

# SPMT BRIDGE MOVE

## SAFETY AND CONTINGENCY PLANS

### REV 1

Minnesota Department of Transportation

Metro District

## Maryland Avenue Bridge Design-Build Project



PARSONS



Lunda Construction Company

*In association with Parsons and SRF Consulting Group, Inc.*

**August 12, 2012**

### SPMT Safety Plan

1. Only employees engaged in the work will be allowed in the work area.
2. During the lift and move only those employees that are actively engaged in the work will be allowed to be within 100 feet of the span. Only critical employees will be allowed on or near the span and SPMT equipment.
3. Tool box/pre-task meeting will be held with all employees engaged in the work at the points described below. Tool box meeting will cover the activities for each crew, risk with their given task, and how the risk will be controlled. A Lunda Safety Representative will be present for tool box meetings.
  - i. Prior to assembling the SPMT.

- ii. Prior to lifting span 1 and removing the temporary abutment in the travel path.
  - iii. Prior to moving Span 1.
  - iv. As needed to address any safety concerns during the process.
- 4. A final walk through pre-move safety meeting will be held 1 hour prior to lifting the Span 1 and again 1 hour prior to moving Span 1. This will include walking the travel paths one last time to identify any issues prior to the move. This meeting will include Lunda Construction, Parsons, Mammoet, MnDOT, and E&J Steel Erectors.
- 5. All personnel will be required to wear appropriate PPE including but not limited to; hard hat, safety shoes, safety glasses, high visibility work wear, and fall protection equipment as needed.
- 6. Additional safety concerns.
  - i. Moving equipment in the work area including SPMT, cranes, and other wheeled equipment. Educate employees of struck by accidents and how to prevent them. *This will be done at pre-task and tool box meetings.*
  - ii. Falls from SPMT equipment or spans. All employees exposed to fall heights over 6 feet will be required to be protected from that fall through the use of fall protection including but not limited to handrails, guardrails, tie off, or manlifts.
- 7. Key Contacts for decisions during the move.
  - i. Mammoet – Dennis Theis – SPMT supervisor. Dennis will be responsible for decisions directly related to the Operations of SPMT equipment.
  - ii. Parsons – Steve Haines – SPMT Engineer. Steve will be responsible for reviewing equipment and travel paths prior to the lift and moves. Steve will coordinate his review with Dennis. Steve will also directly supervise twist monitoring during the move. Steve is responsible for Twist related issues.

- iii. Lunda Construction – Dale Even – Project Manager. Dale will be responsible for overall project coordination during the lift and moves and will communicate directly with Steve Haines and Dennis Theis. Dale will communicate with David Herzog for MnDOT participation. Communications to the public will be through MnDOT.
  - iv. Any technical issues during the move will be resolved as needed between Dennis, Steve, and Dale. The first line of communication is between Dennis and Steve. Please also refer to appendix A, section 6 for additional information on communications.
8. Safety of Spectators and other Industry people will be controlled by MnDOT and Lunda Construction. All spectators and other interested industry people will be allowed to view the move from the designated viewing areas which will be established by MnDOT and Lunda Construction at a date closer to the move. It is our understanding the MnDOT will also have a Police presence to help control the area.
9. See appendix A, sections 7 and 9, for additional SPMT specific safety.

### **SPMT Contingency Plan**

- 1. Travel Path Failure.
  - a. Review and prove travel path as described in our proposal with a loaded dump prior to moving the span
  - b. In the event of a travel path failure we will have labor and equipment to make repairs including excavating/compaction equipment and steel plates to bridge any small areas. Recommendations for repairs will be from Steve Gerber(Geotech). Approval of any required repairs prior to proceeding will be the responsibility of Dennis Theis.
- 2. Utility crossings.
  - a. All utility crossing have been identified. There should be no surprises here.
  - b. In the event a utility is damaged during the move, we will notify the utility owner as soon as damage is identified.

3. Weather.
  - a. In the event of threatening weather, strong storms or high winds, we will hold off the move until favorable conditions exist. The move would have to be postponed for lightening, winds above 30 MPH, or dense fog. The decision to postpone the move will be made by Dale Even. Project related issues for postponement will be communicated through Dale Even and Jesten Sterry. Communication for Public relations will be through David Herzog of MnDOT.
  - b. Check weather forecast 24 hours, 12 hours and 1 hour prior to move.
4. SPMT Equipment failures.
  - a. See Appendix A, section 10 for details provided by Mammoet.
5. Span will not fit or cannot set down in final location.
  - a. In the event for whatever reason the span cannot be positioned as planned in the final location and corrections cannot be made immediately (within the allotted closure of 12 hours) the span will be moved back to the BSA. At this time it will have to be determined if the span needs to be put back onto falsework. Falsework would have to re-erected if needed.
6. Twist Limit on Superstructure is reached during move.
  - a. Please refer to the SPMT Bridge Move Monitoring Plan in Appendix B.



# Appendix A

Worldwide specialists in heavy lifting and transport



## Method Statement

Office **Mammoet USA South Inc. - Rosharon**  
20525 FM 521  
Rosharon, Texas 77583  
USA

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Status For Review

Phone 281-369-2200  
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Client **Lunda Construction**  
Project Maryland Ave Bridge Replacement  
Subject Method Statement with Qualifications – Rev. 01



01	For Review	August 9, 2012	WJK	
00	For Review	April 13, 2012	KHal	
<b>Rev.</b>	<b>Description</b>	<b>Date</b>	<b>Ref.</b>	<b>Checked</b>



## Method Statement

Client	Lunda Construction	Sap Nr.	0010057233-P154	Page	2 of 41
Project	Maryland Ave Bridge Replacement	Doc. Nr.	4000052837-M01-01	Date	August 9, 2012
Subject	Method Statement and Qualifications	Ref.	WJK	Rev.	01

Contents	1	Introduction	4
	1.1	Introduction of this manual	4
	1.2	General information	4
	1.3	Summary of work scope Mammoet	5
	1.4	Mammoet Supply Scope	5
	1.5	Lunda Supply Scope	5
	1.6	Schedule Summary	6
	1.7	Bridge Sections Details	6
	2	Mobilization	7
	2.1	Mammoet Personnel to Site	7
	2.2	Unload and Assembly of SPMTs and Jacking Equipment	7
	3	Transport Operation	9
	3.1	General Transport Arrangements	9
	3.2	Installation of the New Bridge Spans	9
	4	Site-data	10
	4.1	Bridge Replacement Operation Location	10
	5	Weather conditions	11
	5.1	Termination Criteria	12
	5.2	Power / Transmission - Failure Procedure	12
	6	Communications	14
	7	Transport Safety	15
	7.1	Pre-movement checklist	15
	8	Equipment outline specifications	18
	8.1	Self Propelled Modular Transporters	18
	9	Safety Expectations	20
	9.1	Site Orientation	20



## Method Statement

Client	Lunda Construction	Sap Nr.	0010057233-P154	Page	3 of 41
Project	Maryland Ave Bridge Replacement	Doc. Nr.	4000052837-M01-01	Date	August 9, 2012
Subject	Method Statement and Qualifications	Ref.	WJK	Rev.	01

9.2	Mammoet Safety Policies	20
9.3	Equipment safety	21
9.4	Mammoet standard site safety regulations	23
9.4.1	Scope	23
	Before work commences	23
9.4.2	Whilst working on site	24
9.4.3	At completion of work	24
9.4.4	Employee's responsibility	24
9.4.5	Relation between Mammoet and any sub-contractors (including union employees otherwise not familiar with Mammoet practices)	25
10	Risk Analysis and Contingency Plans	26
11	Reference Projects	34
12	Appendix – Personnel Resumes	41
12.1	Dennis Theis	41
12.2	Craig White	41
12.3	Alfred Cox	41
12.4	Eddie Arroyo	41





## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 4 of 41  
 Date August 9, 2012  
 Rev. 01

### 1 Introduction

#### 1.1 Introduction of this manual

The purpose of this document is to provide engineering and planning data to enable the safe installation of the new bridge segment and to verify that all reasonable considerations have been taken. Additionally, personnel resumes, equipment specifications and Mammoet's qualifications are provided. The Installation Operation is the responsibility of the fabricator who will sublet key elements of the work to Mammoet. This document has been originated by Mammoet and refers essentially to their work scope on the new Maryland Ave bridge spans (2) over Interstate 35E in St. Paul, MN.

