MDOT RC-1610

Accelerated Bridge Construction and Structural Move - Workshop

MARCH 2014

Department of Civil & Construction Engineering
College of Engineering and Applied Sciences
Western Michigan University

Research

Accelerated Bridge Construction and Structural Move - Workshop

Appendices

Project Manager: Matthew Chynoweth, P.E.

Submitted to:

MDOT

Submitted by

Haluk Aktan, Ph.D., P.E.
Professor
(269) 276 – 3206
haluk.aktan@wmich.edu

Upul Attanayake, Ph.D., P.E.
Associate Professor
(269) 276 – 3217
upul.attanayake@wmich.edu

Abdul Wahed Mohammed, EIT
Graduate Research Assistant
(269) 276 - 3204
abdulwahed.mohammed@wmich.edu

Western Michigan University
Department of Civil & Construction Engineering
College of Engineering and Applied Sciences
Kalamazoo, MI 49008
Fax: (269) 276 – 3211

APPENDIX D (PART-I)

WORKSHOP PRESENTATIONS

Michigan Department of Transportation Accelerated Bridge Construction Workshop

Gregory Johnson, P.E.
Chief Operations Officer
Michigan Department of Transportation

Accelerated Bridge Construction Workshop, December 9, 2013

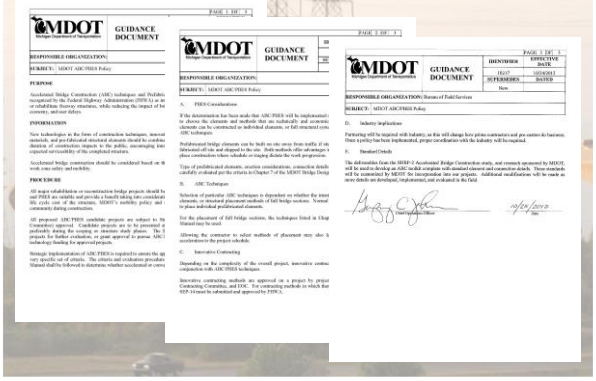
MDOT ABC Policy

- Welcome to MDOT's first ABC/PBES workshop
  - We have two bridge slide projects to be done via CM/GC next year
  - Future bridge slide/structural move projects will most likely be design/bid/build, and we want the Michigan contracting industry, and those delivering the projects to be comfortable, and knowledgeable of these techniques

MDOT ABC Policy

- Every Day Counts (EDC)
  - Goal: **25% of bridges constructed/reconstructed with Federal Aid to incorporate at least one Accelerated Bridge Construction (ABC) or major precast component.**
  - Goal was to have 25% of bridges in program by December 2012
  - MDOT executive leadership approved policy document in October 2012

MDOT ABC Policy


MDOT GUIDANCE DOCUMENT

RESPONSIBLE ORGANIZATION:

SUBJECT: MDOT ABC/PBES Policy

PURPOSE

INFORMATION

PROCEDURE

MDOT ABC Policy

- The MDOT ABC policy was selected as a national example, and presented at the 2013 TRB meeting
- MDOT is also working at the national level, through the AASHTO Subcommittee on Bridges and Structures on the advancement of ABC/PBES methods and technologies

MDOT ABC Policy

- ABC/PBES is a part of our business practice, and must now be part of our culture when thinking about how our projects impact the public, and the economy

MDOT ABC Policy

- Why ABC, Why now?

Enjoy the workshop!

BRIDGE FIELD SERVICES

Michigan Department of Transportation
Accelerated Bridge Construction Workshop

Matthew J. Chynoweth, P.E.
Bridge Field Services Engineer
Michigan Department of Transportation

Accelerated Bridge Construction Workshop, December 9, 2013

MDOT ABC Policy

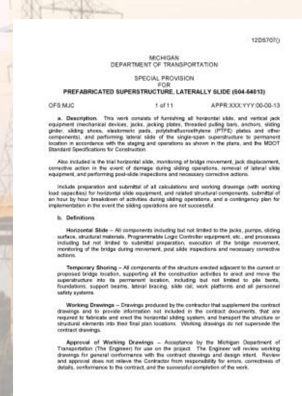
- Progress at MDOT:
  - **Committee established with members from MDOT, Consultant, and Industry staff**
  - **Goals over the Next Few Years:**
    - Move this Technology Forward from demonstration to standardized deployment
    - Gain additional experience
    - Develop a Program Approach
    - Develop Selection Criteria and a Decision Making Framework
    - Develop methods for Performance Measurement

MDOT ABC Policy

- Section 7.01.19 of the MDOT Bridge Design Manual covers ABC and PBES considerations
- This section will be further updated as means and methods are further evaluated

MDOT ABC Policy

- Special provision for Prefabricated Superstructure, Laterally Slide



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MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
PREFABRICATED SUPERSTRUCTURE, LATERALLY SLIDE (S04-64013)

OFS:MJC 1 of 11 APPR:XXX:YYY:00-00-13

a. Description. This work consists of furnishing all horizontal slide, and vertical jack equipment (mechanical devices, jacks, jacking plates, threaded pulling bars, anchors, sliding girder, sliding shoes, elastomeric pads, polytetrafluoroethylene (PTFE) plates and other components), and performing lateral slide of the single-span superstructure to permanent location in accordance with the staging and operations as shown in the plans, and the MDOT Standard Specifications for Construction.

