

GENERAL CONSTRUCTION STAGING

- TUNNEL CONSTRUCTION SHALL BE UNDERTAKEN WITH THE NORTH SEGMENT AS STAGE 1 AND THE SOUTH SEGMENT SECOND AS STAGE 2.
- THE CONTRACTOR SHALL PREPARE AND SUBMIT HIS STRUCTURAL EXCAVATION AND SHORING SAFE WORKING PLAN TO THE CONTRACT ADMINISTRATOR FOR REVIEW A MINIMUM OF TWO WEEKS BEFORE THE COMMENCEMENT OF WORK.
- INITIAL SURFACE GRADING EXCAVATION AND THE INSTALLATION OF STAGE 1 GROUNDWATER DEPRESSURIZATION SYSTEMS AS DETAILED IN THE CONTRACT DOCUMENTS SHALL BE COMPLETED PRIOR TO THE COMMENCEMENT OF STRUCTURAL EXCAVATION AND SHORING SYSTEMS FOR STAGE 1.
- STAGE 1A, THE SHEET PILE COFFERDAM SECTION SHALL BE UNDERTAKEN FIRST. IF DESIRED THE CONTRACTOR MAY ALSO PROCEED WITH THE INSTALLATION OF CANTILEVER SHORING AND BRACED SHORING SYSTEMS IN STAGE 1B AT THIS TIME AS LONG AS CONSTRUCTION ACCESS TO THE STAGE 1A IS NOT COMPROMISED.
- FOLLOWING STAGE 1B, STAGE 1C MAY PROCEED IN A SOUTHERLY DIRECTION UP TO STATION 11+940 AT WHICH POINT FURTHER SHORED EXCAVATION CANNOT PROCEED UNTIL THE CONCRETE TUNNEL SECTION IN STAGE 1A IS COMPLETE AND ATTAINED A CONCRETE STRENGTH OF 85% OF ITS SPECIFIED 28 DAY STRENGTH.
- ONCE THE NEW CONCRETE TUNNEL HAS MET THE STRENGTH REQUIREMENTS THEN STAGE 1C SHORING INSTALLATION AND EXCAVATION MAY PROCEED TOWARDS THE COFFERDAM SECTION.
- REMOVAL OF THE NORTH FACE COFFERDAM SHEETING AND THE INSTALLATION OF THE SOLDIER PILE SHORING SYSTEM SHALL BE COORDINATED TO PROVIDE ADEQUATE SUPPORT TO ACTIVE SHORED EXCAVATION FACES AT ALL TIMES.
- AFTER THE COMPLETION OF THE TUNNEL CONSTRUCTION IN STAGE 1 AND THE INSTALLATION OF TEMPORARY TUNNEL SHORING SYSTEMS, STAGE 2 RAIL DIVERSION WILL BE COMPLETED BY OTHERS.
- INITIAL SURFACE GRADING EXCAVATION AND THE INSTALLATION OF STAGE 2 GROUNDWATER DEPRESSURIZATION SYSTEMS AS DETAILED IN THE CONTRACT DOCUMENTS SHALL BE COMPLETED PRIOR TO THE COMMENCEMENT OF THE STRUCTURAL EXCAVATION AND SHORING SYSTEMS FOR STAGE 2.
- STAGE 2 STRUCTURAL EXCAVATIONS AND SHORING INSTALLATIONS SHALL PROCEED FROM SOUTH TO NORTH WITH STAGES 2A, 2B, 2C, AND STAGE 2D, THE INTERFACE SHEET PILE COFFERDAM SECTION BEING COMPLETED LAST.
- THE CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT THE COMPLETED WORKS INCLUDING NEW AND EXISTING STORM DRAINAGE AND MAINTAIN TEMPORARY DEWATERING SYSTEMS WITHIN THE LIMITS OF HIS CONTRACT WORK AREAS FOR THE DURATION OF THE PROJECT.

