#### **Tool Kit Overview**

THIS TOOL KIT IS INTENDED TO INDICATE DETAILS THAT WERE SUCCESSFUL IN PAST PROJECTS AND TO INDICATE LEVEL OF DETAIL REQUIRED IN THE BID DOCUMENTS. THESE DETAILS ARE NOT 'CUT AND PASTE' FOR ALL

EACH SUPPORT SHOULD HAVE A CONSTRUCTION REFERENCE NOTE REFERRING TO A SECTION DETAIL. SUPPORTS THAT ARE IDENTICAL MAY USE THE SAME NOTE AND SECTION DETAI (AS IN CONSTRUCTION REFERENCE NOTES 5 AND 6). NOT ALL SUPPORTS HAVE BEEN DETAILED FOR THIS EXAMPLE.

GIVE EXISTING CONDITIONS TO SUPPORT ACCURATE BIDDING. CONSULT AEC FOR AVAILABLE DRAWING AND/OR LASER SCAN FILES. DESIGN PRESSURES:

THE DESIGN PRESSURE OF THE SOURCE STEAM PIPING IS AT 80 PSIG FOR THE NOMINAL 60 PSIG STEAM SYSTEM(HPS); AND 15 PSIG FOR THE NOMINAL 9 PSIG STEAM SYSTEM LPS & HPC 40 PSIG FOR PUMPED CONDENSATE (PC) 15 PSIG FOR LOW PRESSURE CONDENSATE (LPC)

# **DESIGN TEMPERATURES:**

NOMINAL 60 PSIG(HPS) - 320 F NOMINAL 9 PSIG(LPS) & HPC - 260 F 1 HR EXCURSION - HPS AND LPS - 450 F

CONTRACTOR TO CONSULT WITH A STRUCTURAL ENGINEER TO DESIGN ALL TEMPORARY PIPING SUPPORTS. SUBMIT DETAILS FOR OWNER REVIEW AND APPROVAL.

**HYDRO TEST PRESSURE:** HIGH PRESSURE STEAM (60#) - 130 PSIG

PUMPED CONDENSATE (PC) - 60 PSIG LOW PRESSURE CONDENSATE (LPC) - 25 PSIG

#### **SOIL EROSION AND SEDIMENTATION CONTROL SEQUENCE:**

IN ACCORDANCE WITH RULE 1709 PROMULGATED UNDER THE AUTHORITY OF PART 91, SOIL EROSION AND SEDIMENTATION CONTROL, OF THE NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION ACT, 1994 PA 451, AS AMENDED, AND IN ADDITION TO THE INFORMATION IN THE PROJECT PLANS AND SPECIFICATIONS, THE FOLLOWING GENERAL CONDITIONS APPLY TO THE EARTH CHANGE AUTHORIZED BY THIS DOCUMENT:

