection will be parallel to stream flow.

GABANAN BRIDGE



ELEVATION
SCALE 1:400



PLAN
SCALE 1:400

Required Top of Roadway Elevation :

MFWL	=	50.22 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.75 m
Top Elevation	=	53.47 m or more

GABANAN BRIDGE

MONKAYO BYPASS NO. 1 BRIDGE (PACKAGE 14)

- **HORIZONTAL ALIGNMENT**

  Horizontal alignment of this Proposed New Bridge was dictated by Highway Design Alignment which is also constricted by Proposed New Monkayo Bypass No. 2 Bridge and with the intersection to existing roadway. Longer and normal bridge was use due to meandering water channel.

- **VERTICAL ALIGNMENT/TOP OF ROADWAY ELEVATION**

  Top of roadway/finished elevation was base on a Minimum Free board of bottom of girder to Maximum Flood Water Level (MFWL) of 1.50m MFWL is brought by the back-water of Agusan River.

- **BRIDGE/SPAN LENGTH**

  The Proposed Bridge was positioned such tht both abutment will not fall or to near to river channel. To avoid pier construction @ center of river, three spans was used with bridge length of 60.00m. Single Column Piers is suitable for meandering river flow.

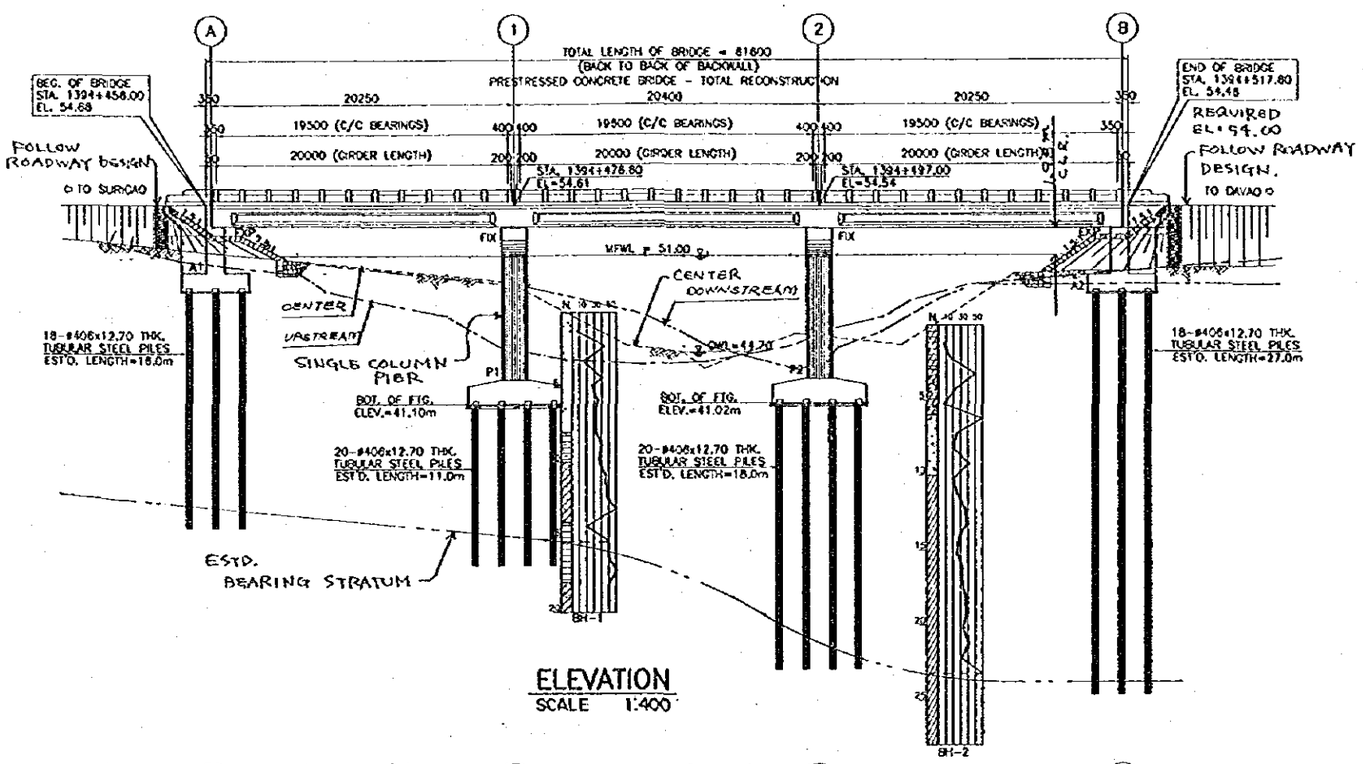
- **PILE FOUNDATION**

  Natural ground or river bed in this area is almost stable to scouring and this embedment of top of pier footing @ least 1.00m Steel Tubular Piles Pile Foundation is provided due to presence of stiff layer to bearing stratum which is very difficult/unnecessary for ordinary Precast Concrete Piles.