CANTILEVER SOLDIER PILE PROCEDURE

- CANTILEVER SOLDIER PILES SHALL BE INSTALLED BY DRIVING THE STEEL PILE INTO UNDISTURBED GROUND SO THAT EMBEDDED PILE DEPTH IS TWICE THE LENGTH OF THE HEIGHT OF THE SOIL FACE THE WALL IS RETAINING.
- REMOVAL OF SOIL TO THE BOTTOM OF EXCAVATION MAY BE COMPLETED BY AUGERING PRIOR TO DRIVING THE STEEL PILE INTO UNDISTURBED MATERIAL.
- ALL EXCAVATION OF CANTILEVER SOLDIER PILES SHALL INCLUDE THE CONTINUOUS INSTALLATION OF SPECIFIED LAGGING AND COMPACTED BACKING SAND. THE MAXIMUM DEPTH OF EXPOSED OPEN FACE EXCAVATION BETWEEN SOLDIER PILES SHALL BE 1500 PRIOR TO THE INSTALLATION OF LAGGING AND SAND BACKFILL. THE CONTRACTOR SHALL MONITOR AND INSURE SAND BACKFILL REMAINS IN PLACE ON A DAILY BASIS AND RECTIFY ANY LOSS OF MATERIAL BEHIND THE LAGGING.
- ALL CANTILEVER STEEL SOLDIER PILES SHALL BE REMOVED AFTER THE SHORING IS NO LONGER REQUIRED IN THE SPECIFIC AREAS THAT THEY WERE EMPLOYED.

COFFERDAM CONSTRUCTION PROCEDURE

- THE CONTRACTOR SHALL STRICTLY ADHERE TO THE LIMITS OF THE WORK AREA. UNDER NO CIRCUMSTANCES SHALL CONSTRUCTION EQUIPMENT OR PART THEREOF APPROACH NEARER THAN 5 METRES FROM THE CENTERLINE OF ANY TRACK IN SERVICE.
- THE SHEET PILING AND INTERIOR COLUMN SUPPORTS SHALL BE INSTALLED AS SHOWN ON THE DRAWINGS. INDIVIDUAL SHEET PILES SHALL BE DRIVEN TO REFUSAL IN BEDROCK SURFACE. THE MINIMUM EXTENSION OF SHEET PILE BELOW THE UNDERSIDE OF THE TUNNEL FLOOR SLAB SHALL NOT BE LESS THAN 3000. THE CONCRETE CAISSON PORTION OF THE BRACING INTERIOR SUPPORT COLUMNS SHALL BE ENCASED IN A MINIMUM 3000 LENGTH OF 712 DIAMETER CONCRETE CAISSON BELOW THE UNDERSIDE OF THE CONCRETE BASE SLAB. THE TIP ELEVATION SHALL BE A MINIMUM OF 500 ABOVE BEDROCK AS ESTABLISHED BY THE INSTALLATION OF THE SHEET PILING. THESE COLUMNS DO NOT REQUIRE SLEEVES AS THEY WILL BE CAST INTO THE TUNNEL BASE SLAB.
- THE EXCAVATION SHALL PROCEED WITHIN THE COFFERDAM TO AN ELEVATION APPROXIMATELY 2000 BELOW THE LEVEL OF THE TOP OR FIRST BRACING LEVEL. ALL CROSS BRACING STEEL SYSTEMS SHALL THEN BE STACKED AND SUITABLY SECURED WITHIN THE EXCAVATION IN THE ORDER IN WHICH THEY WILL BE INSTALLED. A SPLICE DETAIL FOR THE INTERIOR BRACE MEMBERS IS SHOWN IN THE DRAWINGS IN ORDER THAT THE CONTRACTOR CAN SELECT SUITABLE MEMBER LENGTHS FOR HANDLING. SPLICES SHALL BE LOCATED WITHIN 1 METRE OF A COLUMN LOCATION IN THE INTERIOR BRACING SYSTEM. THE TRANSVERSE (PERPENDICULAR TO THE TUNNEL CENTERLINE) BRACES MAY BE SPLICED ONCE IF DESIRED AND THE LONGITUDINAL (PARALLEL TO THE TUNNEL CENTERLINE) MAY BE SPLICED TO LIMIT MEMBER LENGTH NOT LESS THAN 10 METRES. THE CONTRACTOR SHALL SUBMIT HIS BRACING SPLICING PLANS PART OF THE STRUCTURAL EXCAVATION AND SHORING SAFE PLAN TO THE CONTRACT ADMINISTRATOR FOR REVIEW.