Also included is the trial horizontal slide, monitoring of bridge movement, jack displacement, corrective action in the event of damage during sliding operations, removal of lateral slide equipment, and performing post-slide inspections and necessary corrective actions.

Include preparation and submittal of all calculations and working drawings (with working load capacities) for horizontal slide equipment, and related structural components, submittal of an hour by hour breakdown of activities during sliding operations, and a contingency plan for implementation in the event the sliding operations are not successful.

b. Definitions

Horizontal Slide – All components including but not limited to the jacks, pumps, sliding surface, structural materials, Programmable Logic Controller equipment, etc., and processes including but not limited to submittal preparation, execution of the bridge movement, monitoring of the bridge during movement, post slide inspections and necessary corrective actions.

Temporary Shoring – All components of the structure erected adjacent to the current or proposed bridge location, supporting all the construction activities to erect and move the superstructure into its permanent location, including but not limited to pile bents, foundations, support beams, lateral bracing, slide rail, work platforms and all personnel safety systems.

Working Drawings – Drawings produced by the contractor that supplement the contract drawings and to provide information not included in the contract documents, that are required to fabricate and erect the horizontal sliding system, and transport the structure or structural elements into their final plan locations. Working drawings do not supersede the contract drawings.

Approval of Working Drawings – Acceptance by the Michigan Department of Transportation (The Engineer) for use on the project. The Engineer will review working drawings for general conformance with the contract drawings and design intent. Review and approval does not relieve the Contractor from responsibility for errors, correctness of details, conformance to the contract, and the successful completion of the work.

MDOT ABC Policy

- Prefabricated Superstructure, Laterally Slide SP requirements:
  - Working drawings, calculations and submittals
  - Move Operations Manual
  - Geometry Control and Monitoring Plan
  - Contingency Plan
  - Trial Horizontal Slide
  - Movement of Superstructure requirements
  - Allowable Tolerances
- Also working on SPMT special provision

MDOT ABC Policy Update:

- Developing static and kinetic friction calculations and criteria for jacking force calculations:
  - $f_{\max\_static} = \mu_{static} \times F_{normal}$
  - $f_{\max\_kinetic} = \mu_{kinetic} \times F_{normal}$

Surfaces	μ (static)	μ (kinetic)
Steel on steel	0.74	0.57
Glass on glass	0.94	0.40
Metal on Metal (lubricated)	0.15	0.06
Ice on ice	0.10	0.03
Teflon on Teflon	0.04	0.04
Tire on concrete	1.00	0.80
Tire on wet road	0.60	0.40
Tire on snow	0.30	0.20

MDOT ABC Policy

- Currently working on updates to MDOT Project Scoping Manual and Mobility Manual for evaluation of ABC/PBES techniques with respect to:
  - Site and Structure considerations
  - Work zone Safety and Mobility
  - Cost
  - Technical Feasibility
  - Seasonal Constraints and Project Schedule
  - Environmental Issues

Why Accelerated Bridge Construction?
Reduced Time

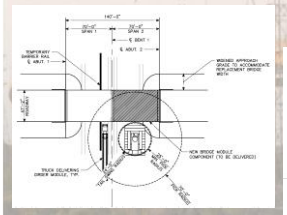
- Project Schedule (Length/Events)
- Part-Width / Detour / Temp Bridge
- User Delay Costs
- MDOT Mobility Policy
  - Volume to capacity ratio less than 0.80
  - Work zone travel delay less than 10 minutes.
  - Corridors of significance
  - Level of service shall not be D or less or drop from A to C.

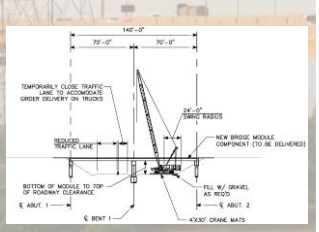
Why Accelerated Bridge Construction ?
Recommended Activities

- Achieve industry buy-in
  - Workshops and Technical Exchange Conferences
  - Allow time to become comfortable and knowledgeable using PBES.
- Think like a Contractor
  - Consider equipment capabilities and capacities
  - Means and methods to be more thoroughly developed during the design phase
- Plan a Program of Projects
  - Build Momentum – a clear signal to the industry that the business model is changing.

Barriers and Challenges to ABC

- Think like a contractor during design
  - Consider equipment capacities





Barriers and Challenges to ABC

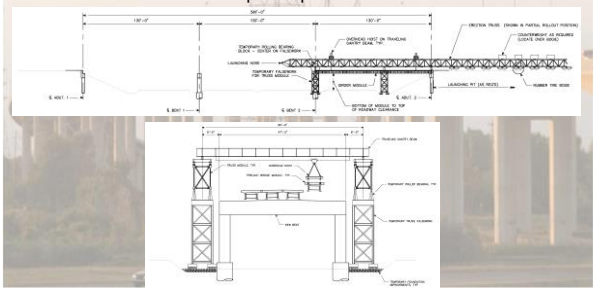
- Lack of Knowledge and Experience
  - Detailing Connections
  - Tracking Durability
  - Designing Curvilinear Geometry
  - Accounting for Negative Moment Continuity
- Availability of Precast Contractors
- Designing component size for transport and site erection
- Contractor Proposing to go Back to CIP After Award