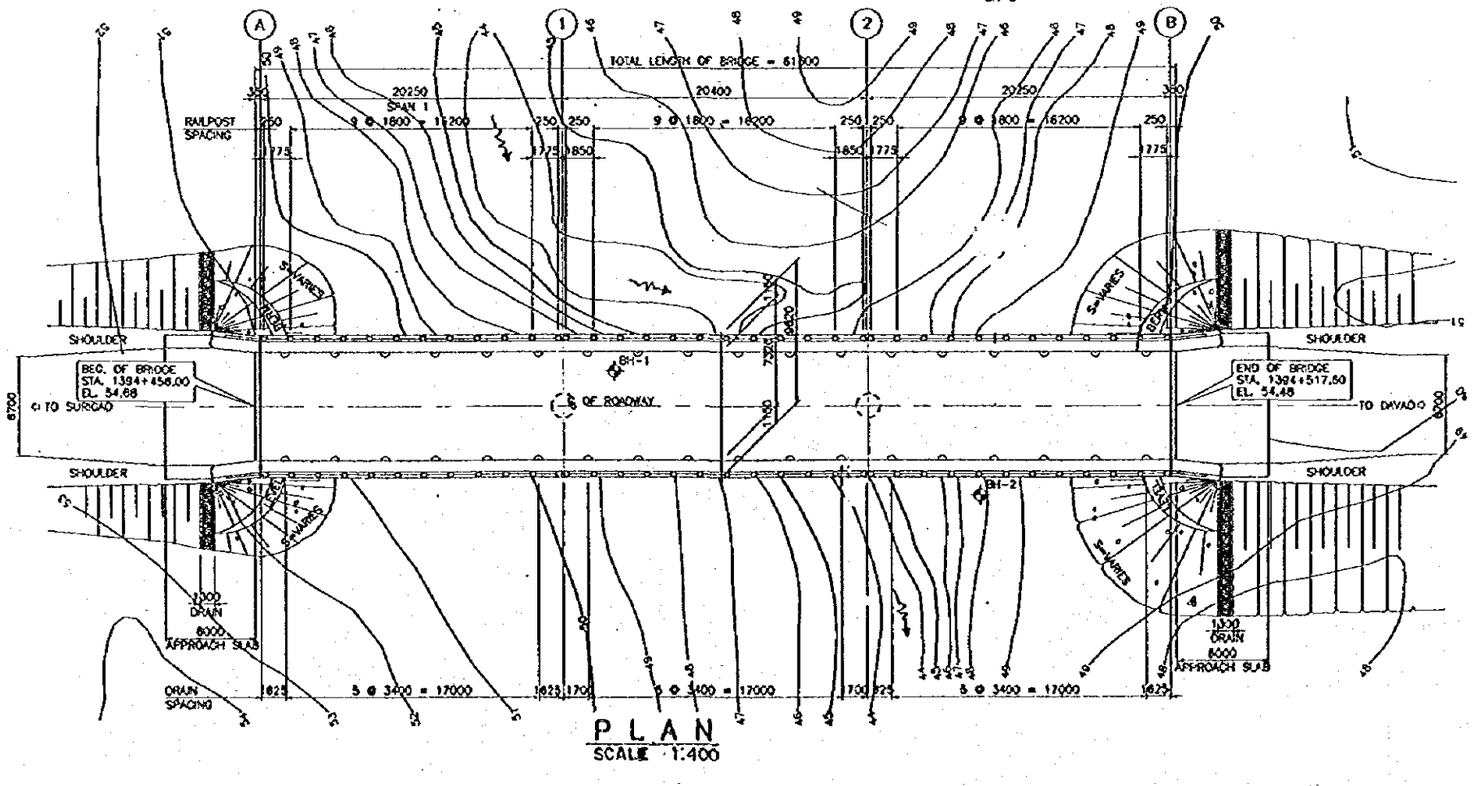
- **PROTECTION WORKS**

  Trimming of river bed especially near abutments to smoothen stream flow.

MONKAYO BYPASS NO.1 BRIDGE



ELEVATION
SCALE 1:400



PLAN
SCALE 1:400

Required Top of Roadway Elevation :

MFWL	=	51.00 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.50 m
Top Elevation	=	54.00 m or more

MONKAYO BYPASS NO. 2 BRIDGE (PACKAGE 14)

- **HORIZONTAL ALIGNMENT**

  The Proposed New Bridge will transverse the Agusan River and horizontal alignment will be dictated by condition of the Proposed Monkayo Bypass No. 1 Bridge and intersection of proposed bypass roadway to the existing roadway.

- **VERTICAL ALIGNMENT/TOP OF ROADWAY ELEVATION**

  Finished elevation/top of roadway elevation of proposed bridge is based on the Allowable Minimum of 1.50m Freeboard between the bottom of girder to Maximum Flood Water Level.

- **BRIDGE/SPAN LENGTH**

  Three Alternative Schemes were prepared to determine costwise schemes. With these three Alternative Schemes, studied and evaluated, a four spans bridge with Type V AASHTO girder was adopted.