- IT IS RECOMMENDED THAT THE CONTRACTOR ALSO STACK THE LONGER TUNNEL CONCRETE STRUCTURE REINFORCING BARS AT THE BOTTOM OF THE EXCAVATION AND BELOW BRACING FRAMES THAT WOULD BE DIFFICULT TO PLACE THROUGH THE COFFERDAM INTERIOR BRACING SYSTEMS. THIS REINFORCING STEEL SHALL BE SUITABLY SECURED, BUNDLED AND WRAPPED TO PROTECT THE GALVANIZED SURFACE PROTECTION DURING THE COFFERDAM EXCAVATION PROCESS.
- THE UPPER BRACING SYSTEM SHALL BE INSTALLED, WELDED CONNECTIONS COMPLETED AND SHIMMED TIGHT TO THE SHEET PILE PERIMETER. SHIMMING SYSTEMS SHALL BE STEEL OR HARDWOOD AND MECHANICALLY HELD IN POSITION IN A MANNER APPROVED BY THE CONTRACT ADMINISTRATOR.
- SIMILAR PROCEDURES SHALL FOLLOW FOR THE INSTALLATION OF THE MIDDLE AND LOWER BRACING SYSTEMS WITH THE EXCEPTION THAT EXCAVATION BELOW BRACE LEVEL SHALL NOT EXCEED 750mm PRIOR TO BRACE INSTALLATION. THE CONTRACTOR SHALL SUBMIT HIS STRUCTURAL EXCAVATION AND SHORING SAFE WORK PLAN FOR REVIEW BY THE CONTRACT ADMINISTRATOR A MINIMUM OF TWO WEEKS BEFORE THE COMMENCEMENT OF WORK. ALL TEMPORARY SUPPORT SYSTEMS EMPLOYED TO SUSPEND COFFERDAM BRACING MEMBERS AND TUNNEL REINFORCING STEEL BUNDLES SHALL BE DESIGNED BY A STRUCTURAL ENGINEER RETAINED BY THE CONTRACTOR AND REGISTERED IN THE PROVINCE OF MANITOBA. THE CONTRACTOR SHALL SUBMIT A SEALED COPY OF THESE TEMPORARY SYSTEMS AND PROCEDURES TO THE CONTRACT ADMINISTRATOR FOR REVIEW AS PART OF HIS SAFE WORK PROCEDURES.
- THE EXCAVATION BELOW WALER BRACING SHALL PROCEED BY REMOVAL OF MATERIAL IN A MAXIMUM 2.5 METRE WIDE TRENCH IN EACH BRACING BAY RUNNING PERPENDICULAR TO THE TUNNEL CENTERLINE TO LEVEL 400 BELOW BOTTOM OF LOWEST PORTION THE TUNNEL FLOOR SLAB. UPON COMPLETION OF THE EXCAVATION OF EACH TRENCH THE CONTRACTOR SHALL IMMEDIATELY FILL THE TRENCH WITH 30 MPa WORKING BASE CONCRETE TO THE LEVEL OF THE UNDERSIDE OF TUNNEL FLOOR SLAB. NO TRENCH SHALL BE PERMITTED TO STAY OPEN OVERNIGHT OR BETWEEN WORK SHIFTS. THIS CONCRETE TRENCH INSTALLATION SHALL PROCEED FROM THE NORTH FACE OF THE COFFERDAM TO THE INTERFACE JOINT.
- AFTER COMPLETION OF THE CONCRETE TRENCHES THE 2 METRE STRIP BETWEEN THEM MAY BE EXCAVATED AND FILLED WITH 30 MPa CONCRETE. THIS OPERATION SHALL ALSO PROCEED FROM THE NORTH END OF THE COFFERDAM TO THE INTERFACE JOINT.