#### 1.2 General information

##### Maryland Ave Bridge Sections

Lunda Construction has appointed MAMMOET as Transport Operation contractor for the above-mentioned Project.

##### COMPANY INFORMATION

<i>Lunda Construction</i>			
Contact	Email	Cell	Role
Dale Even	deven@lundaconstruction.com	651-775-7206	Project Manager
Jess Sterry	jsterry@lundaconstruction.com	651-325-6845	Project Engineer

<i>Mammoet</i>			
Contact	Email	Cell	Role
JR Gonzalez	Jr.gonzalez@mammoet.com	281-914-2183	Project Manager
Alfonso Martin	Alfonso.martin@mammoet.com	832-291-4930	Project Engineer
Michael Willenborg	Michael.willenborg@mammoet.com	281-914-2138	Engineering Manager
Piet Nooren	Piet.nooren@mammoet.com	281-733-4999	Technical Director



## Method Statement

Client	Lunda Construction	Sap Nr.	0010057233-P154	Page	5 of 41
Project	Maryland Ave Bridge Replacement	Doc. Nr.	4000052837-M01-01	Date	August 9, 2012
Subject	Method Statement and Qualifications	Ref.	WJK	Rev.	01

### 1.3 Summary of work scope Mammoet

- Engineering of the transport methods
- Mobilization and demobilization
- The Transport of the new bridge section from false work to the final position on the bridge bents.
- The handling and assembly of the SPMTs and related cribbing.
- The securing of the bridge sections to the transport system.

### 1.4 Mammoet Supply Scope

Supply of personnel to include:

- 1 supervisor
- 2 SPMT operators
- 4 Mammoet riggers
- Transport, board and lodging for Mammoet personnel.

Supply of major equipment, including:

- 88 lines of SPMT's with 4 Power packs
- Cribbing, stands and steel mats
- Chain and cable lashings as required
- Mammoet Mega Jacks
- Climbing Jacks

### 1.5 Lunda Supply Scope

Supply of major equipment, including:

- 90T crane(min) with riggers and operators to assist with Mammoet equipment unloading
- Forklift or extendable boom forklift for loading and unloading and setup
- Safety instruction / introduction to Mammoet crew directly after their arrival at site
- Supply of adequate staging area and travel zone with compacted soil
- Traffic control and police assistance
- Sufficient clearance to move the bridge sections into place
- Appropriate lighting during night time work hours if and when needed
- Removal of street furniture where applicable



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 6 of 41  
 Date August 9, 2012  
 Rev. 01

### 1.6 Schedule Summary

For time consideration, the bridge installation operation will be carried out by means of *Self Propelled Modular Transporters (SPMTs)* fitted with a combination of Mammoet Megajacks and climbing jack systems. This setup will lessen the reconfiguration time required from the first bridge panel to the second. Mammoet has been given a 12 hour window for placement of the bridge spans. The following is an estimated schedule.

Event	Day	Description
Mobilization of crew	Day 0	The crew will arrive the night before the work is to begin.
Site specific orientation Equipment mobilization Equipment assembly	Day 1	The equipment will be offloaded, assembled and tested. This time will be used to correct any planning issues.
Equipment placement Test lift/test drive Contingent day for site preparation	Day 2	The configured SPMTs will be positioned under the first bridge span, test lift the bridge span/test drive the bridge span. This time will be used to correct any issues with the operation.
Bridge span installations*	Day 3	Bridge spans will be installed.
Equipment demobilization	Day 4	Equipment will be disassembled and loaded for shipping.

\*Bridge spans will only be moved with MNDOT and client approval.

### 1.7 Bridge Sections Details

The heaviest (new) bridge section is estimated to weigh 1,363 Ton [2,720,000 lbs].

New Bridge	Weight
120' wide x 100' long	1363 tons (2,726,000 lbs)



## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 7 of 41  
Date August 9, 2012  
Rev. 01

## 2 Mobilization

### 2.1 Mammoet Personnel to Site

Mammoet will provide approximately 7 personnel during the peak of the operation. A maximum Mammoet presence of 6 days from setup to demobilization will be anticipated. Mammoet personnel will arrive the night before and plan on receiving a site orientation from the Lunda site H&S officer before the start of work. Any required site specific training or PPE shall be conveyed ahead of time to expedite the operation.

### 2.2 Unload and Assembly of SPMTs and Jacking Equipment

Mammoet will use flatbeds and stepdeck trailers to mobilize its equipment to site. The SPMTs come in units of 4 and 6 lines. Mammoet will ask Lunda Construction to provide a crane with a minimum capacity of 90 tons to unload the trailers. Each SPMT unit will be off-loaded using 4 slings of sufficient capacity to off-load the trailers and the powerpacks.

After off-loading the first SPMT unit, the crane will lift the powerpack off the truck and install it behind the unit. The connection between the powerpack and the SPMT will be made with two bolts and one hydraulic operated pin. Hydraulic hoses with couplings will provide the connection between the powerpack and the SPMT. Once this connection is accomplished, the unit is operational and will be used to couple the other units. The crane will lift the next unit of the trailer and lower it on the ground. The SPMT unit with the powerpack will line up with this unit and the connection between the two units will be installed. This connection consists of one hydraulically operated pin, 4 bolts and a number of hydraulic hoses.

To couple SPMTs sideways, special coupling blocks will be bolted to the side of one SPMT unit. This unit will then be driven next to another unit, lined up and adjusted in height. The other side of the coupling block will then be connected with bolts to the other SPMT. If necessary, hydraulic hoses will be installed between the two units. The timeframe necessary to connect one SPMT unit to the next is roughly half an hour. However the total duration depends largely on the arrival of the trucks.

Once both sets of trailers are ready, the crane or an extendable boom forklift will place the transport beams across both sets of double SPMTs. At this time the SPMTs will be connected electrically. The computer in the SPMT will be programmed to make sure all units will work as one and can be operated by one man.



## Method Statement

Client	Lunda Construction	Sap Nr.	0010057233-P154	Page	8 of 41
Project	Maryland Ave Bridge Replacement	Doc. Nr.	4000052837-M01-01	Date	August 9, 2012
Subject	Method Statement and Qualifications	Ref.	WJK	Rev.	01

In the meantime the exact location of the climbing jacks and Megajacks will be determined by measuring down the length of the trailers using the center line of the trailers as a reference point. The dimensions from drawing: 0010057233-P154-D-T01 will be used.

Approx. 4 or 5 layers of 4"X 4" hardwood timbers of 3.5 ft length will be stacked in the required pattern for the climbing jacks. The climbing jacks will be placed on top using an extendable boom forklift and the hydraulic hoses connected to the climbing jack powerpack. The climbing jack powerpack will be located on the SPMT with the climbing jack assemblies. Once the climbing jacks are installed, the steel mats will be placed on top and secured to the climbing jack tops via welded clips.

The next step will be to drive the trailers under the first of the prefabricated spans and position them in their correct locations. The units will need to be lined out exactly to ensure no problems during the transport of the spans. Chains and binders will be installed securing the SPMTs to the first new bridge span.

The Mega jacks have lashing points that will serve as connection points when lashing the bridge span. See lashing lines on Drawing: 0010057233-P154-D-T01.