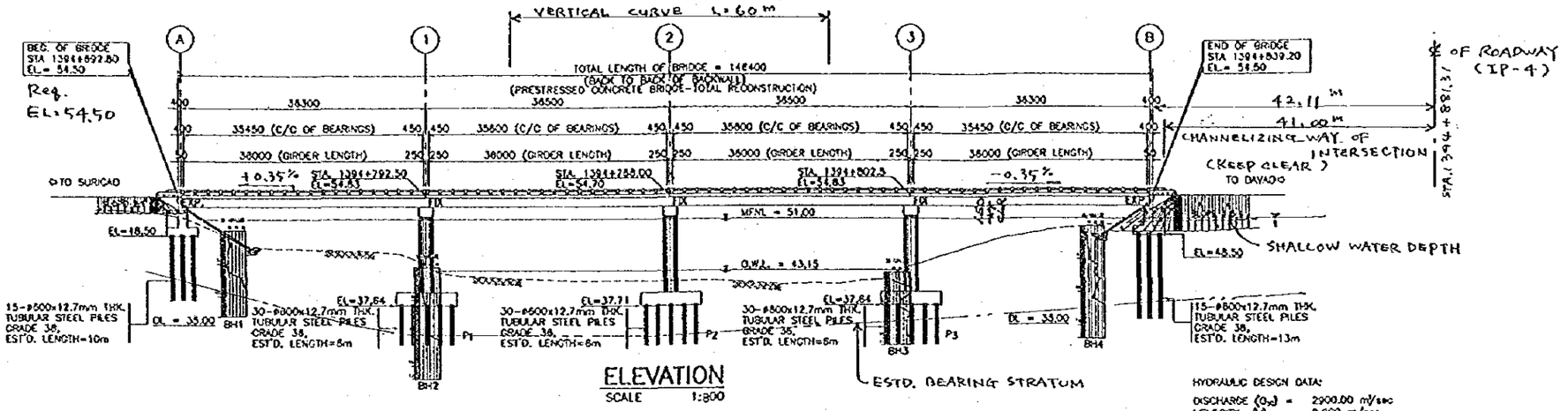
- **FOUNDATION**

  From Geotechnical Investigation of the area, location of bearing strata is shallow around 6.00m from the bottom of proposed footing but using spread footing for piers will render high column and big structural excavation below Ordinary Water Level (OWL) which may costly and difficult construction. Steel Tubular Piles was adopted since it can penetrate to some extent to bearing stratum for necessary anchorage unlike ordinary precast piles which may be destroy during piling on bearing stratum.

- **PROTECTION WORKS**

  Construction of grouted riprap slope protection on both abutment with slope 2:1 is necessary

MONKAYO BYPASS NO.2 BRIDGE

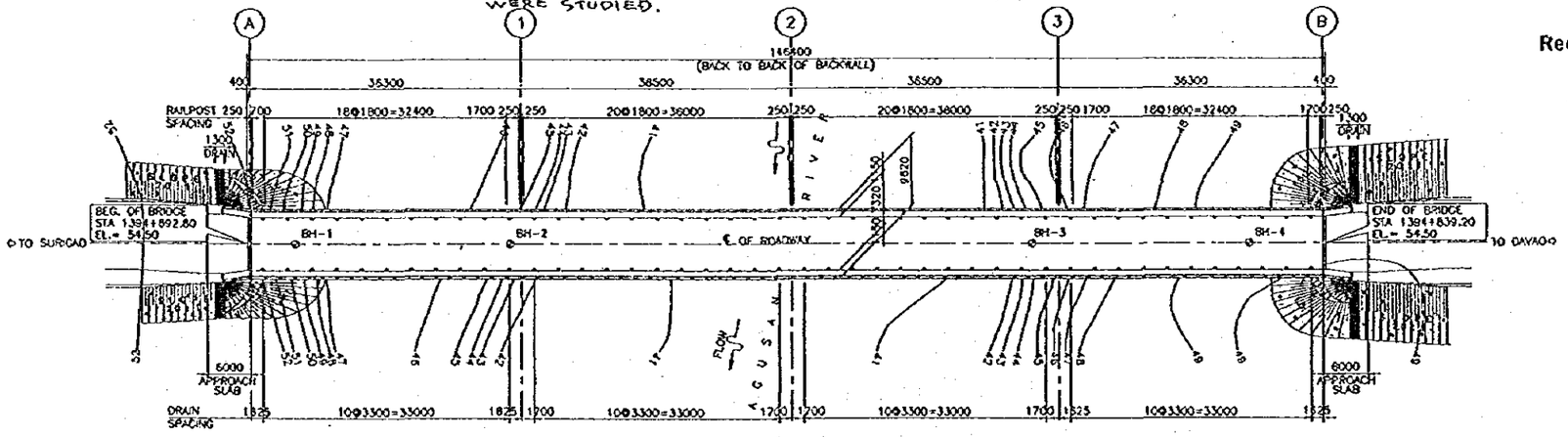


ELEVATION
SCALE 1:800

REGARDING NUMBER OF SPANS AND SPAN LENGTH, THREE (3) ALTERNATIVE SCHEMES WERE STUDIED.

HYDRAULIC DESIGN DATA:

DISCHARGE (Q_w)	=	2900.00 m³/sec
VELOCITY (V)	=	2.980 m/sec
AREA (D.A.)	=	770,000 km²



PLAN
SCALE 1:800

Required Top of Roadway Elevation :

MFWL	=	51.00 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	2.00 m
Top Elevation	=	54.50 m or more

MONKAYO BYPASS NO. 2 BRIDGE

TINA BRIDGE (PACKAGE 15)

- **HORIZONTAL ALIGNMENT**

  The Proposed New Bridge horizontal alignment is same as that of existing bridge, thus, provision of detour road/bridge is necessary during construction. First approach of proposed new bridge is 2.50m back of the first approach of existing bridge to avoid first abutment to be near or fall to river bank.

- **VERTICAL ALIGNMENT/TOP OF ROADWAY ELEVATION**

  The site is a flooded area that raising of finish grade of the roadway of about 2.20m is needed and that affect also the top of roadway of Proposed New Bridge. Maximum Flood Water Level (MFWL) due to back water of Agusan River (EL = 52.50) is lower than the Maximum Flood Water Level (MWFL) of hydraulic calculation of the branch river (EL = 53.25) and that MFWL of EL = 53.25 was adopted as design criteria. Construction of high embankment of both approach were necessary.

- **BRIDGE/SPAN LENGTH**

  Proposed New Bridge is a Single Span Type V AASHTO Girder which is more advantageous than that of existing bridge which has two piers and rendering obstruction to stream flow.