- A. DESIGN, CONSTRUCT, AND COMPLETE THE EARTH CHANGE IN A MANNER THAT LIMITS THE EXPOSED AREA OF DISTURBED LAND FOR THE SHORTEST PERIOD OF TIME.
- B. REMOVE SEDIMENT CAUSED BY ACCELERATED SOIL EROSION FROM RUNOFF WATER BEFORE IT LEAVES THE SITE OF THE EARTH CHANGE.
- C. TEMPORARY OR PERMANENT CONTROL MEASURES SHALL BE DESIGNED AND INSTALLED TO CONVEY WATER AROUND, THROUGH OR FROM THE EARTH CHANGE AT A NON-EROSIVE VELOCITY.
- D. INSTALL TEMPORARY SOIL EROSION AND SEDIMENTATION CONTROL MEASURES BEFORE OR UPON COMMENCEMENT OF THE EARTH CHANGE ACTIVITY AND MAINTAIN THE MEASURES ON A DAILY BASIS. REMOVE TEMPORARY SOIL EROSION AND SEDIMENTATION CONTROL MEASURES AFTER PERMANENT SOIL EROSION MEASURES ARE IN PLACE AND THE AREA IS STABILIZED. ("STABILIZED" MEANS THE ESTABLISHMENT OF VEGETATION OR THE PROPER PLACEMENT, GRADING OR COVERING OF SOIL TO ENSURE ITS RESISTANCE TO SOIL EROSION, SLIDING, OR OTHER EARTH MOVEMENT.)
- E. COMPLETE PERMANENT SOIL EROSION CONTROL MEASURE FOR THE EARTH CHANGE WITHIN FIVE (5) CALENDAR DAYS AFTER FINAL GRADING OR UPON COMPLETION OF THE FINAL EARTH CHANGE. IF IT IS NOT POSSIBLE TO PERMANENTLY STABILIZE THE EARTH CHANGE, THEN MAINTAIN TEMPORARY SOIL EROSION AND SEDIMENTATION CONTROL MEASURES UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IN PLACE AND THE AREA IS STABILIZED.
- F. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING LANDSCAPING DURING THE WARRANTY PERIOD. AFTER THE WARRANTY HAS EXPIRED, THE PERMANENT SESC MEASURES WILL BE MAINTAINED BY THE UNIVERSITY OF MICHIGAN PLANT OPERATIONS GROUNDS & WASTE MANAGEMENT DEPARTMENT AND THE PLUMBING SHOP AS APPROPRIATE. THE GROUNDS & WASTE MANAGER WILL BE RESPONSIBLE FOR MAINTENANCE OF ANY PERMANENT LANDSCAPING SESC MEASURES. THE PLUMBING SHOP FOREMAN WILL BE RESPONSIBLE FOR THE MAINTENANCE OF ANY SESC MEASURES THAT ARE PART OF THE STORMWATER DRAINAGE SYSTEM PIPING.

#### SOIL EROSION AND SEDIMENTATION CONTROL MAINTENANCE NOTES:

- INSTALL TEMPORARY INLET FILTERS AT ALL ADJACENT AND DOWN-GRADIENT STORMWATER INLETS, CATCH BASINS AND MANHOLES THAT MAY BE IMPACTED. CATCH BASIN INLET FILTERS SHALL BE MAINTAINED CLEAN AT ALL TIMES THROUGHOUT THE CONSTRUCTION PERIOD. IF A FILTER HAS HOLES OR IS INUNDATED WITH SEDIMENT, THE FILTER WILL REQUIRE
- INSTALL AN ANTI-TRACKING PAD AT THE SITE ENTRY AND EXIT(S). THE ANTI-TRACKING PAD SHOULD BE CONSTRUCTED OF GEOTEXTILE FABRIC
- SILT FENCE SHALL BE MAINTAINED AT ALL TIMES THROUGHOUT THE CONSTRUCTION PERIOD. IF REPAIR OR REPLACEMENT IS NECESSARY, IT SHALL BE PERFORMED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS. MAINTENANCE INCLUDES THE REMOVING OF BUILT-UP SEDIMENT ACCUMULATES TO 1/2 THE HEIGHT OF THE FENCE. CONTRACTOR SHALL REMOVE, REPLACE, RETRENCH, OR RE-BACKFILL THE FENCE IF IT FAILS. ADDITIONALLY, THE CONTRACTOR SHALL REINSTALL ANY PORTION OF THE FENCING DAMAGED BY CONSTRUCTION MACHINERY.
- PLACE STOCKPILES AND OTHER SPOIL PILES AWAY FROM THE DRAINAGE SYSTEM TO MINIMIZE SEDIMENT TRANSPORT. IF THE STOCKPILE AND/OR SPOIL PILE MUST REMAIN ON-SITE OVERNIGHT, OR IF THE WEATHER CONDITIONS INDICATE THE CHANCE FOR PRECIPITATION, A) COVER THE PILE WITH WATER REPELLENT MATERIAL TO PREVENT EROSION AND/OR B) INSTALL SILT FENCING AROUND THE BASE OF THE PILE TO PREVENT TRANSPORT OF SEDIMENT TO THE STORMWATER SYSTEM, OR APPLY OTHER CONTROL METHODS APPROPRIATE TO THE SIDE. CONTROL MEASURES TO GUARD AGAINST WIND EROSION MUST ALSO BE EMPLOYED, SUCH AS WETTING OR COVERING THE STOCKPILES. KEEP AS FEW STOCKPILES AS POSSIBLE DURING THE COURSE OF THE PROJECT.
- THROUGHOUT THE CONSTRUCTION PERIOD, ALL MUD/SILT TRACKED ONTO EXISTING ROADS FROM THE SITE DUE TO CONSTRUCTION SHALL BE IMMEDIATELY REMOVED
- SEEDING OR OTHER STABILIZATION SHALL BE REQUIRED IMMEDIATELY TO AREAS WHICH HAVE BEEN DAMAGED BY RUNOFF.
- THE CONTRACTOR SHALL MAINTAIN DUST CONTROL ON THE SITE THROUGHOUT THE DURATION OF THE CONSTRUCTION PROCESS.
- WEEKLY INSPECTIONS BY A UNIVERSITY SESC TRAINED CERTIFIED STORMWATER MANAGEMENT OPERATOR AS WELL AS PERIODIC INSPECTIONS WITHIN 24 HOURS OF ANY RAINFALL WILL BE REQUIRED. THESE INSPECTIONS MAY RESULT IN RECOMMENDATIONS FOR ROUTINE MAINTENANCE OF THE SOIL EROSION CONTROL DEVICES, AS WELL AS ADDITIONAL CONTROLS.