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 9 of 41  
 Date August 9, 2012  
 Rev. 01

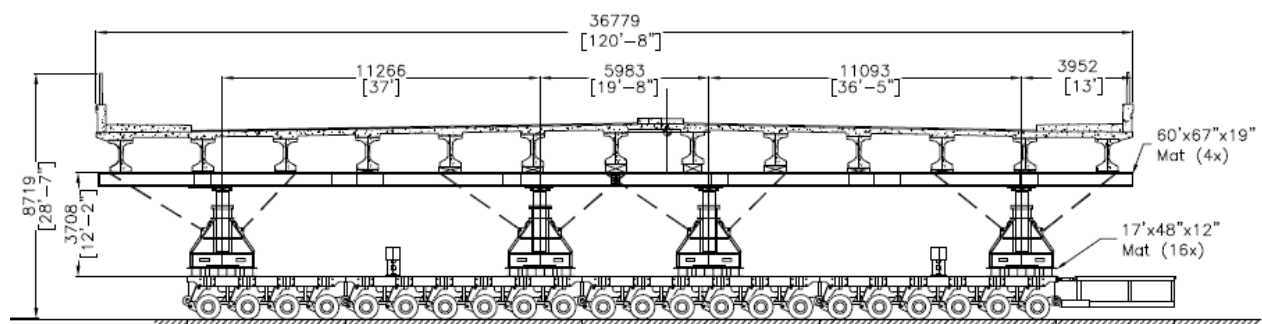
### 3 Transport Operation

#### 3.1 General Transport Arrangements

It is assumed that the old bridge spans will be removed and the piers prepared to accept the new bridge spans prior to Mammoet's work scope is to begin. Mammoet will mobilize its personnel on August 12, 2012. The necessary Mammoet equipment will begin to arrive to site on Day 1: August 13th for assembly prior to the bridge installation operation. Day 3: Mammoet will use two trains of SPMTs to move the new spans into place.

#### 3.2 Installation of the New Bridge Spans

The new bridge spans will be built at height on false work and the trailers driven and installed underneath as shown on the diagram below (See "Issued for Execution" Drawing Set 0010057233-P154-D-T03 Rev. 05 for complete details). Transport beams will be secured to the trailers to maintain the critical spacing in moving precast bridge members. The hydraulic jacks will be extended and push the 60ft and 65ft bolted mats up against the bottom of the bridge girders. As shown on the drawing, graduated shim blocking will be installed for contact between all bridge beams and the mats. The hydraulic suspension of the trailers will be raised and the bridge will be lifted off its temporary supports and driven to a location as close as possible to its final location. Additional height adjustments can be made using the climbing jack assemblies and Megajacks.



**Transport Array for the New Bridge Sections - Megajacks and typical lashing shown.**



## Method Statement

Client Lunda Construction

Sap Nr. 0010057233-P154

Page 10 of 41

Project Maryland Ave Bridge Replacement

Doc. Nr. 4000052837-M01-01

Date August 9, 2012

Subject Method Statement and Qualifications

Ref. WJK

Rev. 01

### **4 Site-data**

#### **4.1 Bridge Replacement Operation Location**

Lunda Construction's site is located on the southwest side of the intersection of Maryland Ave (Hwy 31) and Interstate 35E (Hwy 10) in St Paul, MN. The spans will be constructed at or near installation height in the orientation for which they will be installed. The current plan is to break the concrete hwy divider to allow one set of SPMTs to travel north bound lanes while the other travels the south bound lanes with the transport spanning over the concrete divider.



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 11 of 41  
 Date August 9, 2012  
 Rev. 01

### 5 Weather conditions

The construction manager will establish a weather report prior to the transport operations, in accordance with the jacking/transport requirements from Mammoet.

In general the transport operation shall not proceed unless a weather report forecasting suitable conditions for a minimum of twenty-four hours or three times the operation period whichever is the greatest, has been received.

Prior to the start of the transport operation, Lunda Construction will be consulted regarding the decision whether to proceed with the operation or to postpone it due to weather conditions or other restrictions.

A maximum wind criteria for starting the Bridge Installation Operation is proposed to be Wind-force 6 (Beaufort) and decreasing. Stability calculations have been based on these criteria. In addition, a minimum visibility of 100m is required.

Wind-force	Wind Speed	Wind Speed	Wind speed	Wind Speed	Pressure	Pressure
Beaufort	Knots	miles / h	Km / h	m / s	kg/m <sup>2</sup>	Te/m <sup>2</sup>
3	7 – 10	12,1	19.4	5,4	1,9	0,002
4	11 – 16	17,7	28.4	7,9	4,0	0,004
5	17 – 21	23,9	38.5	10,7	7,3	0,007
6	22 – 27	30,9	49.7	13,8	12,1	0,012
7	28 – 33	38,3	61.6	17,1	18,6	0,019
8	34 – 40	46,3	74.5	20,7	27,3	0,027
9	41 – 47	54,6	87.8	24,4	37,9	0,038
10	48 – 55	63,5	102.2	28,4	51,4	0,051
11	56 – 65	73,0	117.4	32,6	67,7	0,068
12	65 +					





## Method Statement

Client	Lunda Construction	Sap Nr.	0010057233-P154	Page	12 of 41
Project	Maryland Ave Bridge Replacement	Doc. Nr.	4000052837-M01-01	Date	August 9, 2012
Subject	Method Statement and Qualifications	Ref.	WJK	Rev.	01

### 5.1 Termination Criteria

Decisions on whether to postpone or terminate a transport operation may have to be taken at any time prior to a transport operation commencing or during the transport operation.

#### PRIOR TO TRANSPORT OPERATION COMMENCING

A Transport operation will be postponed if one of the following conditions applies:

- If any significant item of the transport equipment becomes defective
- If any data relating to the trailers is found to be significantly at variance with the loading calculations, drawings or transport operation procedures
- If the weather conditions are found to be significantly worse than those predicted.

#### AFTER TRANSPORT OPERATION HAS COMMENCED

There can be no absolute rules for determining at what stage a transport operation would be "aborted" or "continued with" following technical problems arising once the transport operation has commenced. In the event of a serious problem or delay occurring, then a joint decision, whether to proceed or pull back, would be taken by Lunda Construction and Mammoet, based on the following general guide lines.

### 5.2 Power / Transmission - Failure Procedure

Unlike conventional transport systems, which may rely on external power units (tractor units, winches, hydraulic jacks, etc.), the power source for a Mammoet self-propelled modular transporter is entirely self-contained. Equipment specifications can be found in Section 8 of this manual, but he details can be summarized as follows:

- Propulsion is obtained from hydrostatic motors, which are located within the "drive" axles of a 4-line or 6-line unit. The 4-line unit has 2 motors while the 6-line unit has 4 motors. Once hydraulic pressure is delivered, each motor produces torque, which when transferred to the ground, equals a horizontal force of 5.5 tonnes. As such, a 6-line unit can transmit a horizontal force of 22.0 tonnes.

Should a transmission fault occur in any individual drive unit, the drive can be disengaged simply, without removing any wheel or releasing any of the payload. This is accomplished by turning a screw which has a direct internal connection and acts as a clutch to isolate the drive mechanism.



## Method Statement

Client	Lunda Construction	Sap Nr.	0010057233-P154	Page	13 of 41
Project	Maryland Ave Bridge Replacement	Doc. Nr.	4000052837-M01-01	Date	August 9, 2012
Subject	Method Statement and Qualifications	Ref.	WJK	Rev.	01

The power pack units, which are mounted to the rear of each trailer unit, supply "constant" pressure to the hydrostatic drive units. In the event of a power pack failure, the remaining functioning power packs have additional capacity and fittings, which can be easily connected to the affected trailer, allowing the transport to proceed. Although pressure can be maintained, the flow rate of hydraulic fluid is reduced. The result is horizontal force with a reduced travel speed.



## Method Statement

Client	Lunda Construction	Sap Nr.	0010057233-P154	Page	14 of 41
Project	Maryland Ave Bridge Replacement	Doc. Nr.	4000052837-M01-01	Date	August 9, 2012
Subject	Method Statement and Qualifications	Ref.	WJK	Rev.	01

### 6 Communications

A radio can be furnished by Mammoet to Lunda's construction manager to communicate critical or emergency information. However, it is mandatory that communication (other than emergency information) during transport and associated operations is limited to Mammoet personnel (which will include Steve Haines). Otherwise, verbal communication is recommended during critical tasks. Outside communication shall be relayed through designated Lunda personnel. Designated Lunda representatives shall be responsible for communicating status updates, problems, postponement, resolutions, etc.

Communications among Mammoet operators and transport supervision will be by radio, unless there is local interference, on our nationally licensed frequencies. All other communication will be verbal; face to face or by mobile phone.

Communications among Mammoet personnel during operations will be in English, on one of the frequencies listed below. Mammoet radios are equipped with a "Tone Lock" which will keep any interference from other frequencies to a minimum.