Barriers and Challenges to ABC

- Connections
- Tolerances
- Weight of segments
- Construction Staging

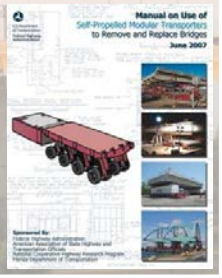
Barriers and Challenges to ABC

- When to innovate during design
  - Without become too prescriptive on means and methods



Barriers and Challenges to ABC

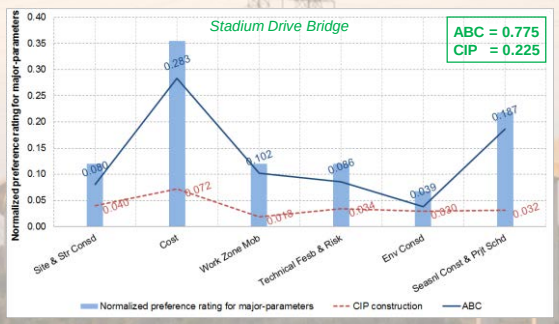
- Costs
  - User delay vs. construction cost, and what equipment to select



Guidelines for Choosing ABC

- Decision making frame work and analysis tools currently being developed as part of an ongoing research project
- Based on AHP (Analytical Hierarchy Process) taking into account both qualitative and quantitative values
- Tool to be used during call for projects process, and project scoping

Decision-Making Model Analysis Result



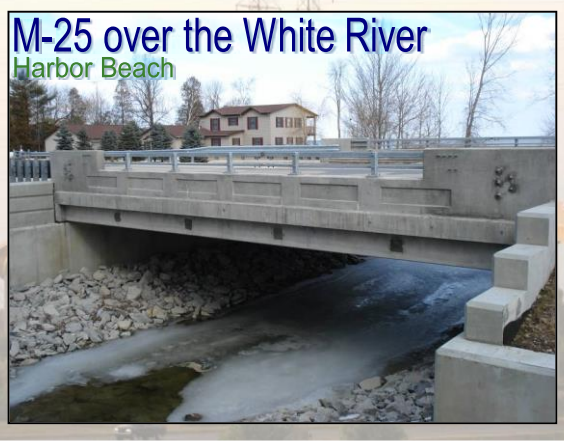
Successful ABC Projects

- Choose proper projects/material applications
- Target abilities of contractors/fabricators
- Analyze effects of cost and schedule
- Partnering
- Shared risk

MDOT's Past and Present with ABC/PBES

- Parkview Avenue over US 131 - 2008
- US 31 BR over White Lake - 2011
- M-25 over the White River - 2011

M-25 over the White River
Harbor Beach

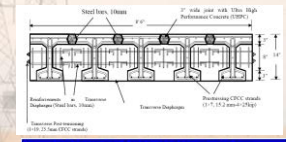


The Future of ABC at MDOT

- 2014 and beyond
  - 3 structural moves scheduled for 2014
  - 1 bridge involving PBES elements (with IBRD funding)
  - Looking for first Self Propelled Modular Transporter candidate
  - Evaluating standard joint and connection details

Future of PBES at MDOT
Decked I-Beam

- Decked I-beam being developed using Carbon Fiber Prestressing Strands and Ultra-High Performance Concrete
- Pooled Fund research project approved by the FHWA – Six States Participating so far (IA, MI, MN, OR, WI)



Thank You

Questions?

MDOT
Michigan Department of Transportation
BRIDGE FIELD SERVICES

Bridge Slides and Moves
Owner Perspective

Rebecca Nix, S.E., Bridge Program Manager
Utah Department of Transportation
MDOT Bridge Move Workshop
December 9, 2013

Presentation Outline

- ABC Implementation
- Contracting Methods
- Contract Documents
- SPMT vs. Lateral Slide
- Monitoring
- Contingency Plan
- Lessons Learned

ABC Implementation

History

- Half depth deck panels – 1999
- Full depth deck panels – 2004
- Precast Substructures – 2007
- Self Propelled Modular Transports (SPMT) – 2007
- Lateral slide – 2009
- Superstructure launch - 2010

ABC Implementation

History

ABC Implementation

History

ABC Method / Element	Number of Bridges
Slide-in	14
Self Propelled Modular Transporters (SPMT)	25
Bridge Launch	2
Heavy Lift Cranes	2
Half Depth Precast Deck Panels	83
Full Depth Precast Deck Panels	34
Precast Voided Slabs	2
Approach Slab Panels	14
Precast Sleeper Slabs	14
Precast Abutments	6
Precast Bent Caps	3
Precast Columns	1
Prefabricated Pedestrian Bridge	5
Precast Box Culvert	44

Leaders in Innovation

ABC Implementation

Benefits

- Enhanced safety
- Shortened on-site construction time
- Reduced traffic/mobility impacts
- Potentially reduced project costs
- Improved quality
- Increased constructability

