



## MEMORANDUM

**DATE:** April 18, 2014

**TO:** Shanon Murguito, P.E., ITD

**FROM:** Larry Evans, P.E./Barrie Jo Moss, EIT

**RE:** Phase II Permit Assistance: Calumet Reactor T04 Rev 00 Truck Analyses of Identified Bridges along Alternate Route US 95, from Coeur d'Alene to Sandpoint then SH 200 to Montana

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Forsgren Associates has finished the BrR and BARS load rating analyses on five (5) bridges on US 95 between Coeur d'Alene and SH 200 and SH 200 to Montana previously identified in the Phase I memo dated March 24, 2014. The results for these 5 bridges are summarized in Table 1. Three additional bridges listed in Table 1 had no existing BrR or BARS models. BrR models were developed for bridges 33705, 33710, and 33715 during this phase. The results of the analyses for these 3 bridges are also included in Table 1.

We have used the BrR and BARS files provided by ITD, the BrR models developed for the 3 bridges listed above, and the truck configuration provided by Mammoet (see Figure 1) to perform the BrR and BARS analyses following ITD's procedures. The anticipated permit requirements are listed in Figure 2.

Mammoet has revised the route continuing on US 95 at Coeur d'Alene to SH 200 and then along SH 200 to Montana. The revised route is shown in Figure 3.

The analysis of bridges 33710 and 33715 showed that the bridge factors for these structures were greater than the truck factor for the Mammoet truck. No additional analysis was performed for these two structures.

There were 4 bridges modeled in BrR as systems. Using the non-standard gauge truck analysis and the Distribution Factor-Line Girder analysis in BrR, the truck configuration has an operating rating  $\geq 1.0$  on each of these bridges. The 4 bridges are summarized in Table 2. These bridges will require a speed reduction and the Mammoet truck should be the only vehicle on the bridge and travel down the center of each bridge.

Bridge 18705 is a reinforced concrete frame structure. The load rating model provided by ITD for this bridge was developed in BARS using the strip width analysis method. The fill load was re-calculated based on new fill heights recorded in the 2012 inspection report. These fill load calculations are presented in the Appendix, and the load rating

results are presented in Table 2. The operating rating factor for the Mammoet truck on the revised BARS model for this structure is greater than 1.0.

One bridge, Bridge number 19065, is modeled in BARS as a line girder in the load rating model provided by ITD. The load rating was found to be  $\leq 1.0$ , and the results are presented in Table 2. Pre-loading and alternate truck configurations will be evaluated in order to increase the operating rating above 1.0. This curved, reinforced concrete, 3-span, multi-cell box structure is supported on single column bents. A separate torsional analysis will be completed for this structure. The results of the load rating evaluation with revised transport configuration will be summarized in a separate report.

ITD will review all of the bridges along the route with the selected truck configuration and may require further analysis of the bridges due to reasons other than the bridge factor vs. truck factor comparison criteria or BrR or BARS analysis.

The following is a list of attachments:

- Table 1 Summary of Bridges Requiring BrR and BARS Analysis for Calumet Reactor T04 Rev 00 Truck & Bridges Newly Modelled in BrR
- Table 2 Calumet Reactor T04 Rev 00 Truck Rating Results for BrR and BARS Bridges
- Figure 1 Calumet Reactor T04 Rev 00 Truck Configuration
- Figure 2 Anticipated Permit Requirements
- Figure 3 Route from Coeur d'Alene along US 95 to SH 200 to Montana

**Table 1 - Summary of Bridges Requiring BrR and BARS Analysis for Calumet Reactor T04 Rev 00 Truck**

Route	BrKey	Bridge		Load Rating Analysis Required	Route Comments/Recommendations
		Factor	Span		
US 95	18690	865	59	YES	
US 95	18705	946	22	YES	
US 95	33705*	1429	279	YES	
US 95	33710*	1554	65	NO	Bridge passes factor comparison
US 95	33715*	1380	13	NO	Bridge passes factor comparison
SH 200	19035	926	59	YES	
SH 200	19065	1240	142	YES	Requires further evaluation
SH 200	19071	1403	210	YES	

\*BrR models developed during the permit analysis.