- ALL COFFERDAM BRACING SYSTEMS SHALL BE CAST INTO THE TUNNEL FLOOR SLAB, WALLS AND ROOF SLAB WHERE INTERFACES EXIST. AS THE TOP BRACING LEVEL IS ABOVE THE ROOF SLAB THE TRANSVERSE BRACING SHALL BE CAST INTO THE ROOF UPSTAND RETAINING WALL AS SHOWN ON THE DRAWINGS. A 100mm STYROFOAM SURFACE BLOCKOUTS SHALL BE EMPLOYED FOR REMOVAL OF STEEL SECTIONS AND PATCHING AFTER THE BRACING IS NO LONGER REQUIRED.
- ONCE THE TUNNEL CONCRETE HAS ATTAINED ITS SPECIFIED 28 DAY STRENGTH AND EXTERIOR WATERPROOFING AND DRAINAGE SYSTEMS HAVE BEEN INSTALLED THE TUNNEL WALLS SHALL BE BACKFILLED. DURING THIS OPERATION THE BRACING STRUTS OUTSIDE OF THE WALL SHALL BE CUT OFF AND THE WALLS SHALL BE PATCHED WITH A PRE-BAGGED GROUT AND PEA GRAVEL AGGREGATE MIXTURE AND WATERPROOFED. THE UPPER BRACING SYSTEM SHALL ALSO BE REMOVED EXCEPT WHERE IT IS REQUIRED FOR THE STAGE 2 COFFERDAM. THE STAGE 1A COFFERDAM BRACING BELOW THE NEW TUNNEL ROOF SLAB AND WITHIN THE TUNNEL WALLS WILL BE REQUIRED TO PROVIDE SUPPORT FOR THE STAGE 2 COFFERDAM CONSTRUCTION.
- ADDITIONAL SHORING STEEL COLUMN SUPPORTS AS SHOWN ON THE DRAWINGS SHALL BE INSTALLED BY THE CONTRACTOR TO PROVIDE SUPPORT TO THE NEW STAGE 1 TUNNEL ROOF SLAB UNTIL SUCH TIME AS STAGE 2 TUNNEL AND STAGE 1 TUNNEL ARE STRUCTURALLY JOINED AND ALL CONCRETE HAS REACHED ITS DESIGN STRENGTH.
- THE STAGE 2 SHEET PILE COFFERDAM SECTION SHALL BE COMPLETED LAST. THE SOUTH FACE OF STAGE 1A COFFERDAM WILL BE USED IN STAGE 2D COFFERDAM. THE CONTRACTOR SHALL WITHDRAW ONLY THOSE SHEET PILES NECESSARY FOR THE INSTALLATION OF BRACING SYSTEMS OR HE MAY ALSO CUT HOLES IN THE SHEET PILES TO FACILITATE INSTALLATION OF THE STAGE 2 BRACING SYSTEMS. THE CONTRACTOR SHALL INSURE THAT ALL BRACING AND HORIZONTAL WALER BEAMS AT EACH LEVEL ARE ADEQUATELY SUPPORTED DURING THIS OPERATION. SHEET PILE SECTIONS AT THE INTERFACE NOT REQUIRED FOR PROVIDING VERTICAL SUPPORT TO THE HORIZONTAL BRACING MAY BE PULLED FOR MATERIAL RECOVERY OR MAY BE CUT OFF WHEN NO LONGER REQUIRED TO RETAIN SOIL OR PROVIDE VERTICAL SUPPORT TO INTERIOR BRACING SYSTEMS.