Leaders in Innovation

Contracting Methods

Design Bid Build

Leaders in Innovation

Contracting Methods

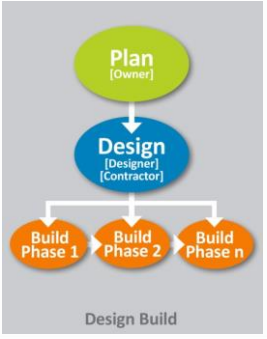
Design Bid Build

- Traditional contracting method
- No contractor involvement during design
- In house or consultant design
- Higher level of risk to owner
- High level of change orders
- Strong team partnering and coordination needed

Leaders in Innovation

Contracting Methods

Design Build



Contracting Methods

Design Build

- Design and construction concurrent
- Early known cost
- Reduced delivery time
- Improved constructability
- Encourage innovation
- Risk mostly transferred to contractor
- Higher bidding effort for contractor

Contracting Methods

Construction Manager/General Contractor

Contracting Methods

Construction Manager/General Contractor

- Contractor on board to consult during design
- Owner able to select innovations
- Reduce design errors, constructability issues, and change orders
- Identify and mitigate risk
- Allows for early procurement
- Limits negotiation on project costs

Contract Documents

Plans

- Level of detail
  - No detail regarding move
  - Show one viable option, schematic
  - Show only permissible move details

Leaders in Innovation

Contract Documents

Specifications

- Clearly define goals, limitations, and requirements of project
  - Submittal requirements
  - Contractor flexibility
  - Tolerance requirements
  - Maintenance of traffic requirements
  - Incentives and disincentives

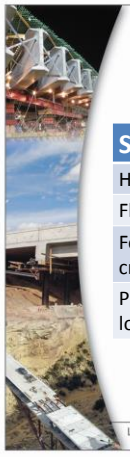
Leaders in Innovation

Contract Documents

Submittals/Acceptance

- Allow for review time in schedule
- Based on level of detail of plans
  - Changes to contract plans
  - Temporary supports (including geotech evaluation)
  - Staging areas
  - Hour by hour schedule
  - Communication plan
  - Contingency plan

Leaders in Innovation



SPMT vs. Lateral Slide

SPMT	Lateral Slide
High equipment cost	Low equipment cost
Flexible staging area	Adjacent staging area
Feature crossed less critical	Feature crossed needs to allow for impacts
Pick points vary from final load path	Load path to supports remains constant

Leaders in Innovation

Monitoring

- Survey
- Levels
- String lines
- Measure gaps
- Simplistic
- Basic

Leaders in Innovation

Monitoring

Leaders in Innovation

Contingency Plan

- Hour by hour schedule
- Well coordinated public involvement
- Backup equipment
- Ability to adjust bridge alignment

Leaders in Innovation

Contingency Plan

Leaders in Innovation

Lessons Learned

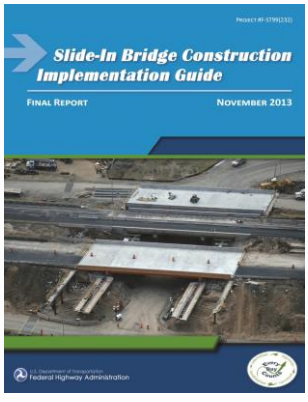
SPMT

- Survey is crucial
- Account for all utilities in travel path
- Specifications need to clearly outline expectations
- Account for varying load paths
- Provide adequate roadway tie-in lengths

Lessons Learned

Lateral Slide

- Select appropriately based on site constraints
- Account for interaction between temporary and permanent supports
- Consider moving approach slabs with superstructure
- Provide adequate roadway tie-in lengths



Thank you

Rebecca Nix, S.E.
Bridge Program Manager
Utah Department of Transportation
rnix@utah.gov
801.633.2810

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Michigan ABC Workshop

Rapid Renewal Project (SHRP-02 R04) Findings

December 2013

Bala Sivakumar

HNTB Corp.

HNTB

Outline

- SHRP2 R04 Goals
- SHRP2 ABC Toolkit
- ABC Standard Design Concepts
- ABC Erection Concepts
- ABC Design Examples
- ABC Specifications
- ABC Training Course
- PBES Demonstration Projects

SHRP2
STRATEGIC HIGHWAY RESEARCH PROGRAM

SHRP2 Project R04

INNOVATIVE BRIDGE DESIGNS FOR RAPID RENEWAL

2008 -- 2013

HNTB (Prime)
Iowa State University
Structural Engineering Assoc.
Genesis Structures

SHRP2 Project R04

PROJECT GOAL

To develop standardized approaches to designing and constructing complete bridge systems that address rapid renewal needs

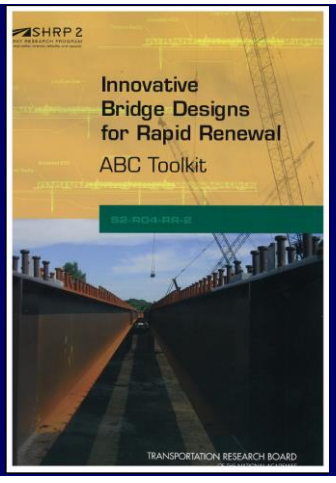
SHRP2 R-04 Tasks

- Capture current impediments to the use of ABC
- Gather successful experiences in ABC
- Propose improved ABC concepts to overcome impediments
- Develop ABC design standards / specifications
- Develop ABC Toolkit / Training materials
- Construct ABC demonstration projects