Table 2 - Calumet Reactor T04 Rev 00 Truck Rating Results for BrR and BARS Bridges

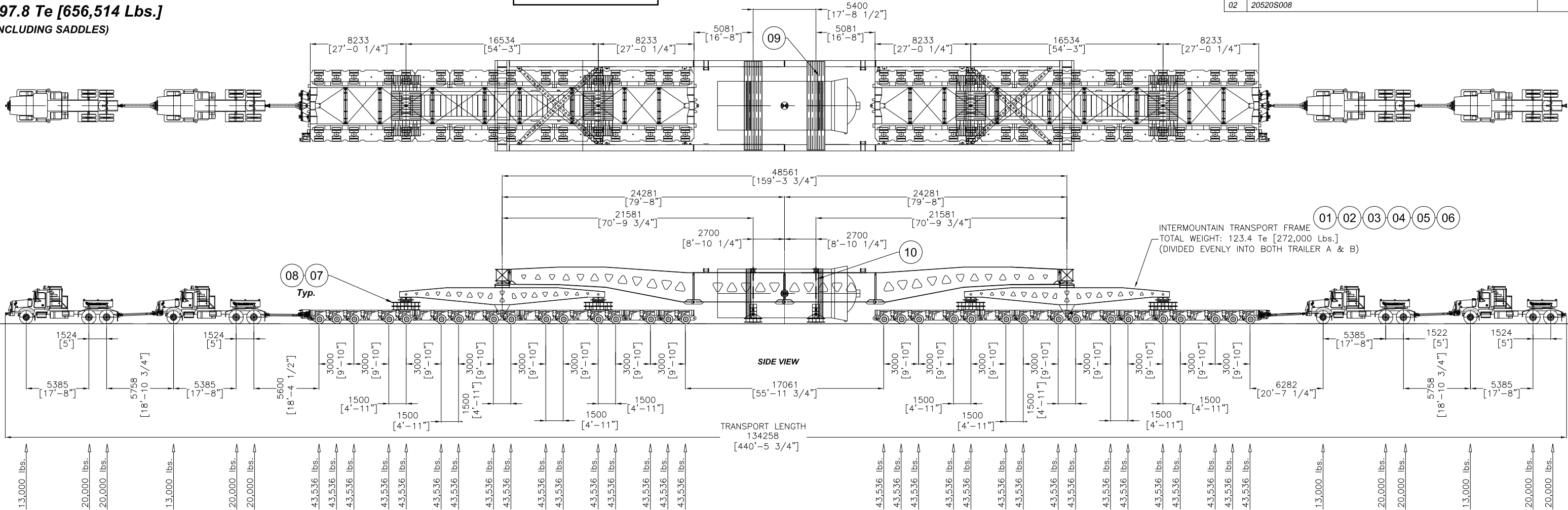
BrKey	Type	Curb to Curb Width	Span Length	Span	Controlling Girder	Truck Location	Operating Rating	LLDF	Design Impact (%)	Permit Rating Impact (%)	Speed Reduction Required	Limit State	Recommended Permit Requirements
18690	System	66.00'	35.63'	1 & 4	G5	Centered	1.765	0.25	30.0%	10.0%	Yes	Shear	Recommend permit vehicle travel down the center of the bridge with no other vehicles allowed on the bridge. Reduce speed to 10 mph or less.
	System	66.00'	57.35'	2 & 3	G8	Centered	2.026	0.229	27.4%	10.0%	Yes	Shear	
18705	BARS Strip Width*	46.75'	23.17'	1	S1	Centered	1.154	0.186	30.0%	10.0%	Yes	Flexure	Recommend permit vehicle travel down the center of the bridge with no other vehicles allowed on the bridge. Reduce speed to 10 mph or less.
33705	Strip*	29.85'	38.00'	1	---	Centered	2.173	0.159	30.0%	10.0%	Yes	Flexure	Recommend permit vehicle travel down the center of the bridge with no other vehicles allowed on the bridge. Reduce speed to 10 mph or less.
	System	29.85'	279.00'	2-3	G2	Centered	1.250	0.262	12.4%	10.0%	Yes	Flexure	
19035	System	42.67'	59.00'	1 & 3	G2	Centered	1.854	0.292	27.2%	10.0%	Yes	Shear	Recommend permit vehicle travel down the center of the bridge with no other vehicles allowed on the bridge. Reduce speed to 10 mph or less.
	System	42.67'	59.00'	2	G2	Centered	1.856	0.292	27.2%	10.0%	Yes	Shear	
19065	BARS*	28.00'	142.00'	1-3	G1	Centered	0.964	4.738	18.7%	10.0%	Yes	Flexure	Requires further analysis.
19071	System	40.00'	210.00'	1-2	G2	Centered	1.271	0.343	14.9%	10.0%	Yes	Flexure	Recommend permit vehicle travel down the center of the bridge with no other vehicles allowed on the bridge. Reduce speed to 10 mph or less.