- Frequency 1 - Transmit/receive 464.50000 MHz.
- Frequency 2 - Transmit/receive 464.55000 MHz.
- Frequency 3 - Transmit/receive 464.60000 MHz.
- Frequency 4 - Transmit/receive 464.70000 MHz.
- Frequency 5 - Transmit/receive 469.50000 MHz.
- Frequency 6 - Transmit/receive 469.55000 MHz.
- Frequency 7 - Transmit/receive 469.60000 MHz.
- Frequency 8 - Transmit/receive 469.70000 MHz.
- Call Sign – WPLR953



## Method Statement

Client Lunda Construction

Sap Nr. 0010057233-P154

Page 15 of 41

Project Maryland Ave Bridge Replacement

Doc. Nr. 4000052837-M01-01

Date August 9, 2012

Subject Method Statement and Qualifications

Ref. WJK

Rev. 01

## 7 Transport Safety

### 7.1 Pre-movement checklist

In order to ensure that all operations are carried out in accordance with approved and engineered procedures, Mammoet personnel on site will complete a checklist as the equipment is assembled and tested. For this operation the following points will be checked:

- The trailer assembly is in accordance with transport drawings
- The trailer drive system is functioning in forward and reverse
- All steering functions are available and operable
- Trailer computer co-ordinates are input and verified
- The hydraulic lifting system is fully pressurized and leak tested
- Diesel levels in the power pack are adequate for the operation
- Hydraulic fluid in the reservoir tank is within operating limits
- Access under the bridge panels is suitable and the transport route is clear

In addition to the above checks, which are carried out before lifting the load, the following are verified:

- All operations personnel fully briefed on operating conditions
- Radios fully charged and working
- After lifting ensure that pressures are within safe limits
- Lunda Construction will be notified of readiness to move
- Local weather conditions checked, to ensure they are not going to cause danger to the load or operating personnel

Only when the above are found to be acceptable, along with the approval of all calculations and the method statement, should Lunda Construction allow the transport operation to commence. The checklist shall be signed by the transport supervisor and reviewed with the Lunda construction manager.



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 16 of 41  
 Date August 9, 2012  
 Rev. 01

<b>TRANSPORT OPERATION CHECKLIST</b>	
Mammoet job number	0010057233-P154
Client	Lunda Construction
Location	Maryland Avenue at I-35E, St Paul, MN
Item reference	Maryland Avenue Overpass
Lunda Construction reference	Dale Even
Marine warranty company	N/A
Estimated start time of operation	August 17, 2012
Estimated completion time of operation	August 19, 2012
<b>Mammoet key personnel</b>	
Project manager	JR Gonzalez
Transport Manager	Dennis Theis
Project Engineer	Alfonso Martin
SPMT/Jacking Superintendent	Jarrod Dorsett
Operations Manager	Mark Bell
<b>SPMT configuration</b>	
Structural strength of transport system checked	Y
SPMT function checks carried out	
Transport layout in accordance with drawings	
All power packs fueled	
Clear access under load	
<b>Environmental data</b>	
Wind restrictions	30 MPH
Weather forecast available	
Spill kits stocked and in place	
Checked and signed for Mammoet	



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 17 of 41  
 Date August 9, 2012  
 Rev. 01

<b>TRANSPORT OPERATION CHECKLIST (continued)</b>	
<b>General conditions</b>	
Transport path clear	
Transport path clearly marked	
Adequate lighting for operations	
Communication systems checked	
Traffic control in place	
Are Local Authorities notified	
Toolbox briefing held	
Pre-transport meeting held	
Shim plates available	
Checked and signed for Mammoet	



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 18 of 41  
 Date August 9, 2012  
 Rev. 01

## 8 Equipment outline specifications

### 8.1 Self Propelled Modular Transporters

Technical specification for the SPMTs to be used on this project:

- Type:** SPMT 3rd Generation.
- Length:** Distance between axle lines longitudinally 1.4 meters
- Width:** Width overall 2.43 meters (when in normal driving mode)
- Height:** 1.5 meters transport height plus/minus 30 cm
- Self-Weight:** Average 4.0 tonnes per axle line
- Suspension:** Suspensions by hydraulic rams operating at a maximum pressure of 250 bar. In the unlikely event of a hydraulic line failure under load, then each suspension ram has an instantaneously activated cut off valve that locks off each ram preventing any collapse of the trailer suspension systems.
- Steering:** Steering is by rack and pinion activated hydraulically and controlled by a computer which permits 360 degree steering capability on each axle. All axles are coordinated electronically enabling each trailer to move forwards, backwards, in a circle, sideways, diagonally or in a carousel about its own center point. Furthermore, computer control of steering and propulsion functions enables groups of trailers, even when in open configuration, to carry out the full range of maneuvers whilst carrying a single load and all with one operator control.
- Propulsion:** Powered axles (generally 2 per 6 or 4 axle unit) have a hydrostatic transmission unit developing 60 kN tractive force per axle. The unit operates with equal efficiency and speed forwards, sideways or in reverse. Maximum speed under load, under site conditions, is 3kms/hr and unloaded 10 kms/hr.
- Braking:** Braking by hydrostatic transmission units backed up by brakes with a capacity of 45.2kN/axle each.
- Suspension:** Hydraulics can be rationalized into 3 or 4-point suspension systems beneath the load, even where units are in open configuration. In both 3 and 4 point suspension modes, the operator has a constant visual display of all hydraulic pressures in suspension rams and can immediately carry out level adjustments to suit changing site cross falls.



## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 19 of 41  
Date August 9, 2012  
Rev. 01

<b>Acceleration:</b>	(Maximum figures)	(Normal figures)
Longitudinal	5.0%	2.0% or less
Lateral	2.5%	1.0% or less
Vertical	Zero	Zero





## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 20 of 41  
 Date August 9, 2012  
 Rev. 01

## 9 Safety Expectations

### 9.1 Site Orientation

The safety officer for Lunda Construction will instruct Mammoet employees directly upon mobilization to site. Mammoet employees will be made familiar with site rules and regulations.

During Mammoet's site operations and transport, the BSA and travel area will be restricted. There will be a "RESTRICTED" perimeter which will be limited Mammoet and Lunda Construction employees directly involved with Mammoet operations. Beyond the "RESTRICTED" perimeter shall be a "LIMITED ACCESS" perimeter, which will be limited to designated members of the project task force and MnDOT. We recommend that attendance by members / employees of applicable companies, agencies, etc. is monitored and controlled from within.

### 9.2 Mammoet Safety Policies

Before each operation a toolbox meeting will be held where the involved people are instructed.

It is the policy of Mammoet USA that the safety and health of its employees and those of its Sub-contractors is of prime importance in all activities of the Company.

The policy is intended to minimize, and if possible, prevent, all avoidable accidents and hazards to health.

Mammoet USA, as employer, accepts that it is primarily responsible for the health and safety of its employees and that it should prepare procedures for carrying out all activities in which it operates, as well as providing adequate supervision to ensure that safe procedures are correctly executed, however, Mammoet also expects its employees to be responsible for their own actions and informs them regularly of the risks and dangers that can be met and expects them to be involved in the preparation of safe working procedures.

Mammoet will arrange for periodic visits to be made to all site establishments by the Mammoet Group Safety Officer. Notwithstanding these visits, all Mammoet employees are encouraged to think "safety" at all times and to notify management of any areas where safety procedures require improvement.

It is the policy of the Company that every employee must wear protective clothing as appropriate to the activity being carried out and that persistent refusal of the employee to do so is likely to result in dismissal.



## Method Statement

Client	Lunda Construction	Sap Nr.	0010057233-P154	Page	21 of 41
Project	Maryland Ave Bridge Replacement	Doc. Nr.	4000052837-M01-01	Date	August 9, 2012
Subject	Method Statement and Qualifications	Ref.	WJK	Rev.	01

To ensure that this policy is actively carried out, the Company accepts that it is responsible for instructing its employees of safe procedures for carrying out all activities and to give further instruction if additional employees are recruited, or if the nature of activities change, or if the location of activities demand additional knowledge or regulations to be complied with.

In the event of an unsafe or dangerous occurrence taking place, (whether or not this causes injury) then this must be fully recorded, investigated and action taken to ensure that any repetition is avoided.

It is the policy of Mammoet that all levels of management are required to enforce this policy statement and that any examples of unsafe activities shall be notified and investigated by the Managing Director of the Company, who is ultimately responsible for safety within the group.