SOLDIER PILE SHORING CONSTRUCTION PROCEDURE

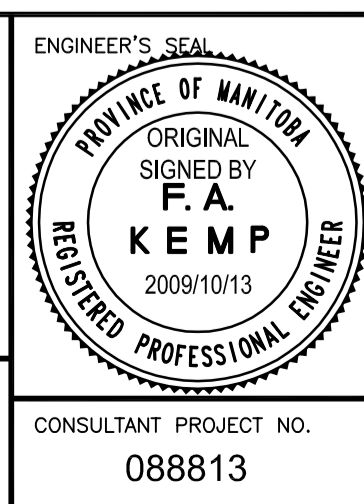
- AFTER COMPLETION OF INITIAL SURFACE GRADING EXCAVATION THE SOLDIER PILES SHALL BE EMBEDDED IN 712 DIAMETER CONCRETE CAISSON DRILLED TO BEDROCK AS SHOWN ON THE DRAWINGS. ALL SOLDIER PILES SHALL BE SLEEVED IN THE CONCRETE ENCASEMENT AS SHOWN ON THE DRAWINGS TO PERMIT EXTRACTION FOR RE-USE IN LATTER INSTALLATIONS. THE MINIMUM EMBEDMENT OF THE SOLDIER PILE BELOW THE UNDERSIDE OF THE CONCRETE WORKING BASE TO BEDROCK LEVEL SHALL BE 3000.
- THE INTERIOR SHORING COLUMNS SHALL BE ENCASED IN A MINIMUM 2500 LENGTH OF 712 DIAMETER CONCRETE CAISSON BELOW THE UNDERSIDE OF THE CONCRETE WORKING BASE. THE TIP ELEVATION OF THESE SHORING COLUMNS SHALL BE A MINIMUM OF 500 ABOVE BEDROCK AS ESTABLISHED BY THE INSTALLATION OF THE SOLDIER PILES. THESE SHORING COLUMNS DO NOT REQUIRE SLEEVES AS THEY WILL BE CAST INTO THE TUNNEL BASE SLAB.
- ALL EXCAVATION OF SOLDIER PILES SHALL INCLUDE THE CONTINUOUS INSTALLATION OF SPECIFIED LAGGING AND COMPACTED BACKING SAND. THE MAXIMUM DEPTH OF EXPOSED OPEN FACE EXCAVATION BETWEEN SOLDIER PILES SHALL BE 1500 PRIOR TO THE INSTALLATION OF LAGGING AND SAND BACKFILL. THE CONTRACTOR SHALL MONITOR AND INSURE SAND BACKFILL REMAINS IN PLACE ON A DAILY BASIS AND RECTIFY ANY LOSS OF MATERIAL BEHIND THE LAGGING.
- EXCAVATION SHALL PROCEED TO LEVEL 900 BELOW THE LEVEL OF THE UPPER OR FIRST BRACING SYSTEM AND BRACING SYSTEMS SHALL BE STACKED AND BLOCKED IN POSITION. THE UPPER OF FIRST BRACING SYSTEM AND WALERS SHALL BE INSTALLED AND ALL STRUCTURAL CONNECTIONS COMPLETED AND SHIMMED TIGHT TO THE SOLDIER PILES. THE LOWER BRACING SYSTEM SHALL THEN BE TEMPORARILY SUPPORTED OR HUNG FROM THE UPPER BRACE. TEMPORARY SUPPORT SYSTEMS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. HE SHALL RETAIN A STRUCTURAL PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF MANITOBA TO DESIGN ALL TEMPORARY SUPPORT SYSTEMS. THESE DESIGNS SHALL BE SUBMITTED TO THE CONTRACT ADMINISTRATOR AS PART OF THE CONTRACTOR'S STRUCTURAL EXCAVATION AND SHORING SAFE WORKING PLAN FOR REVIEW AT LEAST TWO WEEKS PRIOR TO THE COMMENCEMENT OF THE INSTALLATION OF SOLDIER PILE SHORING SYSTEMS.
- THE EXCAVATION SHALL PROCEED TO THE LOWER OR SECOND BRACING LEVEL AND THE SECOND BRACING SYSTEM SHALL BE LOWERED INTO POSITION AND ALL STRUCTURAL CONNECTIONS COMPLETED AND THE WALERS SHALL BE SHIMMED TIGHT TO THE SOLDIER PILES. SHIMMING SHALL BE COMPLETED USING STEEL OR HARDWOOD SHIMS AND ALL SHIMS SHALL BE MECHANICALLY HELD IN PLACE IN A MANNER THAT HAS BEEN REVIEWED BY THE CONTRACT ADMINISTRATOR.