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

SHRP2 Project R04
ABC TOOLKIT

Standardize Prefabricated Bridge Elements and Systems → Make Accelerated Bridge Construction Standard Practice

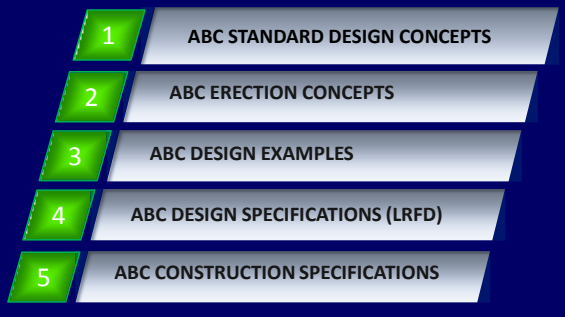


Published Dec 2012

ABC Toolkit

- ***SHRP2 ABC Tool Kit*** was developed for PBES (currently being extended to slide-in construction)
- Will bring about greater familiarity about ABC technologies
- Foster more widespread use of prefabricated elements
- Make best use of program dollars by standardizing design through pre-engineered systems

SHRP2 R04 ABC Toolkit



Expected Outcome: The designer, guided by the Toolkit will be able to easily complete an ABC design for a routine bridge replacement project.

ABC Design Concepts

Guiding Philosophy

- Focus on "workhorse' bridges
- Complete bridges using prefabricated elements and modular systems
- Contractor could self-perform the work
- Simple to fabricate and easy to erect using conventional equipment
- Fast assembly in the field in 1 to 2 weeks
- Durable connections / durable bridges

Conceptual Drawings for PBES

- DECKED STEEL GIRDERS
  - Decked Steel Girder Interior Module
  - Decked Steel Girder Exterior Module
- DECKED CONCRETE GIRDERS
  - Prestressed Deck Bulb-Tee Interior Module
  - Prestressed Deck Bulb-Tee Exterior Module
  - Prestressed Double-Tee module (NEXT Beam)

Conceptual Drawings for PBES

ABUTMENTS & WINGWALSS

- Semi Integral Abutments
- Integral Abutments
- Wingwalls
- Pile Foundations and Spread Footings

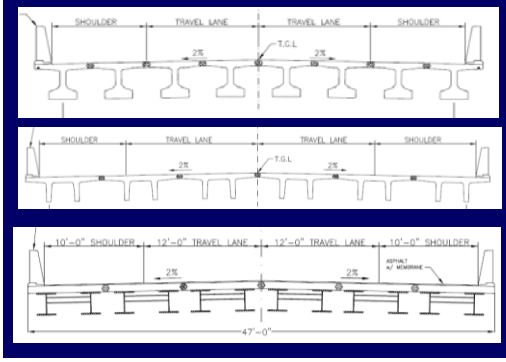
PIERS

- Precast Conventional Pier
- Precast Straddle Bent
- Drilled Shaft and Spread Footing Option

Span Ranges for Superstructures

- Simple / continuous spans from 40 ft to 130 ft.
- Simple for DL ; Continuous for LL ; No Open Joints
- Plans are grouped in the following span ranges:
  - 40 ft to 70 ft
  - 70 ft to 100 ft
  - 100 ft to 130 ft.
- Transported and erected in one piece.
- Weight < 200 Kips for erection using conventional cranes

Prefabricated Decked Beam Elements

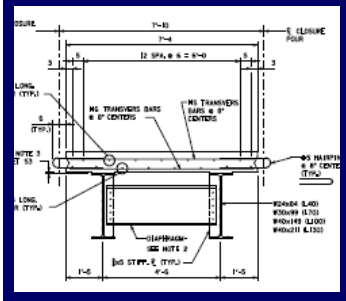


Deck Bulb Tees

Double Tees

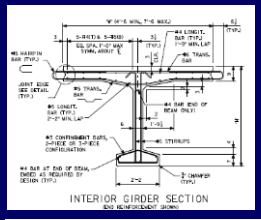
Composite Steel System

Pre-decked Modular Steel Beams

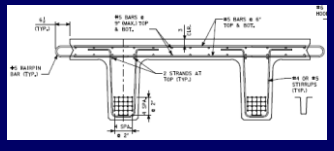


- Not proprietary
- Contractor can self-perform precasting of deck onsite
- Barriers can be precast

Precast Decked Girders



- Deck Bulb Tee
- Span lengths from 40 ft to 130 ft



Adjacent Double Tee

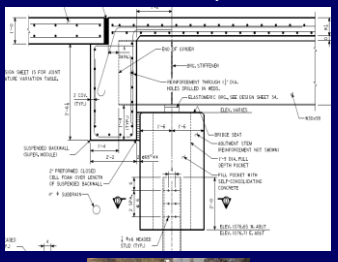
- Based on the PCI NEXT beam
- Spans to 90 ft
- Low depth alternative

Integral and Semi-Integral Bridges for Rapid Renewal

- Well suited for ABC / rapid assembly
- They allow the joints to be moved beyond the bridge
- Close tolerances required when utilizing expansion bearings and joints are eliminated
- The backwall is precast with the deck.
- Fast erection in 1 to 2 days, economical