#### NATEC TO DECICALED NOTES TO DESIGNER. THOSE KIT PLANS ARE INTENDED TO CONVEY THE LEVEL OF DETAILS

- EXPECTED IN THE CONSTRUCTION DOCUMENTS FOR TUNNEL 2 ALL SUPPORTS PRESENTED IN THE BID PACKAGE DRAWING SET
- SHALL BE NUMBERED. SUPPORTS WILL BE TAGGED/LABELED IN FIELD BY OWNER.
- 3 PROVIDE TYPICAL TUNNEL SECTION IN EACH PLAN SHEET. 4 ALWAYS LOCATE WATER LINES (VICTAULIC COUPLING) ON THE AISLE.
- PROVIDE ALUMINUM JACKET, IF SUBJECTED TO DAMAGE. 5 PROVIDE A SCHEDULE FOR VALVES AND EXPANSION JOINTS. OBTAIN TAG NUMBER FROM OWNER.REPLACEMENT VALVES AND JOINTS SHALL ADOPT EXISTING TAG NUMBER, VALVES AND JOINTS WILL BE TAGGED/LABELED IN FIELD BY OWNER CONTACT UTILITIES, MR. GEORGE GOOCH.
- 6 IN NEW TUNNELS PROVIDE ADEQUATE AISLE WIDTH FOR EASY TRANSPORTATION OF THE LARGEST EXPANSION JOINT. IN EXISTING TUNNELS, MAKE SURE EXPANSION JOINT CAN BE TRANSPORTED IF AISLE SPACE IS NOT ADEQUATE, ADDRESS THE PROBLEM AND PROVIDE A METHOD OF TRANSPORTATION
- 7 FOR ADDITIONAL KEY DESIGN CONSIDERATIONS FOR TUNNEL PROJECTS, REFER TO UM DESIGN GUIDELINES SECTION "SPECIAL BUILDING AREAS - H TUNNELS" (http://www.plantext.bf.umich.edu/desguide/sba.html)
- 8 PRIMARY GUIDE AND SECONDARY GUIDE SPACING SHALL BE PER EXPANSION JOINT MANUFACTURERS RECOMMENDATIONS. GUIDE INTEGRAL TO EXPANSION JOINTS, IF ANY, SHALL NOT BE CONSIDERED
- 9 PIPE SUPPORT SPACING REQUIREMENTS ARE INDICATED IN PIPE HANGER SPACING SCHEDULE, THIS SHEET.
- 10 THE INSULATION FOR CALCIUM SILICATE INSERT AT ALL SUPPORTS, ANCHORS, GUIDES, ROLLERS, SLIDES AND HANGERS SHALL MATCH PIPE INSULATION FOR ALL SERVICES.
- SURVEY PROPOSED SLIP JOINT LOCATION FOR INTERFERENCE BETWEEN PACKING PORTS AND ADJACENT PIPES. CUSTOMIZE PORT LOCATIONS IF JOINT CAN NOT BE RE-POSITIONED
- 12 CONSULT TUNNEL MAP TO IDENTIFY CONDENSATE TIE-IN LOCATION S PUMPED OR GRAVITY DRAIN; VERIFY EXISTING HEADER SLOPE IS CORRECT OR ADD CORRECTIONS TO PROJECT WORK SCOPE.
- 13 PROJECT IN CITY AND OR MDOT RIGHT-OF-WAY REQUIRES CLOSE COORDINATION, LONG LEAD TIME FOR APPROVAL, ALL CORRESPONDENCE SHALL BE THROUGH UofM.
- 14 COORDINATION WITH CITY AND UofM EVENTS, REQUIRED PROJECT IUTDOWNS SHALL BE CLEARLY IDENTIFIED