### 9.3 Equipment safety

Mammoet has a high record of safety established over many years of experience. The following additional features are incorporated into Mammoet's self-propelled modular transporters.

A single operator controls all steering and propulsion functions, even where trailers are in open configuration. Misunderstanding and poor co-ordination between operators cannot occur.

Steering is computer controlled, even where trailers are separated in open configuration. This prevents horizontal forces being induced into the structure even where complex turning maneuvers are carried out.

Every suspension is fitted with a safety valve, which cuts off instantaneously in the event of hose failure and prevents suspension collapse.

Fully reversible hydrostatic motors enable 'pull back' to be carried out any stage, if site conditions demand.

Easily disengaged half shafts in power axles enable movement to continue in the unlikely event of power pack failure occurring during movement.

In the unprecedented situation of 2 power packs malfunctioning at the same time, then the spare ports on remaining power pack allow the connection of hydraulic power hoses to be fed to defective transporters allowing movement to continue (but at a slower speed).

The single operator has a continuous visual display of all suspension pressures, whether a 3 point or 4 point suspension system is in use.



## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 22 of 41  
Date August 9, 2012  
Rev. 01

All systems have a mechanical over-ride in the event of a serious malfunction of the electronic controls occurring.



## Method Statement

Client	Lunda Construction	Sap Nr.	0010057233-P154	Page	23 of 41
Project	Maryland Ave Bridge Replacement	Doc. Nr.	4000052837-M01-01	Date	August 9, 2012
Subject	Method Statement and Qualifications	Ref.	WJK	Rev.	01

### 9.4 Mammoet standard site safety regulations

Mammoet's objective connected to safety is to recognize and consider safety as an essential ingredient of good management and efficient workmanship. It is established on site as a matter of normal discipline.

It is the Company's policy to make all staff, supervisors and hourly paid staff fully aware of basic safety requirements.

#### 9.4.1 Scope

These rules apply to the management, supervision and entire workforce of Mammoet, together with its sub-contractors in terms of general safety.

#### PROJECT MANAGER

At all times it must be recognized that the Project Manager is the person who is directly responsible for the protection of the men/women in his charge, and that the responsibility is not lessened by the presence of a Safety Officer in the organization.

#### SUPERVISOR

Supervisors apply the safety rules and procedures. Instructing new employees and making random safety inspections in their areas of responsibility and taking prompt actions when deemed necessary.

#### SAFETY OFFICER

The safety officer is responsible for the overall safety during all operations. The safety officer will have a day-to-day responsibility to ensure that the health and safety arrangements are being applied effectively. He will also be responsible for the marking/confirming of the restricted area during the site-move and assembly operation.

#### **Before work commences**

- Arrange supplies of goggles, safety helmets and other protective equipment, which is deemed necessary.
- Consider site conditions, possible obstructions and other hazards, which may be detrimental to safety and health.
- Personnel should be made familiar with:
  - Location of Emergency Medical Center
  - First Aid positions and MSDS Right to Know Binder location,
  - Procedures to obtain emergency services,
  - Rules governing evacuation of site,
  - Fire drill procedure on site.
- To ensure Mammoet and sub-contractor personnel attend all Lunda Construction induction courses accordingly.



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 24 of 41  
 Date August 9, 2012  
 Rev. 01

### 9.4.2 *Whilst working on site*

- Ensure that health and safety regulations are observed, e.g. the wearing of protective clothing, suitable boots, glasses, etc.
- Monitor the work of all personnel and stimulate their interest and involvement in safety. Red Mammoet issue coveralls will not be worn on this site, alternate coveralls such as Mammoet kaki will be worn.
- Orange reflective vests will be worn by all persons while on site.
- Lace up work boots with minimum 6" height, safety reinforced toes, and minimum ½" high defined heel.
- Periodically inspect equipment, statutory site records (if requested), notices and general tidiness.
- Good housekeeping is a watchword. Any untidy site is more likely to be unsafe.
- Investigate all accidents leading to injury, damage or loss.
- In the event of an accident, take any immediate action necessary to deal with the situation.
- Ensure only competent and authorized personnel use site plant and equipment.

### 9.4.3 *At completion of work*

- Ensure that any statutory records, which Lunda Construction requires, are correctly completed and handed over.

### 9.4.4 *Employee's responsibility*

- Comply with all statutory regulations.
- Work in a safe manner.
- Report to your immediate supervisor all unsafe conditions that arise.
- Report all incidents that may lead to accidents or injury.
- Comply with all rules and regulations made by MNDOT and Lunda Construction with regard to safety on site.
- Co-operate with the management in accident investigation.
- Employees are encouraged to take part in all schemes, which promote an interest in safety.
- Keep working areas clean and tidy.
- Safety helmets must be worn at all times in construction areas.
- Make use of all safety equipment and protective clothing that is available where circumstances require it.
- Inspect your equipment prior to use, if faulty report to your supervisor immediately.
- Where a hazard has to be created, it is important that warning signs are displayed and action taken to prevent injury.
- If you damage equipment or tackle, report it to your supervisor immediately. Damaged equipment leads to accidents.
- All injuries received during the course of your employment on site must be recorded in the Accident Prevention Book and reported to the company Safety Officer.



## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 25 of 41  
Date August 9, 2012  
Rev. 01

### **9.4.5 *Relation between Mammoet and any sub-contractors (including union employees otherwise not familiar with Mammoet practices)***

- The sub-contractor manager is responsible to the Mammoet supervisor for the implementation of all safety rules and regulations connected with sub-contractors/suppliers.
- Sub-contractors staff assigned to site are required to ensure within their particular areas of responsibility that rules and regulations are observed.
- Sub-contractors managers are responsible for making available the information necessary to allow their employees to carry out their work safely.
- This is affected through training, job instruction and safety supervision.
- Protective clothing and equipment must be made readily available and instructions given concerning its use by sub-contractors.
- Mammoet management has the responsibility to ensure that sub-contractors receive all Lunda Construction safety rules relevant to their undertakings and issue directives necessary in accordance with Lunda Construction's safe working procedures.
- Sub-contractors are required to ensure that their employees are properly trained, given all information relevant to the working environment.
- Sub-contractors shall fully comply with the Mammoet safety standards, instructions and safe working procedures and any additional safety information issued by Lunda Construction.
- Sub-contractors must provide their employees with and ensure they are worn, whenever statutory or site regulations prescribe, the following minimum requirements of personal protection equipment: Safety helmets, Safety boots, Safety glasses; all specific to above listed requirements.



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 26 of 41  
 Date August 9, 2012  
 Rev. 01

### 10 Risk Analysis and Contingency Plans

#### TRAILER RELATED RISKS:

- 1.1 Tire failure
- 1.2 Axle failure
- 1.3 Suspension arm failure
- 1.4 Hydraulic suspension hose failure
- 1.5 Power pack failure
- 1.6 Engine/pump connecting bush shears
- 1.7 Electronic controls
- 1.8 Failure of trailer bed or connecting points
- 1.9 Lack of fuel or hydraulic oil

#### OPERATOR RELATED RISKS:

- 2.1 Set up incorrect valve systems
- 2.2 Wrongly configured electric/data coupling
- 2.3 Operating with travel height too high or too low
- 2.4 Operating out of level
- 2.5 Incorrect steering

#### ENVIRONMENT RELATED RISKS:

- 3.1 Ground failure en route
- 3.2 Damaging services en route
- 3.3 Height and width restrictions en route
- 3.4 Obstructions caused by "street or barge furniture" en route
- 3.5 Obstruction of emergency vehicles
- 3.6 Emergency evacuation
- 3.7 Bad weather
- 3.8 Oil spillage

#### LOAD RELATED RISKS:

- 4.1 Weight incorrectly described by client
- 4.2 Centre of gravity incorrectly advised
- 4.3 Saddle or transport beam failure

#### COMMUNICATION RELATED RISKS:

- 5.1 Communications failure
- 5.2 Misunderstandings



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 27 of 41  
 Date August 9, 2012  
 Rev. 01