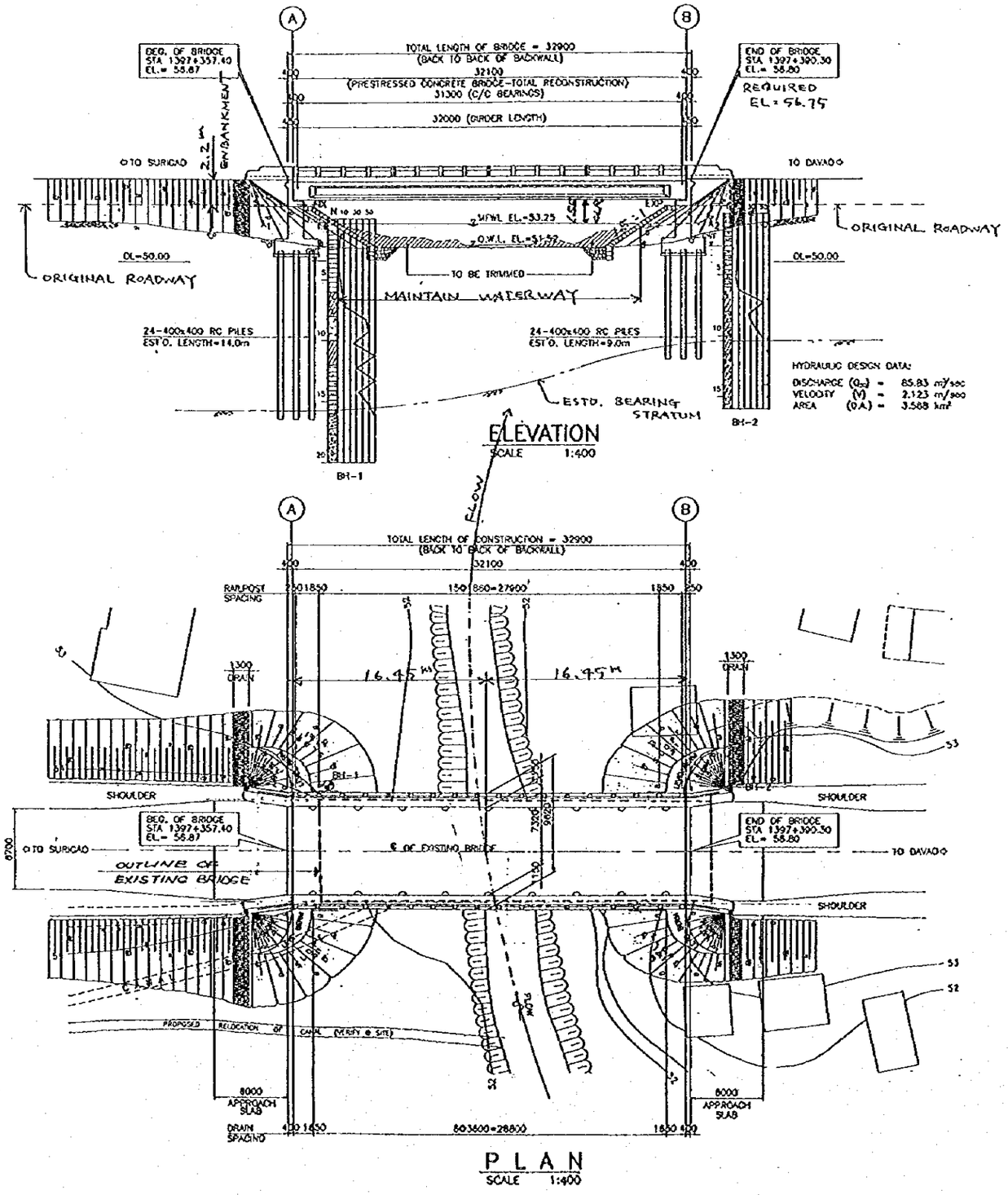
- **ABUTMENT/PILE FOUNDATION**

  Abutment is a Seat Type and a height of 6.00m to allow minimum embedment to original ground. Base on soil subsurface investigation, an ordinary 400mm x 400mm x 16.00mm Precast Concrete Pile is suitable. Soil Bearing Stratum is located not more than 15.00m depth and no stiff layer in between occurs.

- **PROTECTION WORKS**

  Trimming of river bed to smoothen stream flow and construction of grouted riprap slope protection with slope 1.5:1 is to be done.

TINA BRIDGE



Required Top of Roadway Elevation :

MFWL	=	53.25 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	2.00 m
Top Elevation	=	56.75 m or more

TINA BRIDGE

BANLAG BRIDGE (PACKAGE 15)

- **HORIZONTAL ALIGNMENT**

  The horizontal alignment of Proposed New Bridge is the same as the existing but have skew of 15° right so that abutment width will be parallel to stream flow and width of river channel (6.50m) can be maintained. Provision of detour road/bridge is necessary during construction.

- **VERTICAL ALIGNMENT/TOP OF ROADWAY**

  The site is a flooded area and construction of high embankment on both approach is needed. A raising of grade of around 4.40m from the existing grade is determined to insure the roadway will not be flooded. Maximum Flood Water Level (MFWL) due to backwater of Agusan River is IN.EL=52.50.

- **BRIDGE/SPAN LENGTH**

  The Proposed New Bridge is a Single Span Type V AASHTO Girder for faster construction and to avoid construction of pier @ river channel to eliminate obstruction of stream flow. Length of Proposed New Bridge (32.91m) is a little bit longer than existing bridge.