PIPING INSULATION THICKNESS TABLE						
PIPING SYSTEM FLUID TEMPERATURE RANGE DEG. F.		THICKNESS IN INCHES FOR PIPE SIZES LISTED				
		<1"	1" TO <1½"	1½" TO <4"	4" TO <8"	≥8"
HPS (60#)	251-350	3.0	4.0	4.5	4.5	4.5
LPS (15#)	201-250	2.5	2.5	2.5	3.0	3.0
STM. COND.	141-200	1.5	1.5	2.0	2.0	2.0
DHWS&R	110-140	1.0	1.0	1.5	1.5	1.5

THICKNESSES TO MEET ASHRAE 90.1-2010 U.N.O.

MECHANIA	CAL LEGEND
MECHANI	CAL LEGEND
— DHWS—	DOMESTIC HOT WATER SUPPLY
— DHWR—	DOMESTIC HOT WATER RETURN
——НРА——	HIGH PRESSURE AIR (15#)
——LPS ——	LOW PRESSURE STEAM (15#)
——LPC ——	LOW PRESSURE CONDENSATE (15#)
——HPS ——	HIGH PRESSURE STEAM (60#)
—— НРС ——	HIGH PRESSURE CONDENSATE (60#)
—— PC ——	PUMPED CONDENSATE
<b>—</b>	FLOW DIRECTION
$-\!$	VALVE
<b>─</b>	STEAM TRAP
—— <del> </del>	FLEXIBLE CONNECTION
∇ 	ROLLER
<b>————</b>	EXPANSION JOINT
— <del>×</del> —	ANCHOR
<del>=</del> -	GUIDE
	PIPE CLAMP
<del></del>	LINE STOP
<del></del>	SLIDE
<del></del>	REDUCER

PIPE HANGER SPACING SCHEDULE						
PIPE	ROD	SCREWED OR WELDED	GROOVED	NON-GROOVED COPPER PIPE	GROOVED	PVC OR PPL
SIZE	SIZE	STEEL PIPE MAXIMUM	STEEL PIPE MAXIMUM	MAXIMUM	COPPER PIPE MAXIMUM**	PIPE MAX
(IN)	(IN)	(FEET)	(FEET)	(FEET)	(FEET)	(FEET)
THRU 1"	36"	8'-0"	9'-0"	5'-0"	5'-0"	4'-0"
1¼" - 2"	36"	10'-0"	11'-0"	7'-0"	7'-0"	5'-0"
2½" - 3"	1/2"	12'-0"	15'-0"	10'-0"	10'-0"	6'-0"
4"	5%"	16'-0" *	17'-0" *	10'-0"	12'-0"	6'-0"
5" - 6"	34"	16'-0" *	20'-0" *	12'-0"	13'-0"	6'-0"
8" - 12"	<b>%</b> "	20'-0" *	21'-0" *			8'-0"
14" - 16"	1"	20'-0" *	21'-0" *			