\*Half the 20 foot wide axle load was used in a standard gauge truck model.

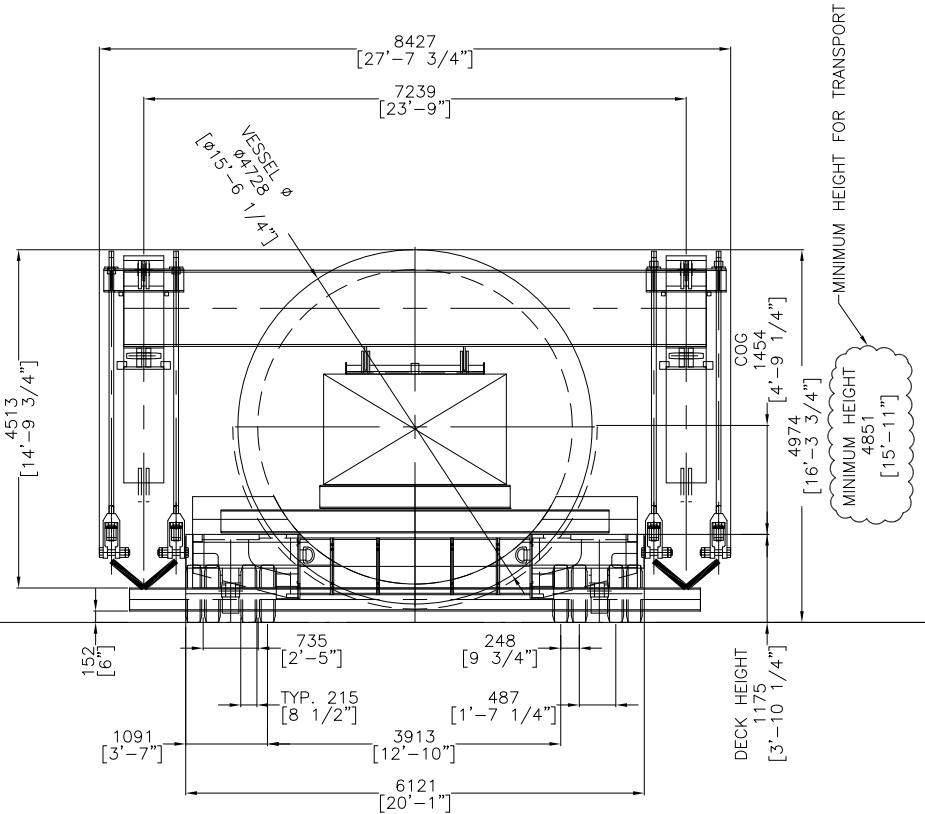
REACTOR  
297.8 Te [656,514 Lbs.]  
(INCLUDING SADDLES)

Figure 1

REF	DRAWING NUMBER	REVISION
01	200000520-D-009	03
02	20520S008	00



END VIEW



GROSS WEIGHT OF TRANSPORT = 728.1 Te [1,605,152 LBS.]

LOAD DESCRIPTION: Reactor  
VEHICLE DESCRIPTION: [2x] 20' 16 L Road Style Goldhofer w\_Frame

UNITS:	METRIC	ENGLISH
LOAD WEIGHT:	297.8 Te	656,514 lbs
SADDLE WEIGHT:	0.0 Te	0.0 lbs
FRAME WEIGHT:	153.7 Te	338,828 lbs
TURNTABLE WEIGHT:	0.0 Te	0.0 lbs
TRUCK WEIGHT:	96.2 Te	212,000 lbs
TRAILER WEIGHT:	180.4 Te	397,810 lbs
TOTAL WEIGHT:	728.1 Te	1,605,152 lbs
LOAD/LINE	19.7 Te	43,536 lbs
LOAD/ AXLE	9.9 Te	21,768 lbs
LOAD/WHEEL	2.5 Te	5,442 lbs
LOAD/LAT. INCH	0.3 Te	640 lbs