### TRAILER RELATED RISKS

	RISK	PREVENTATIVE MEASURES	CONTINGENCY SOLUTIONS
1.1	Tire failure	Drive slowly to avoid overheating Check for visual damage Check pressures regularly Inspect route for hazards before journey.	Spare wheels complete with tires accompanying each journey Isolate affected axle by closing suspension valve, raise trailer using hydraulics of remaining axles then jack up affected wheel with 5t jack and change wheel Lower off on completion and reconnect axle into normal circuit.
1.2	Axle failure	Check for any distortion or "play" during routine maintenance.	If failure occurs before load leaves fabrication point, then set down load and replace affected parts If failure occurs during journey, then isolate affected axle hydraulically, raise axle into the elevated position and lock off using "lock off" pins. Complete journey on one less axle (using spare trailer capacity).
1.3	Suspension arm	Check for any distortion or "play" during routine maintenance.	If failure occurs before load leaves fabrication point, then set down load and replace affected parts If failure occurs during journey, then isolate affected axle hydraulically, raise axle into the elevated position and lock off using "lock off" pins. Complete journey on one less axle (using spare trailer capacity).
1.4	Hydraulic suspension hose failure	Visual inspection every time trailers are assembled. Hydraulic pressure tests (working against closed valves) to 270 bar, following assembly of trailers. Ensure wherever possible that 3-point suspension is used so that safe working pressures are maintained.	If a flexible hose fails during an operation, pressure check valves on each suspension arm prevent the progressive collapse of the suspension system. It would be necessary to replace the hose prior to movement recommencing, as the normal axle pressure compensation would not take place.





## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 28 of 41  
 Date August 9, 2012  
 Rev. 01

1.5	Power pack failure	Configurations normally have 2 or more power packs. Each power pack has spare ports that allow hydraulic oil under pressure to be diverted to any defective power pack.	Power pack failure is dealt with by one of 3 methods  Repair power pack with spares from container using mechanic always in attendance Replace complete power pack with spare unit. (Takes approx. 1 hour) Divert oil from "running" power pack to "defunct" power pack using spare hydraulic ports on each unit.
1.6	Engine/pump connecting bush shears	Change bush every 2000 hours of use. Minimize periods of full throttle.	Failure of the bush results in total loss of power from the affected power pack. Solution is to replace engine in total, or to share hydraulic oil from a "running" unit to defunct unit as in "Power Pack Failure" above.
1.7	Electronic controls	Test all systems each time trailer is assembled, prior to it being positioned under the load.	Self-diagnosis computers indicate fault area so that replacement circuit boards can be slotted in. Spare unit computers, head computers and control boxes are carried within spares container. Mechanical over-ride to all controls means unit can be made safe in the unlikely event of total electronic failure.
1.8	Failure of trailer bed or connecting points	Ensure regular inspection carried out to search out any deformation or other stressing of components.	Carry out moment distribution calculations for all moves to ensure bending moments are within trailer safe moment of resistance. Note deflections in trailer bed are as predicted after lifting, but before movement commences. If significant variance is noted, then set down and investigate prior to moving.
1.9	Lack of fuel or hydraulic oil	Ensure tanks full prior to each and every operation.	Refill from cans carried in support back up vehicle.



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 29 of 41  
 Date August 9, 2012  
 Rev. 01

### OPERATOR RELATED RISKS

	RISK	PREVENTATIVE MEASURES	CONTINGENCY SOLUTIONS
2.1	Set up incorrect valve systems	Supervisor to check set up after valves set, prior to lifting commencing	Check all functions prior to trailer being positioned, and again after positioning and jacking, prior to movement of supports and movement of vehicle.
2.2	Wrongly configured electric/data coupling	Supervisor to check set up after assembly, but before lift commenced. Check all functions work prior to trailer being positioned under load.	Computers will not permit movement to commence unless all other electronic functions are reporting "zero fault".
2.3	Operating with height too high or too low	Supervisor to check trailer is at mean bed height (1500) on flat plain, prior to movement commencing.	Supervisor to monitor and re-check bed height at intervals throughout the operation, and, in addition, whenever there is a sudden change of gradient or level.
2.4	Operating out of level	Supervisor and driver to monitor level and trim using optical aids. Driver to stop and seek clarification from supervisor if level or trim begin to exceed 1 degree.	Level up trailer whenever trim or cross fall exceeds 1 degree. See note below for description of specific instance when condition of > 1degree is will occur.
25	Incorrect steering	Ensure visually that steering functions work in all five modes before positioning trailer under load.	Computers ensure traction cannot take place unless steering is in alignment. "Observers" positioned at strategic points to monitor alignment visually.



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 30 of 41  
 Date August 9, 2012  
 Rev. 01

Note: When exiting the BSA and entering the highway, there will be a transition with a grade of 9 degrees over an approximate distance of 27'. Because the transporter will be moving sideways at this stage, the width of each trailer set (17'-5 1/4") will experience this grade. This grade is within the +/- 300 mm stroke capability of the trailer, which will allow the lead trailer set to maintain level and rear trailer set to pivot (and vice versa) as shown in on Sheet 9 of 10 in Drawing Set 0010057233-P154-D-T03 Rev. 5.

### NVIRONMENT RELATED RISKS

	<b>RISK</b>	<b>PREVENTATIVE MEASURES</b>	<b>CONTINGENCY SOLUTIONS</b>
3.1	Ground failure en route	Check route with client. Check records of other loads using the same route.	For any local failure, stop movement immediately. Lock off affected axle/axles and stabilize trailer using remaining axles. Beam or plate out ground to rectify failure as directed by Dennis Theis. Establish cause of failure prior to re-energizing affected axles.
3.2	Damaging services en route	Check route for services with Client.	Notify owner of service if damage caused. In the case of escape of water or gas, stop vehicle, lock off valves, switch off power pack and evacuate area until service escape is made safe. Ensure Dale Even is fully equipped with emergency phone numbers and mobile phone to call up utilities if unexpected problem arises. List shall be included in overall safety / contingency plan.
3.3	Height and width restriction en route	Thoroughly check all doors, gates, bridges and overhead cables to ensure adequate clearances.	Make use of variable height jacking of trailer and 360 degree steering to pass through "pinch points" in route.
3.4	Obstruction caused by 'street or barge furniture' en route	Thoroughly schedule all furniture removals in good time for removals to be effected. Re-check route one day before movement to ensure no late changes have occurred.	Ensure Dale Even is fully equipped with emergency phone numbers and mobile phone to call up utilities if unexpected problem arises. List shall be included in overall safety / contingency plan.



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 31 of 41  
 Date August 9, 2012  
 Rev. 01

3.5	Obstruction of emergency vehicles	For urban or even site journeys, ensure fire and ambulance services advised of journey. For out of town journeys, liaise with Police only.	Use 360-degree steering facility to allow emergency vehicle to pass if unexpected emergency arises.
3.6	Emergency evacuation	Ensure crew fully briefed on procedures to be adopted if emergency evacuation is required.	Stop vehicle, lock off number 7 (axle) valves, switch off power pack and evacuate area in accordance with procedures.
3.7	Bad weather	Check forecast 48, 24 and 12 hours prior to work commencing. Establish with Client, any unacceptable weather conditions. Normally, only fog, ice, high winds or snow would justify postponement.	Finally check with Client and if weather conditions are borderline. Ensure load is well lit if working in darkness. If necessary, provide additional lighting, poor visibility makes load dangerous to others
3.8	Oil spillage from broken or damaged components	Ensure regular maintenance checks of hard and flexible piping. Check condition of hoses before fitting on site.	Clean up any spillage using clean up kits from the on site container. Change hoses from spares in containers



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 32 of 41  
 Date August 9, 2012  
 Rev. 01

### LOAD RELATED RISKS

	RISK	PREVENTATIVE MEASURES	CONTINGENCY SOLUTIONS
4.1	Weight incorrectly described by client	During initial jack up operation, carefully monitor suspension pressures to ensure pressure is within normal operational limits.	If pressure is exceeded, lower off onto construction supports prior to movement commencing, and seek clarification. If doubt continues, then carry out independent weighing operation prior to continuing
4.2	Center of gravity incorrectly advised	Ensure center of gravity position is issued by Client and taken into account when loading the trailer.	Carefully monitor suspension pressures when initial jacking up takes place. If pressures are not within acceptable limits, lower off onto supports / ground before movement takes place. In conjunction with Client, relocate trailer under load to ensure actual center of gravity properly located.
4.3	Saddle or transport beam failure	Calculate predicted loads into saddles/beams from analysis of trailer. Ensure saddles/beams are designed for inertia forces as well as static load.	Ensure hand held temporary packing material is available to enable temporary packing to be effective, if saddle/beam shows signs of distress.
4.4	Issue arises where Span 1 is to be returned to BSA and removed from SPMT (after removal or falsework)	All of the above; thorough inspection of mechanical equipment; thorough inspection of BSA and route	Return to BSA, stroke trailer down onto cribbing in order to isolate overall load from tires. Release hydraulic pressure from Mega Jacks and re-tension chains once Mega Jacks cylinders are fully retracted. Re-assemble falsework if deemed necessary and reset span if deemed necessary.