- \* LIMIT HANGER SPACING TO 12'-0" FOR STEEL PIPE WHERE POSSIBLE. USE MAXIMUM SPACING VALUES ONLY WHERE LIMITED BY BUILDING STRUCTURAL ELEMENTS OR RESTRICTIONS
- \*\* GROOVED PIPING MAY REQUIRE CLOSER SPACING BASED ON PIPE SIZE AND LENGTH. REFER TO MANUFACTURER'S TECHNICAL

# Tunnels Tunnel Tool Kit

UNIVERSITY OF MICHIGAN 326 East Hoover, Mail Stop E

Ann Arbor, MI 48109-1002 Phone: 734-764-3414 Fax: 734-936-3334

U of M Project Number: P00009388

**Building Number: 1009980** 

University Of Michigan Ann Arbor, MI

### **DESIGNED BY:**

UNIVERSITY OF MICHIGAN

ARCHITECTURE & ENGINEERING 326 East Hoover, Mail Stop B Ann Arbor, MI 48109-1002 Phone: 734-764-3414 Fax: 734-936-3334

#### **WELDING REQUIREMENTS:** TUNNEL ENTRY PROTOCOL: SPECIFIC WELDER QUALIFICATIONS, WELD

SEE WEBSITE FOR TUNNEL ACCESS PROCEDURES AND REQUIREMENTS. SIGNED FORMS SHALL BE PROVIDED TO MR. DENNIS KRETIN PRIOR TO REQUESTING ACCESS.

#### **GENERAL MECHANICAL LEGEND**

NEW ITEM EXISTING ITEM ---- NEW ITEM, HIDDEN ---- EXISTING ITEM, HIDDEN ////////////// EXISTING ITEM TO BE REMOVED NEW CONNECTION TO EXISTING WORK NORTH ARROW SECTION SYMBOL (DIRECTION OF CUT VIEW; TOP-UNIQUE SEQUENTIAL LETTER TITLE: BOTTOM-LOCATION OF SECTION DRAWING) SECTION TITLE (TOP-CORRESPONDING LETTER TITLE; BOTTOM-REFERENCE DRAWING LOCATION) MATCH LINE INDICATOR