GENERAL NOTES

- FIELD VERIFY ALL DIMENSIONS
- THE CLIENT IS RESPONSIBLE FOR THE STRUCTURAL INTEGRITY OF THE LOAD TO BE TRANSPORTED.
- THE CLIENT IS TO IDENTIFY AND CONFIRM THE SUITABILITY OF THE SUPPORT POINTS TO BE UTILIZED DURING THE TRANSPORT OF THE LOAD.
- SECURE CARGO ONTO THE TRAILER USING LASHING MATERIAL TO PREVENT SLIDING AND/OR TIPPING OFF THE LOAD.
- ALL CHAINS GRADE 70, 1/2" 11,300 lbs. CAPACITY (SINGLE) AND TIGHTENED WITH BINDERS (NOT SHOWN) 13,000 lbs. CAPACITY.
- 3/4" PLYWOOD OR ANTI SLIP MATERIAL TO BE USED BETWEEN ALL STEEL CONTACT AREAS TO PROMOTE FRICTION.
- MAXIMUM WEIGHT AND DIMENSIONS SHOWN FOR REACTOR TRANSPORT
- SUBJECT TO FINAL ENGINEERING

MATERIALS LIST				
POS	QTY	DESCRIPTION	MATERIAL/ CAPACITY	WEIGHT (lbs / ea)
01	4	Intermountain Frame Necks		52'-0"
02	6	Intermountain Mid. Sections		25'-8"
03	2	Intermountain Header Beams		25'-6"
04	2	Intermountain Loadspreaders		57'-11"
05	8	Intermountain Long Cross Bracing		30'-4"
06	4	Intermountain Short Cross Bracing		21'-4"
Intermountain Frame Total Weight:				272000
07	2	Steel mats 8'	8'-4" x 8'-1" x 1'	4520
08	8	Steel mats 17'	17' x 4'-1" x 1'	4610
09	2	Hanger Steel Mats 25'	25' x 4' x 1	6454
10	4	Auxiliary Hanger Equipment		2000
Grand Total:				338828

FOR PERMIT

00	First Issue	07/10/13	RLam 940443	JLW 940062	
REV.	DESCRIPTION:	DATE:	DRAWN:	CHECKED:	
Without authorized signatures this document is uncontrolled, not binding and for indicative purposes only.					
CLIENT: CH2M HILL / Calumet Montana Refining					
PROJECT: Great Falls, Montana					
TITLE: Permit Transport of Reactor with [2x] 20' 16 L Road Style Goldhofer w_Frame					
<div><div>MAMMOET USA 20525 FM 521, Rosharon, TX 77583 Tel. +1 (281) 369-2200 / Fax. +1 (281) 369-2178 www.mammoet.com</div><div>THIS PUBLICATION REMAINS THE PROPERTY OF THE PUBLISHER AND SHALL BE TREATED AS CONFIDENTIAL, UNLESS CONTRACTUALLY SPECIFIED OTHERWISE. NO PART OF IT MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, WITHOUT THE PRIOR WRITTEN PERMISSION OF THE PUBLISHER. © 2000 MAMMOET [CQSP-02-01-01]</div></div>					
SCALE: NTS		SIZE: D		DRAWING NUMBER	
SAP No: 7000108105		PROJECT No: 15010242 - P188 - D-		SUB: T04 - 1/1 - 00	
		DOC: PART: SHT: REV.			



**Figure 2**  
**Anticipated Permit Requirements**  
**Mammoet T04 Rev 00**

**BRIDGE ANALYSIS BY:**

ANALYST:	B. Moss
DATE:	4/18/2014
TIME:	