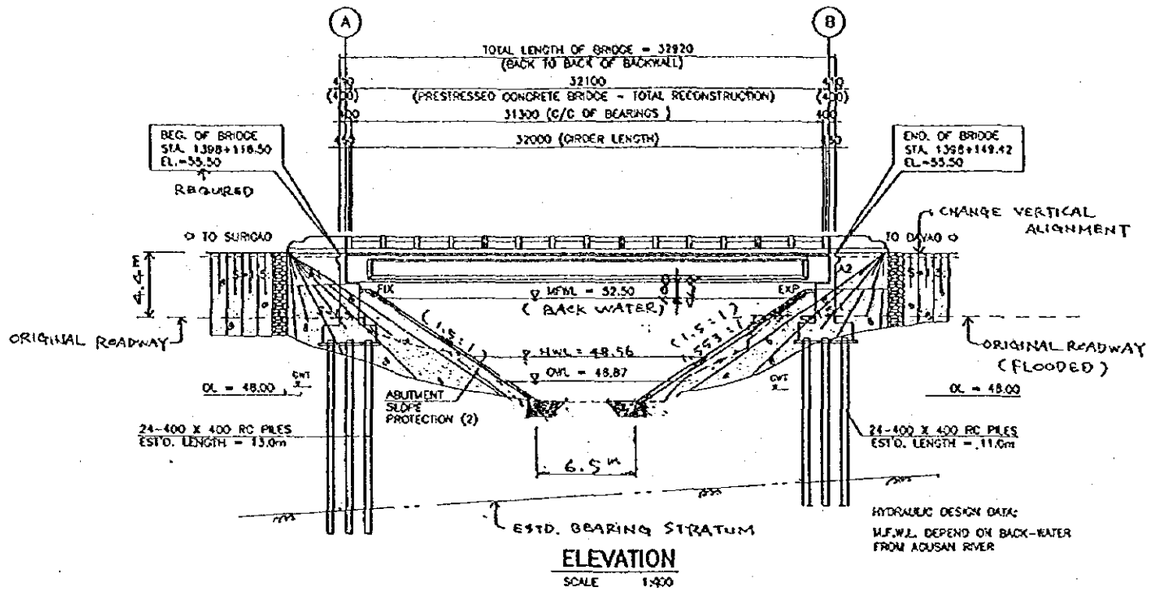
- **ABUTMENT/PILE FOUNDATION**

  Abutment is a Seat Type of height of 6.00m to provide proper embedment of footing to original ground. Bearing stratum is not so deep as per subsurface investigation and use of 400mm x 400mm Precast Concrete Pile is the most economical. Easy handling and construction. Estimated pile length is around 15.00m to have enough embedment of pile tip to bearing stratum.

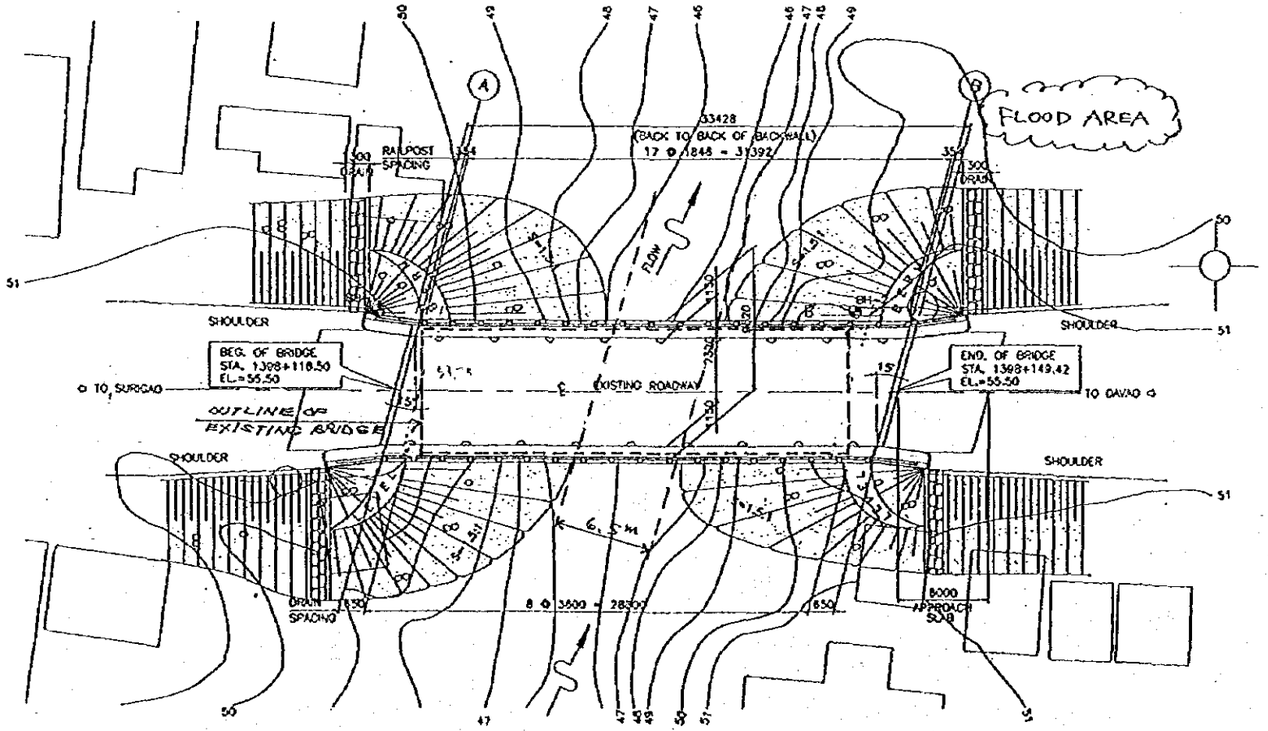
- **PROTECTION WORKS**

  Trimming of river bed is required to have a better stream flow and a grouted riprap slope protection with maximum slope of 1.553:1 is to be constructed.

BANLAG BRIDGE



ELEVATION
SCALE 1:400



P L A N
SCALE 1:900

Required Top of Roadway Elevation :

MFWL	=	52.50 m
Vertical Clearance	=	1.00 m
Depth of Superstructures	=	2.00 m
Top Elevation	=	55.50 m or more

BANLAG BRIDGE

LIBOGANON BRIDGE (PACKAGE 17)

- **HORIZONTAL ALIGNMENT**

  The Proposed New Bridge horizontal alignment was shifted 12.00m rightside/upstream from existing bridge. Existing bridge will serve as a detour during construction.