## Method Statement

Client Lunda Construction  
 Project Maryland Ave Bridge Replacement  
 Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
 Doc. Nr. 4000052837-M01-01  
 Ref. WJK

Page 33 of 41  
 Date August 9, 2012  
 Rev. 01

### COMMUNICATION RELATED RISKS

	RISK	PREVENTATIVE MEASURES	CONTINGENCY SOLUTIONS
5.1	Communications failure	Ensure that all personnel are fully briefed on all aspects of the operation and that each individual is assigned a specific task and operating location. Check radio systems are functioning correctly.	Use hand signals in case of radio failure.
5.2	Misunderstanding	Ensure that all personnel are fully briefed on all aspects of the operation and that each individual is assigned a specific task and operating location. Supervisor and Engineer to monitor actions of operators.	Stop movement and re-instruct operators.





## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 34 of 41  
Date August 9, 2012  
Rev. 01

### 11 Reference Projects



#### CTA Purple Line at Church Street and Benson in Evanston, Illinois





## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 35 of 41  
Date August 9, 2012  
Rev. 01



**Various bridge projects**





## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 36 of 41  
Date August 9, 2012  
Rev. 01

**4500 S bridge coming out of staging area  
0.25 miles from installation position October 2007 Salt Lake City**



**3300 S bridge ready for  
installation after travelling 1.5 mile  
along Wasatch Blvd and I-215.  
August 2008 Salt Lake City.**





## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 37 of 41  
Date August 9, 2012  
Rev. 01



**Highland drive bridge; weight 1300 tonnes on SPMT's, June 2008 Salt Lake City**

**Lambs Canyon Bridge removal; bridge on temporary supports, grade 8%, bridge weight 790 tonnes. August 2008 Salt Lake City**







## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 38 of 41  
Date August 9, 2012  
Rev. 01



**3300 S bridge across I-215 in construction area. Bridge weight 800 tonnes. August 2008 Salt Lake City**

**3300S bridge travelling on Wasatch Blvd, August 2008 Salt Lake City, Utah**





## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 39 of 41  
Date August 9, 2012  
Rev. 01



I-4 job (Graves Road) in Florida

I-4 job (Graves RD) in Florida





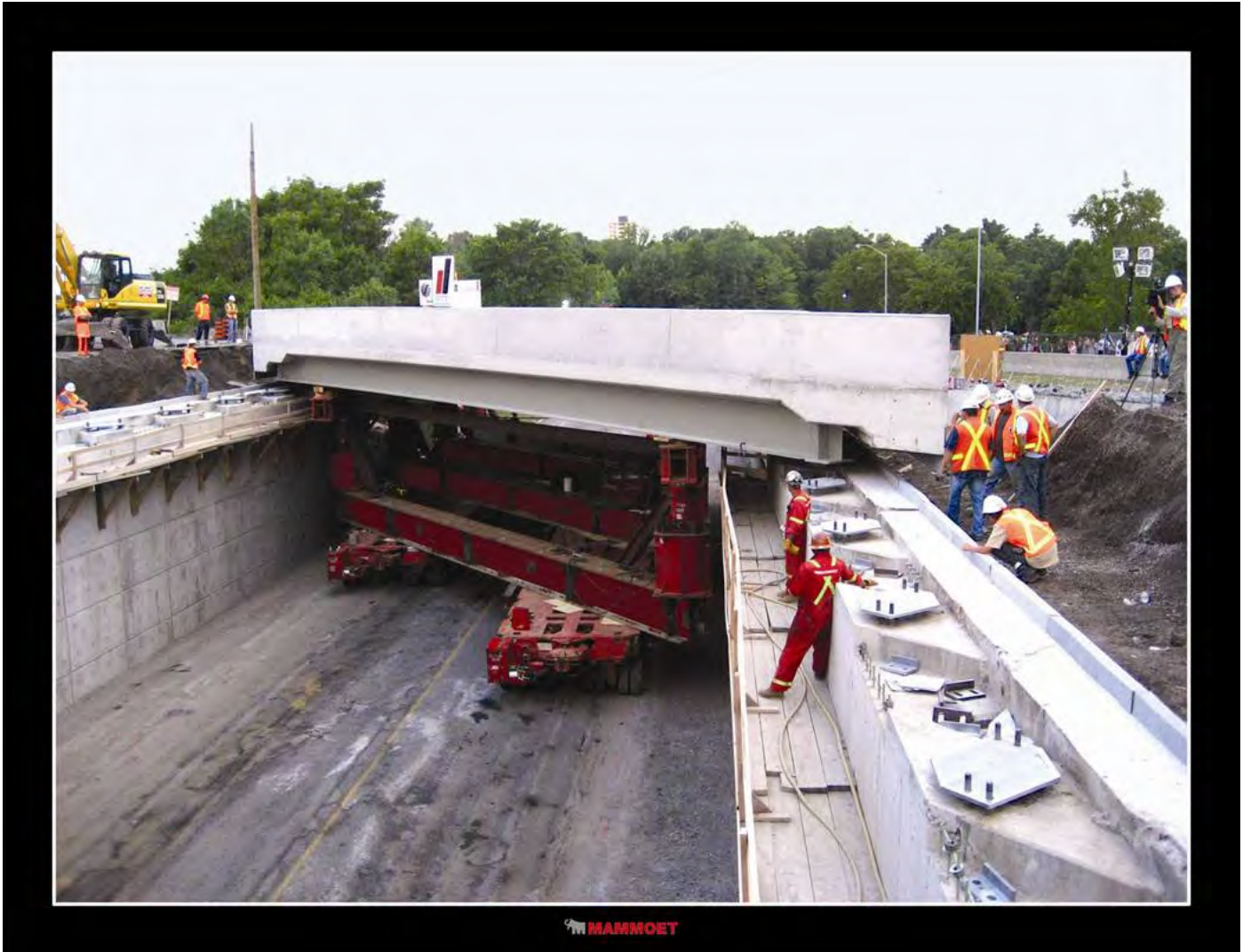


## Method Statement

Client Lunda Construction  
Project Maryland Ave Bridge Replacement  
Subject Method Statement and Qualifications

Sap Nr. 0010057233-P154  
Doc. Nr. 4000052837-M01-01  
Ref. WJK

Page 40 of 41  
Date August 9, 2012  
Rev. 01





## Method Statement

Client Lunda Construction

Sap Nr. 0010057233-P154

Page 41 of 41

Project Maryland Ave Bridge Replacement

Doc. Nr. 4000052837-M01-01

Date August 9, 2012

Subject Method Statement and Qualifications

Ref. WJK

Rev. 01

### **12 Appendix – Personnel Resumes**

**12.1 Dennis Theis**

**12.2 Craig White**

**12.3 Alfred Cox**

**12.4 Eddie Arroyo**



## Resume

Name : Dennis Theis  
Address : 40 North Erik, Angleton, Texas 77515  
Date of Birth : January 23, 1971  
Date of employment : February 17, 1992  
Present position : Transport Supervisor

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### Education

### Training

Specialized training from the manufacturer regarding the production and operation of Mammoet's proprietary product line of equipment

### Work Experience

Supervises heavy transport activities using self-propelled modular transporters (SPMT) since 1992