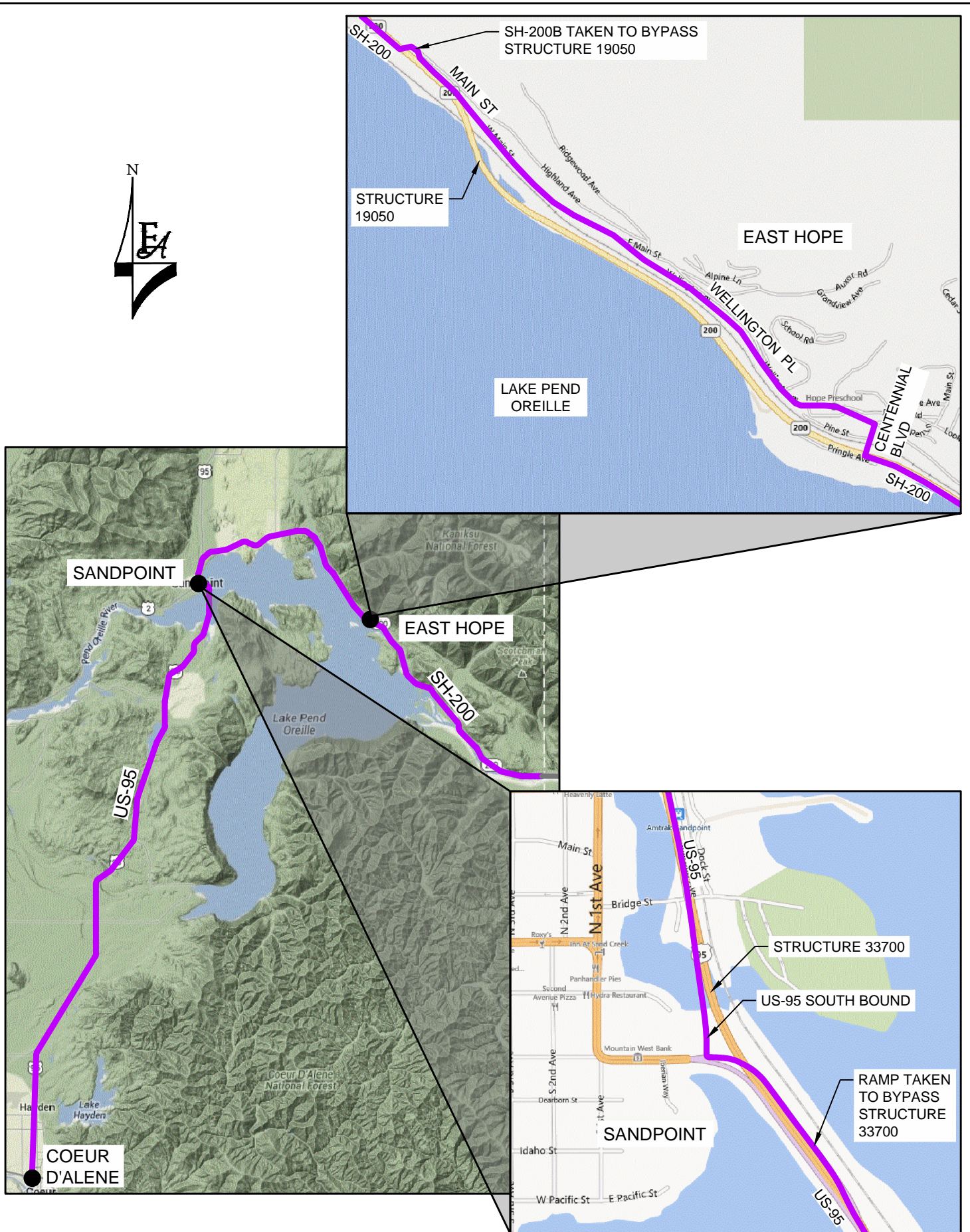
**PERMIT REQUEST FOR:**

COMPANY:	Mammoet
UNIT:	Calumet Reactor T04 Rev 00
DRAWING NO.:	
Vehicle configuration and route is recorded on the attached sheets	

**SPECIAL BRIDGE REQUIREMENTS:**

Route BrKey	Milepost	Requirements	Traffic Control
For all Bridges on Route		For bridges without median barriers: * The load must travel down the center of the bridge. * The load must be the only vehicle on the bridge. For bridges with median barriers: * The load must travel down the center of the travelway. * The load must be the only vehicle in direction of travel.	Not reviewed as part of this scope of work.
US 95 18690	430.592	* Speed must not exceed 10 mph	Not reviewed as part of this scope of work.
US 95 18705	461.315	* Speed must not exceed 10 mph	Not reviewed as part of this scope of work.
US 95 33705	10.055	* Speed must not exceed 10 mph	Not reviewed as part of this scope of work.
SH 200 19035	38.660	* Speed must not exceed 10 mph	Not reviewed as part of this scope of work.
SH 200 19065	51.592	* Further analysis is currently ongoing for this structure.	Not reviewed as part of this scope of work.
SH 200 19071	54.563	* Speed must not exceed 10 mph	Not reviewed as part of this scope of work.





## Appendix



# FORSGREN

Associates Inc.

OWNER-PROJECT MAMMOET	BY BGM	DATE 4/7/2014	PROJECT NO. 02-13-0177
FEATURE T04 REV 00	CHK'D BY LLE	DATE 4/7/14	SHT 1 OF 1

BR KEY 18705

CURRENT LOAD: 187.5 PLF

$$187.5 \text{ PLF} / (1 \text{ FT})(140 \text{ PCF}) = 1.34 \text{ FT OF FILL}$$
$$= 16 \text{ IN}$$

NEW LOAD: 19 IN OF FILL = 7 IN ASPHALT + 12 IN GRANULAR

$$140 \text{ PCF} (1 \text{ FT})(19 \text{ IN}) = 221.7 \text{ PLF}$$