- **VERTICAL ALIGNMENT/TOP OF ROADWAY ELEVATION**

  The top of roadway elevation of Proposed New Bridge depend on the Minimum Free board/Clearance of 1.50m between bridge bottom of girder to hydraulic calculation of Maximum Flood Water Level of the stream. Vertical alignment of this proposed bridge lies on vertical curve.

- **BRIDGE/SPAN LENGTH**

  Proposed new bridge is a Single Span Type V AASHTO Girder which have same length of existing bridge (32.00m). Single span bridge was adopted to eliminate construction of piers at river not only to expedite or shorten construction period but also to avoid obstruction of stream flow.

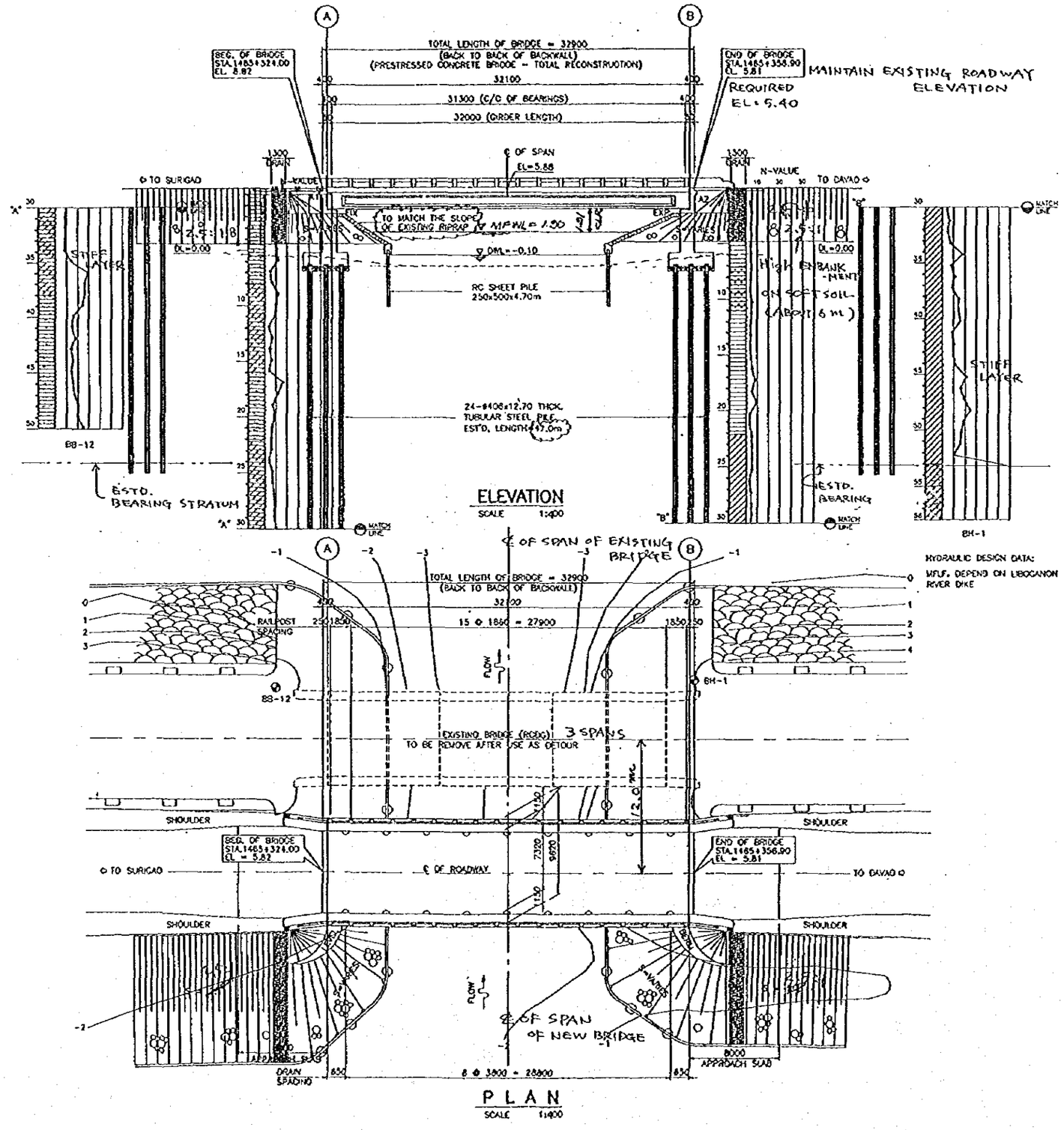
- **ABUTMENT/PILE FOUNDATION**

  Subsurface soil investigation indicate than soil bearing stratum is so deep and use of 400mm x 400mm Prestressed or Precast Concrete Piles is not advisable because it takes time for splicing not only prolonging construction period but you won't sure that the piles will not buckle during driving because of it's long unsupported length. Cast-in place piles or bored piles is also suitable but construction period make longer and maybe expensive. Steel Tubular Piles is advisable to use not only easy to handle but it can penetrate to some stiff layer between bearing stratum and less buckling.

- **PROTECTION WORKS**

  Since both abutments is to be constructed on high embankment and characteristic of soil beneath the new embankment is so poor, precast concrete piles should be driven around the abutments. Grouted riprap slope protection should have a slope of 2.5:1.