- EXCAVATION BELOW THE LOWER BRACING SYSTEM SHALL THEN PROCEED IN THE SECTION BETWEEN BRACING FRAMES TO ALLOW FOR THE INSTALLATION OF A 30 MPa WORKING BASE SLAB THAT HAS A MINIMUM THICKNESS OF 400 mm AT ITS LOWEST POINT. THE WORKING BASE EXCAVATION AND INSTALLATION OF CONCRETE MUST BE COMPLETED DURING A SINGLE WORK SHIFT.
- ONCE THE WORKING BASE INSTALLATION BETWEEN BRACE BAYS HAS ACHIEVED 85% OF ITS 28 DAY STRENGTH, THE EXCAVATION FOR THE INSTALLATION OF WORKING BASE DIRECTLY BELOW THE BRACE BAYS MAY PROCEED. THE EXCAVATION AND INSTALLATION OF THE WORKING BASE MUST BE COMPLETED IN A SINGLE WORK SHIFT.
- ONCE THE TUNNEL FLOOR SLAB HAS BEEN COMPLETED AND ACHIEVED 85% OF ITS 28 DAY DESIGN STRENGTH, STRUCTURAL WELL-COMPACTED BACKFILL SHALL BE PLACED TO WITHIN 100 mm OF THE TOP OF THE TUNNEL FLOOR SLAB. IN ADDITION 200 x 200 SOLID FIR POSTS SHALL BE INSTALLED BETWEEN EACH SOLDIER PILE AND THE TUNNEL FLOOR SLAB. THE LOWER BRACING FRAME MAY THEN BE REMOVED FOR THE CONSTRUCTION OF THE TUNNEL WALLS WHERE APPLICABLE FOR THE TWO BRACE LEVEL SOLDIER PILE INSTALLATIONS.
- IN ALL SOLDIER PILE INSTALLATIONS THE TUNNEL CONCRETE WALLS HAVE BEEN DESIGNED TO RETAIN THE FILL PRIOR TO THE INSTALLATION OF THE TUNNEL ROOF SLAB. THIS WILL PERMIT REMOVAL OF THE INTERIOR BRACES SEQUENTIALLY WITH INSTALLATION OF THE WALL WATERPROOFING AND STRUCTURAL BACKFILL. THE TUNNEL ROOF SLAB CONSTRUCTION CAN THEN BE UNDERTAKEN WITHOUT THE HINDRANCE OF INTERNAL SHORING BRACING.
- REMOVAL AND SALVAGE OF THE STEEL SOLDIER PILES WILL BE UNDERTAKEN AT THE COMPLETION OF THE TUNNEL CONCRETE WORK. ALL VOIDS SHALL BE FILLED WITH SAND AND WATER COMPACTED.

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LOCATION UNDERGROUND	APPROVED STRUCTURES	B.M. ELEV.	DESIGNED BY	FK
SUPV. U/G STRUCTURES COMMITTEE	DATE		DRAWN BY	CAA
			CHECKED BY	RE/KC
			APPROVED BY	EBL
			HOR. SCALE	AS NOTED
			VERTICAL	
0	ISSUED FOR TENDER	10.13.09	CAA	
NO.	REVISIONS	DATE	BY	DATE
				2009.10.13



THE CITY OF WINNIPEG TRANSIT DEPARTMENT	
SOUTHWEST RAPID TRANSIT CORRIDOR - STAGE 1 TRANSITWAY TUNNEL AT CN RIVER SUBDIVISION MILEAGE 1.38 & ASSOCIATED WORKS	
CITY DRAWING NUMBER	U237-09-13A
SHEET OF	13A OF 73
CONSULTANT DRAWING NUMBER	C4-S1001A-T
GENERAL NOTES CONSULTANT PROJECT NO. 088813	