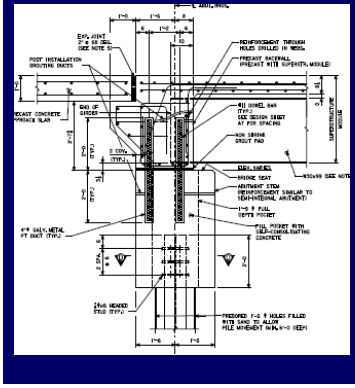
Semi-Integral Abutment

Suspended Backwall



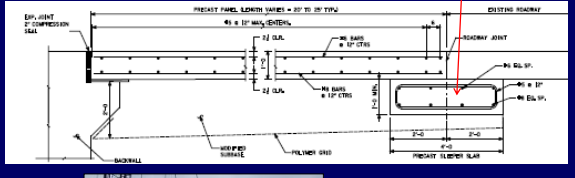
- H piles or spread footings
- Fill pile pockets with SCC
- Easy fit-up in the field

Integral Abutment



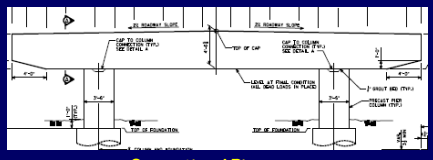
- Only one row of vertical piles
- Precast backwall - dowelled
- Fast construction

Precast Approach Slab



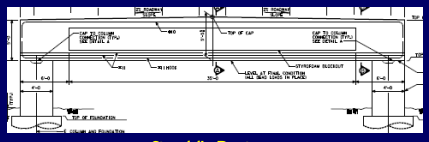
- Exp joint can be moved to sleeper slab
- UHPC / rapidset closure pours

Precast Piers



Conventional Pier

- Non-prestressed so contractor can self-perform precasting
- Fast erection using grouted splice couplers



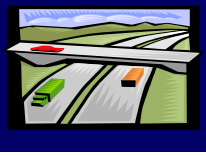
Straddle Bent

- Deep foundation may be outside existing footprint

ABC Erection Concepts for PBE

Erection Concept Drawings

1. Erection using conventional cranes.
2. Erection using ABC construction technologies adapted from long span construction



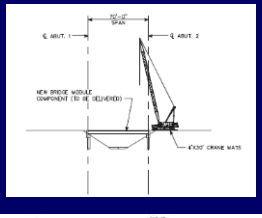
Erection Using Conventional Cranes

Most Economical

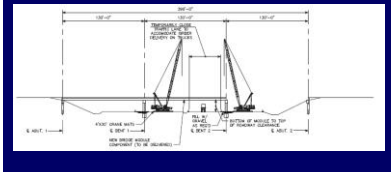
Factors to Consider

- Weight of Module
- Pick Radius
- Crane Set Up Locations
- Ground Access / Barge / Causeway / Work Trestle
- Truck Access for Delivery

Crane Placement for Erection



Short Single Span over Stream
Cranes selected for 90 Kip pick



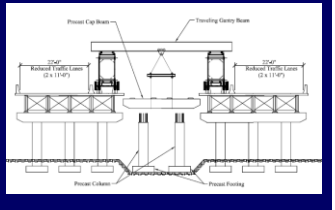
Longer Span over Roadway
Weight up to 200 kips

Crane Picks for Erection

Erection with ABC Construction Technologies

- Use where ground access for cranes may be limited.
- ABC technologies allow construction from above:
  - Above Deck Driven Carriers
  - Launched Temporary Bridge (LTB)
  - Transverse Gantry Frames
  - Longitudinal Gantry Frames
  - Regular cranes with enough reach

Above Deck Driven Carriers



- Allows fast rate of erection
- Rides on existing bridge, new bridge (check capacity to support)
- Ideal for bridges with many spans. long viaducts

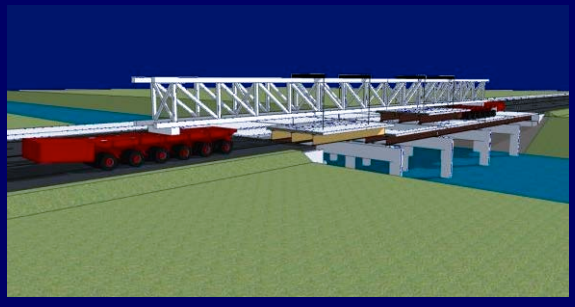
Launched Temporary Bridge

- LTTB's are launched across or lifted over a span to act as a "temporary bridge"
- Used to deliver the heavier modules without inducing large erection stresses.
- Increases the possibility of erecting longer spans
- LTTB example would be a set of standardized lightweight steel trusses that would be assembled to a specific length that suites a given project.