LIBOGANON BRIDGE



HYDRAULIC DESIGN DATA:
MFWL DEPEND ON LIBOGANON RIVER DIKE

Required Top of Roadway Elevation :

MFWL	=	1.90 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	2.00 m
Top Elevation	=	5.40 m or more

LIBOGANON BRIDGE

GOV. MIRANDA BRIDGE (PACKAGE 18)

- **HORIZONTAL ALIGNMENT**

  Two alternate route had been proposed and studied considering also the construction of dikes on both of the river bank. Proposed new bridge abutments are located/position such that it will lie on the propose dike.

- **VERTICAL ALIGNMENT**

  Since the bridge site is a flooded area construction of high embankment on both approach is a necessity. Computed Maximum Flood Water Level (MFWL) is on EL = 5.00 which is 5.00m high to ordinary water level (OWL) EL = 0.00.

- **BRIDGE/SPAN LENGTH**

  Total bridge length (back to back of backwall) was 650.00m long with a 60.00m width that is under stream flow during ordinary season or ordinary water level (OWL).

  Since the proposed new bride is considerably long, four alternative schemes were proposed and evaluated with construction cost as established criteria. The four (4) schemes included are;

  1. Scheme 1 - 18 equal spans of 36.11m of Type V AASHTO Girder
  2. Scheme 2 - 16 equal spans of 40.63m of Type VI AASHTO Girder
  3. Scheme 3 - 14 equal spans of 46.40m of Type VI (Modified) AASHTO Girder
  4. Scheme 4 - 14 equal spans of 46.40m of Steel Plate Girder

- **ABUTMENT/PIER PILE FOUNDATION**

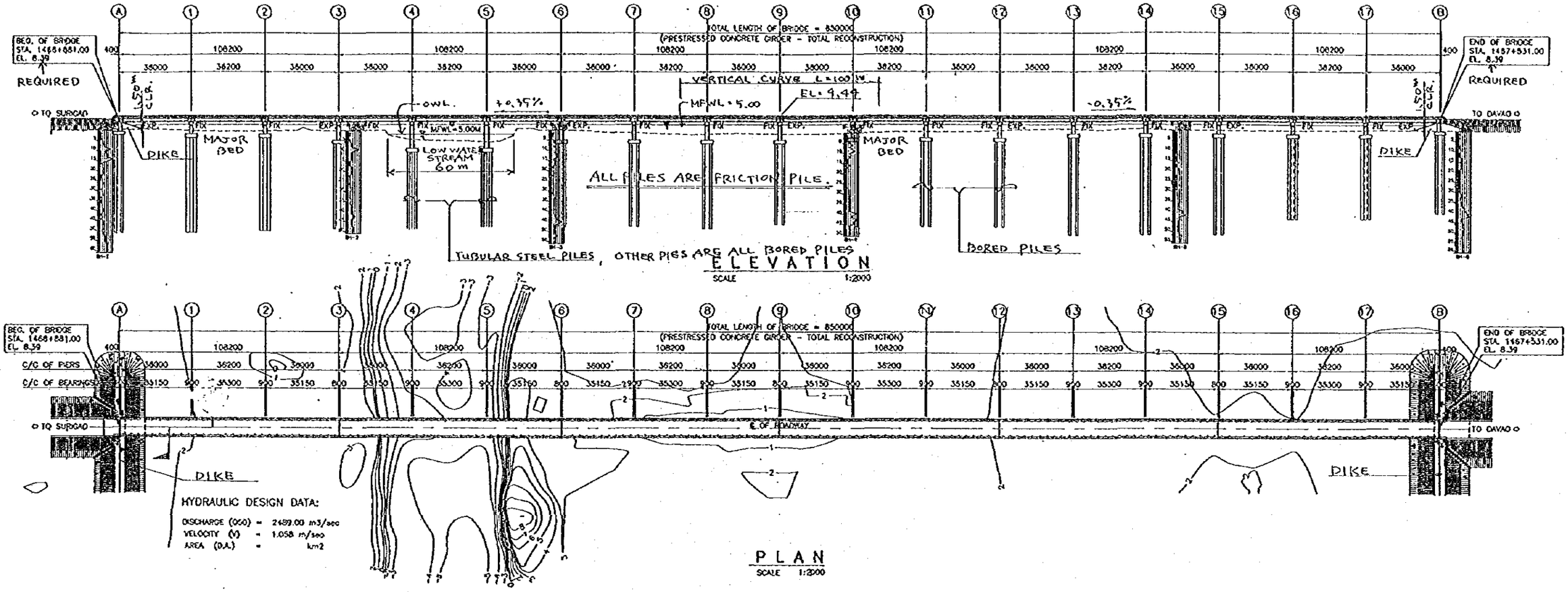
  Abutment and pier footings are in Cast-in Place Piles or Bored Piles Foundation except piers 4 & 5 which are on Steel Tubular Piles because they are on shore or under stream flow piers. Comparative cost between 1.20m Cast-in Place/Bored Piles & ϕ0.40m Steel Tubular Piles showed that Steel Tubular Piles is more expensive on this particular required length and number of piles and that the reason why Bored Piles are adopted.

- **PROTECTION WORKS**

  Constructon of dike on both river bank are necessary to protect further erosion @ downstream.

GOVERNOR MIRANDA BRIDGE (18 SPANS)

FOUR (4) ALTERNATIVE SCHEMES WERE STUDIED



GOVERNOR MIRANDA

Required Top of Roadway Elevation :

MFWL	=	5.00 m
Vertical Clearance	=	1.50 m
Depth of Superstructures	=	1.89 m
Top Elevation	=	8.39 m or more

ILANG BRIDGE (PACKAGE 18)

- **HORIZONTAL ALIGNMENT**

  The Proposed New Bridge horizontal alignment was shifted 5.00m (center to center of New Bridge and existing bridge) leftside/downstream of existing bridge with a 20° skew so that abutment wall will be parallel to stream flow. Since the location is on urban area (Town Proper) and existing road is already four (4) lanes on Davao side, the new bridge will be also a four (4) lanes of wider sidewalks to accommodate pedestrians thus, existing bridge will be totally encroached. Best engineering construction method will be apply here because no available site to construct detour road/bridge. Existing bridge will serve detour bridge in construciton the first two lanes and then it will be demolish after the new two lanes are possible for the construction of the last two lanes.