- Bechtel-Jacobs CEP Port Arthur JV - Port Arthur TX Motiva Crude Expansion
- SGT - St. Lucie FL Steam Generator & Reactor Replacement Project Unit 2
- Jacobs Engineering – Port Arthur TX Motiva PAR HTU5 Project Transport/Lift
- Cardi Corp - Providence River Bridge Remove Replace
- Bechtel Power Corp – Rockdale TX Bechtel Steam Generator HP/IP Install
- Marinette Marine – Marinette WI Oversized Transportation 3 Ferries
- Kiewit Construction - Manhattan NY Bridge Lift
- AVS Services - Joliet Billings 4 Reactors Lift/Transport
- Signal International LLC - Orange, TX Stack Tension Leg Platform Load Out
- Fluor – Sweeny TX Clean Fuels Project
- Fluor – Norco LA Hydrocracker Complete Load Out Transport
- Gulf Island – Houma LA Alma Jacket and Topside Load Out
- Pride International – Lake Charles LA Mad Dog DSM
- Lexicon – Trinidad Steel Mill Unload
- J Ray McDermott – Holstein Various Modules Load Out
- Invista – Charlotte NC (2) Oxidizers Relocate



- BP – Whiting IN BP Canadian Crude Lift and Transport

**Present Employment**

Mammoet USA South, Inc., Rosharon, Texas

Transport Supervisor



# Appendix B

## SPMT BRIDGE MOVE

### MONITORING PLAN

Minnesota Department of Transportation

Metro District

## Maryland Avenue Bridge Design-Build Project



August 10, 2012

#### SPMT Monitoring Plan

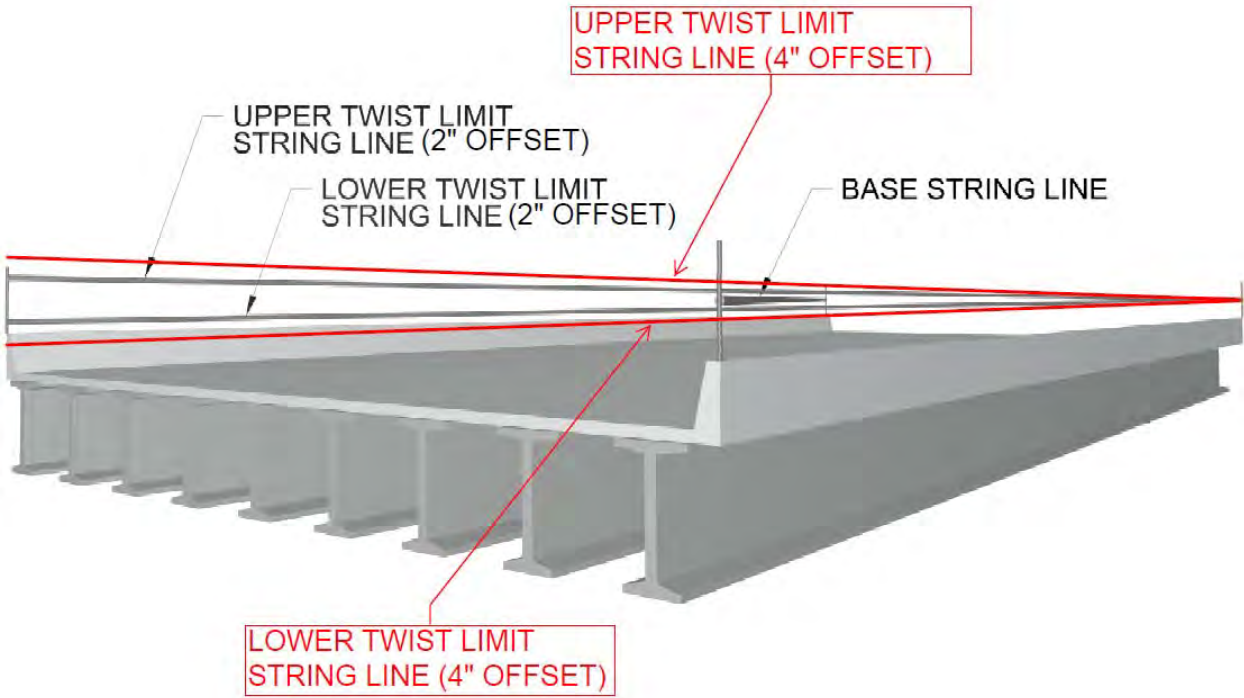
1. Key Contacts for decisions during the move.
  - i. Mammoet – Dennis Thies – SPMT supervisor. Dennis will be responsible for decisions directly related to the Operations of SPMT equipment.
  - ii. Parsons – Steve Haines – SPMT Engineer. Steve will be responsible for reviewing equipment and travel paths prior to the lift and moves. Steve will coordinate his review with Dennis. Steve will also directly supervise twist monitoring during the move.
  - iii. Lunda Construction – Dale Even – Project Manager. Dale will be responsible for overall project coordination during the lift and moves.

- iv. Any technical issues during the move will be resolved as needed between Dennis, Steve, and Dale. The first line of communication is between Dennis and Steve.
2. Prior to lifting the spans, set up the string-line monitoring system. The ends of the string-lines are to be located at approximately the intersection of the CL of SPMT support and the exterior barrier. A base string line is to be set along one diagonal of the bridge at a constant offset from the top of deck. On the opposite diagonal a dual string is to be set. At one end of the dual diagonal both strings are to be set at the constant offset from the top of the deck. On the opposite end one string is to be set at the constant offset plus 2" (the allowable support movement) and the other is to be set at the constant offset minus 2". A secondary set of contingency string lines will be set at the constant offset plus 4" (the maximum allowable support movement). Monitoring/measurements of the string-lines occur at the intersection of all the string-lines, see Attachment #1 for rendering of example string-line setup.
3. Immediately prior to lifting the spans, record elevations at designated locations at each end of span, mid-span and lift points on each of the two edge beams and confirm that the monitoring system is set. See Attachment #2 for locations of survey points.
4. Engage SPMT lifting system and follow lifting procedure established by Mammoet. Ensure that there is even lift-off at all bearings.
5. After the bridge is completely off the temporary BSA supports and prior to any horizontal movements, record elevations at designated locations established in Step 3 of the move procedure. Compare the elevation results of the span to confirm that the span is performing as designed. If the results are more than 20% different than the anticipated results verify the following:
  - i. All SPMT support structures are performing as designed.
  - ii. All girders have even and proper engagement with the SPMT support system.
  - iii. The span does not have any unanticipated cracking.

- Discuss technical resolution among Key Contacts prior to proceeding.
6. When the span has been successfully lifted and any issues have been addressed, proceed with transporting the new bridge to the final bridge location.
  7. During the transporting of the new bridge, Steve will actively monitor the string-lines along with a Lunda Construction representative. Steve will communicate with Dale any adjustments required to keep the span within the twist tolerance. Dale will communicate required adjustments to Dennis who will implement the adjustment. Typically, adjustments will be made prior to being close to the twist limit which will allow the span to keep moving while the adjustments are being made. If the twist limit is reached, Steve will issue an immediate stop request and the span movement will be stopped by Dale and Dennis. Adjustments will be made to re-center the string-lines. Once all adjustments are made then the span movement can resume. The 2" limit line will be shifted by hand for the first 10 occurrences that exceed the limit. If 10 or more occurrences occur then we will clip the 2" limit lines and utilize the 4" limit lines to give us more twist tolerance while staying within the allowable limit.
  8. As the span gets close to the approximate final bridge location all clearances are to be checked visually to ensure the span does not have any conflicts with the intended final location. Vertical, horizontal and skew clearances are to be checked. Visual verification will be performed by all available personnel in the vicinity. Dale will be notified of any potential conflicts and determine if the movement needs to be stopped. If the movement is stopped, it will not be resumed until the conflict is resolved by Dale.
  9. Bring span into close proximity in elevation and location. Check that all permanent supports are at planned elevations and match the underside elevations, slope and profile of the new bridge. The Key Contacts will evaluate if any shimming or grinding is required. Dale will execute any shim installation or grinding required to provide even support to all the girders prior to the span being set.

10. Once elevation differences are resolved, set span down on bearings.
11. Take final set of elevation observations after setting the new bridge in the final place to verify the permanent in place elevations.

# Attachment #1 – String-line Setup Rendering



# Attachment #2 – Survey Monitoring Locations