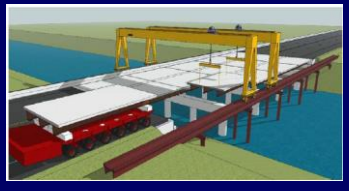
Launched Temporary Bridge

- Sites with limited ground access or long spans
- Launched across or lifted over a span to act as a "temporary bridge"
- Used to deliver the heavier modules without inducing large erection stresses.
- Temp bridge can also support transverse gantry frames

Erection Using Longitudinal Gantry Frame

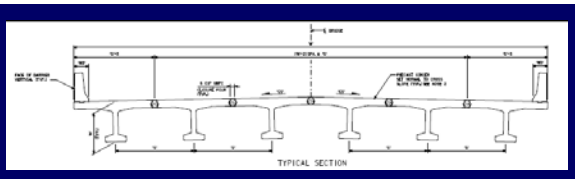


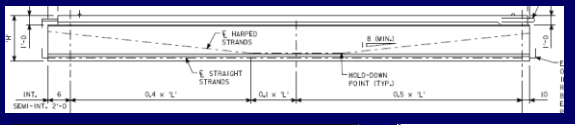
Erection Using Transverse Gantry Cranes



Sample Drawings from ABC Toolkit

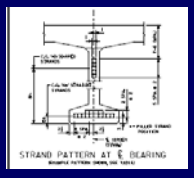
- Shows typical level of detail
- Plan sheets contain ABC specific details for routine bridges
- Guides the designer new to ABC on appropriate module configurations and connections
- Guidance on erection

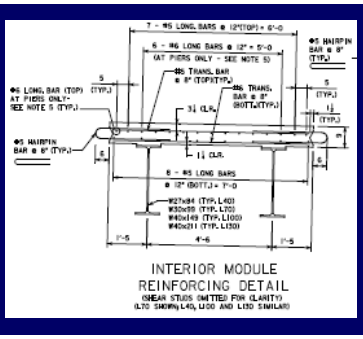


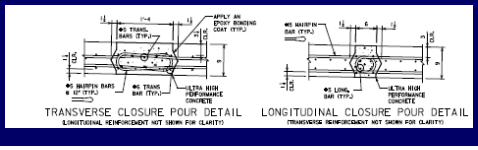


EXAMPLE STRAND LAYOUT - INTERIOR GIRDER

BEAM TYPE	'L' (FT)	'S' (FT)	f'c (KSI)	STRAND SIZE (IN)	STRAIGHT 'Ns'	STRAIGHT 'Es' (IN)	HARPED 'Nh'	HARPED 'Eh' (IN)	TOTAL 'N'	TOTAL 'E' (GRL) (IN)	TOTAL 'E' (WHL) (IN)
DBT42	40	5	8	0.5	6	3.00	4	23.00	10	11.00	3.80
		8	8	0.5	6	3.00	6	22.00	12	12.50	4.00
	70	5	8	0.5	12	3.33	10	20.00	22	10.91	4.09
		8	8	0.5	16	3.75	14	18.00	30	10.43	4.33
DBT48	70	5	8	0.5	10	3.00	10	26.00	20	14.50	4.00
		8	8	0.5	14	3.57	14	24.00	28	13.79	4.29
	100	5	8	0.6	14	3.57	14	24.00	28	13.79	4.29
		7	8	0.6	16	3.75	16	23.00	32	13.38	4.38
DBT60	100	5	8	0.6	12	3.33	10	38.00	22	19.09	4.09
		8	8	0.6	14	3.57	14	36.00	28	19.79	4.29
	130	5	10	0.6	16	3.75	16	35.00	32	19.38	4.38
		7	10	0.6	24	4.50	16	35.00	40	16.70	4.70







SHRP2 Proposed LRFD Specs for ABC

- Prepare LRFD formatted design and construction specifications based on research
- Address impediments in LRFD Specs to ABC implementation:
  - Loads and Load combinations
  - Construction load cases, Erection stresses
  - Design of connections
  - Design responsibility --- EOR / Contractor's engineer
  - Prefabrication tolerances, quality, rideability
  - Assembly plans

Loads for ABC Design

- **Construction Loads –**
  - What kinds of loads are unique to rapid construction?
  - Loads associated with support conditions during fabrication that may be different than the permanent supports
  - Loads associated with member orientation during prefabrication
  - Loads associated with suggested lift points,
  - Load associated with impact considerations for shipping and handling of components,
  - Loads associated with camber leveling, etc.

ABC Specific Construction Loads

- **Dynamic Dead Load Allowance**—An increase in the self-weight of components to account for inertial effects during handling and transportation

- **Camber Leveling Force**—A vertically applied force used to equalize differential camber prior to establishing connectivity between the elements.

ABC Design Examples

- In ABC design the careful determination of span arrangement, girder spacings and module dimensions for shipping and erection can add significant savings.
- Span length is equally important as it is a primary factor in component length.