#### **General Notes**

- 1. ALL EXISTING PIPING AND EQUIPMENT LOCATIONS SHOWN ON THE DRAWINGS ARE GENERALLY ACCURATE, BUT CONSIDERED APPROXIMATE. THE CONTRACTOR SHALL VERIFY ALL SYSTEM INTERFACES AND TIE-IN POINTS PRIOR TO DEMOLITION AND PROJECT EXECUTION
- 2. DUE DILIGENCE AND CARE SHALL BE TAKEN TO AVOID DAMAGE TO EXISTING PLANT SYSTEMS AND EQUIPMENT THAT WILL REMAIN IN OPERATION THROUGHOUT THE PROJECT. CONTRACTOR SHALL PROTECT TO THE GREATEST EXTENT POSSIBLE ALL EXISTING PLANT FACILITIES LOCATED IN OR ADJACENT TO THE WORK AREAS. ANY INADVERTENT DAMAGE TO EXISTING FACILITIES SHALL BE CORRECTED AT THE CONTRACTOR'S EXPENSE, IN ACCORDANCE WITH, AND TO THE SATISFACTION OF THE OWNER'S REQUIREMENTS. DOCUMENT PRE-CONSTRUCTION CONDITIONS WITH PHOTOS
- 3. THE CONTRACTOR SHALL PROVIDE IMMEDIATE CLEAN-UP OF ALL CONSTRUCTION DEBRIS AND SPILLS. KEEP WORK AND STAGING AREAS CLEAN, NEAT, AND ORDERLY. CONTROL AND CONTAIN DUST WITH BARRIERS. FINAL CLEAN-UP REMOVAL OF ALL CONSTRUCTION-GENERATED WASTE AND DEBRIS, VACUUM DUST FROM PIPES, SUPPORTS AND FLOOR; WASH DOWN AND REMOVAL OF CONCRETE ACTIVITY SPILLS.
- 4. CONTRACTOR SHALL PLAN ALL WORK ACTIVITIES ON WEEKDAYS, MONDAY THROUGH FRIDAY, BETWEEN THE HOURS OF 6 A.M. AND 5 P.M., UNLESS SPECIAL OFF HOUR ARRANGEMENTS ARE APPROVED BY THE PLANT REPRESENTATIVE. THE CONTRACTOR SHALL ARRANGE A MEETING WITH TUNNEL REPRESENTATIVE, UM PROJECT MANAGER, TO DISCUSS ACCESS PRIOR TO START OF CONSTRUCTION.
- 5. CONTRACTOR SHALL PERFORM ALL NECESSARY WORK IN ENSURE EXISTING WATER MAINS IN CLOSE PROXIMITY OR IN TUNNEL PROJECT WORK AREAS ARE POSITIVELY ISOLATED OUT OF SERVICE, OR RE-LOCATED DURING CONSTRUCTION
- 6. CONTRACTOR SHALL INSTALL FULL-LENGTH LADDER, FROM TUNNEL FLOOR, EXTENDING ABOVE GRADE AND HATCH, MEETING MIOSHA STANDARDS. INSTALL REQUIRED FALL PROTECTION

#### TUNNEL QA/QC PROGRAM IN LIEU **OF COMMISSIONING:**

**OBTAINED FROM UTILITIES.** 

PROCEDURES, AND ASSOCIATED SUBMITTALS ARE AS DESCRIBED IN THE CUSTOM PIPING SPECIFICATION,

OBTAIN AND EDIT FROM UTILITIES QA/QC BOILER PLATE RFQ AND SUGGESTED BIDDER'S LIST, TO FIELD VERIFY PROPER WELDING, EXPANSION JOINT INSTALLATION, EXTERIOR CONCRÉTE WATER PROOFING, AND OTHER CRITICAL TUNNEL CONSTRUCTION REQUIREMENTS.

## Contacts

UM UTIL. SERV. MANAGER	MIKE SWANSON	734-763-3011
UM TUNNELS SR. SUPERVISOR	DENNIS KRETIN	734-323-8592
UM PROJECT MANAGER	TOM WALTERHOUSE	734-323-6011
UM CPP I&C	RON CAMPBELL	734-764-3476

# **Applicable Codes**

HPS - ASME B31.1 POWER PIPING LPS - ASME B31.9 BUILDING SERVICES PIPING MICHIGAN BUILDING CODE 2009 2012 MICHIGAN MECHANICAL CODE MICHIGAN PLUMBING CODE 2012 MICHIGAN ELECTRICAL CODE NATIONAL FIRE PROTECTION ASSOCIATION 101

CONSULTANT TO VERIFY CURRENT CODE VERSION ADOPTED BY U-M AT TIME OF PROJECT

## Sequencing Notes

CONSULTANT IS RESPONSIBLE TO IDENTIFY ALL BUILDINGS IMPACTED BY UTILITY OUTAGES NECESSARY TO PERFORM THE WORK. EACH IMPACTED BLDG REPRESENTATIVE SHALL BE CONTACTED TO ARRANGE FOR, AND DEFINE WHEN, AND FOR HOW LONG AN OUTAGE WILL BE ALLOWED. THE DETAILED OUTAGE WORK PLAN SHALL ADDRESS ALLOWABLE DATES, START AND COMPLETION TIMES, AND BLDG REP EMERGENCY CONTACT INFORMATION. OBTAIN PREVIOUS PROJECT EXAMPLE FROM UTILITIES.