- **VERTICAL ALIGNMENT/TOP OF ROADWAY**

  Raising of grade was necessary to satisfy the required Minimum Clearance/Free board of 1.50m between the bottom of girder of Proposed Bridge to Maximum Flood Water Level.

- **BRIDGE/SPAN LENGTH**

  Proposed new bridge have a total length of 23.95m from back to back of backwall, Single Span composed of eight (8) Type IV AASHTO Girders.

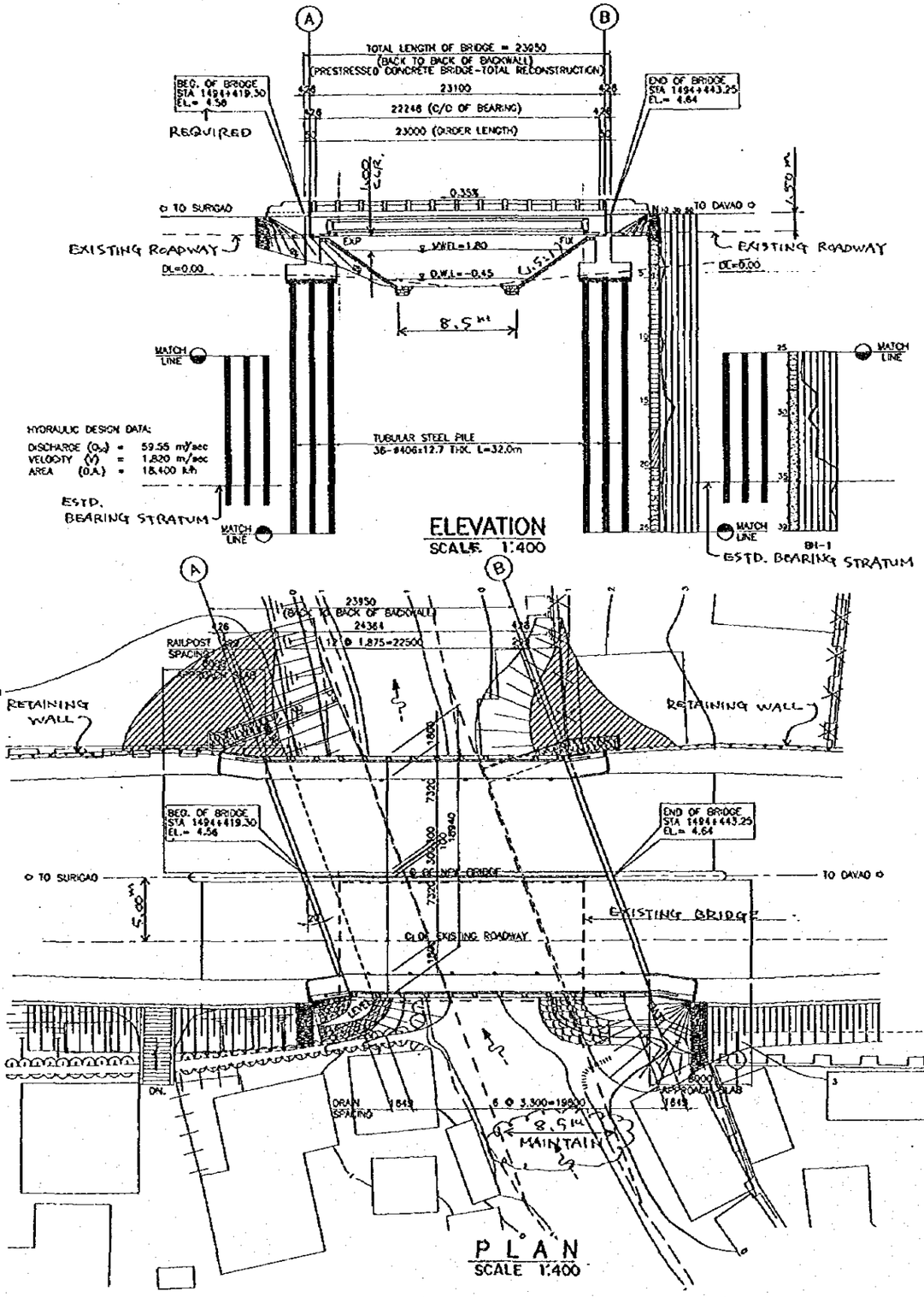
- **ABUTMENT/PILE FOUNDATION**

  Abutment is a seat type on a Steel Tubular Pie Foundation of estimated length of 32.00m. A 400mm x 400mm Prestressed or Precast Concrete Piles is not suitable due to presence of stiff layer between bearing stratum as shown on the boring log data and occurrence of buckling of piles during driving because of it's long unsupported length. Splicing of piles (limited casting length) will also prolong construction period. Cast-in place or Bored Piles is suitable but preparation/construction will take also a considerable construction period.

- **PROTECTION WORKS**

  Provision of grouted riprap slope protection at both are necessary.

ILANG BRIDGE



Required Top of Roadway Elevation :

MFWL	=	1.80 m
Vertical Clearance	=	1.00 m
Depth of Superstructures	=	1.76 m
Top Elevation	=	4.56 m or more

ILANG BRIDGE