Decked Steel Girder Design for ABC

Organization of Design Examples in the Toolkit	
I. General: Design Philosophy Design Criteria Material Properties Load Combinations **II. Girder Design:** Flexural Strength Checks Flexural Service Checks Shear Strength Fatigue Limit States	**III. Deck Design:** Flexural Strength Check Deck Reinforcing Design Deck Overhang Design **IV. Continuity Design:** Compression Splice Closure Pour Design

ABC Design Example – Deck Bulb Tee

Organization of Deck Bulb Tee Design Example	
General: Design Philosophy Design Criteria **Girder Design:** Permanent Loads Precast Lifting Weight Live Loads Prestress Losses -- Erection Prestress Losses -- Final	Concrete Stresses at Release Concrete Stresses at Erection Concrete Stresses at Final Flexural Strength Shear Strength Negative Moment Design Camber and Deflections at Release / Erection / Final

*** Engineer of Record should perform own ABC design

Proposed ABC Construction Specifications for LRFD

Recommended Special Requirements for ABC

Proposed Section in LRFD Construction Specifications

XX.1 GENERAL
XX.2 RESPONSIBILITIES
XX.3 MATERIALS
XX.4 FABRICATION
XX.5 SUBMITTALS
XX.6 QUALITY ASSURANCE
XX.7 HANDLING, STORING, AND TRANSPORTATION
XX.8 GEOMETRY CONTROL
XX.9 CONNECTIONS
XX.10 ERECTION METHODS
XX.11 ERECTION PROCEDURES

Proposed ABC Construction Specifications

- Pertain specifically to PBES.
- Focus heavily on means and methods for PBES.
- Mainly a compilation of best practices for ABC construction
- To be updated as new information and lessons learned are accumulated from future ABC projects.
- Use as a guide could develop *Special Provisions* for an ABC project.

SHRP2 STRATEGIC HIGHWAY RESEARCH PROGRAM

SHRP2 Project R04

One-Day Course on

ACCELERATED BRIDGE CONSTRUCTION

Introduction

- The course is geared for engineers, owners, and contractors new to ABC.
- One goal of this course is to familiarize the participants with the ABC Toolkit and its use in ABC designs.
- The slides should be used in conjunction with the ABC Toolkit.
- The slides introduce and explain the use of the ABC Toolkit, which provides the "Training Wheels" for those new to ABC.
- Can be incorporated into an NHI course

Course Outline

- Structured into six lessons as follows:
  - Lesson 1 : Introduction to ABC
  - Lesson 2 : Prefabricated Elements and Systems
  - Lesson 3 : Bridge Movement Technologies
  - Lesson 4 : ABC Toolkit for Designers from SHRP2 – Part 1
  - Lesson 5 : ABC Toolkit for Designers from SHRP 2 – Part 2
  - Lesson 6 : ABC Demonstration Projects

1 day and ½ day versions for DOTs: NY, MI, PA, OK, LA, ME

SHRP2 R04 ABC Demonstration Project #1
Prefabricated Elements (IADOT)

Oct 17, 2011

14 Day ABC Period

Keg Creek Bridge

Nov 1, 2011

Prefabrication of Abutments and Piers

Erection of the Modular Beam Elements

UHPC Joints in Bridge Deck

Precast Approach Slabs

SHRP2 R04 ABC Demonstration Project #2

Slide-In Construction
NY I-84 Bridges
2013

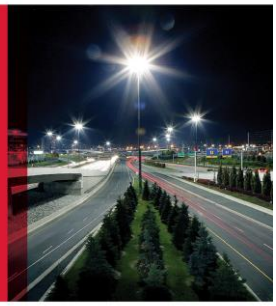
20 Hr Closure

Lateral Slide -- Oct 21 2013

7 hours to demolish exist bridge and slide-in new bridge

AECON

Rapid Bridge Deployment Overview

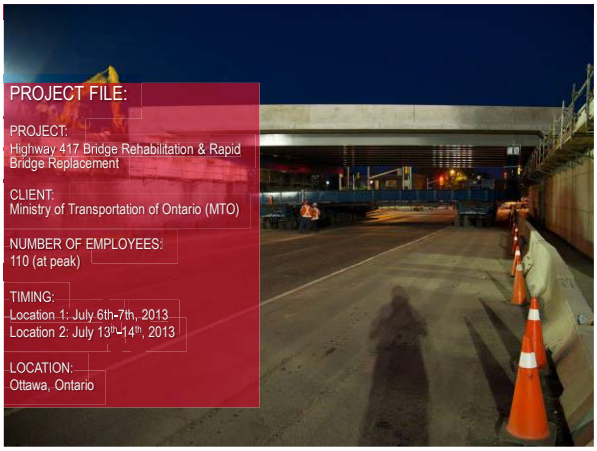


JOHN ALMEIDA P.ENG
General Manager,
Aecon Infrastructure

December 9, 2013

HWY 417 – RAPID BRIDGE REPLACEMENT

Background
Incentives & Disincentives
Planning
Geotech
Sequence of Operations
Future of RBR in Ontario



PROJECT FILE:

PROJECT:
Highway 417 Bridge Rehabilitation & Rapid Bridge Replacement

CLIENT:
Ministry of Transportation of Ontario (MTO)

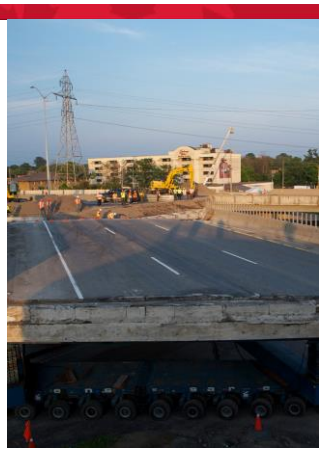
NUMBER OF EMPLOYEES:
110 (at peak)

TIMING:
Location 1: July 6th-7th, 2013
Location 2: July 13th-14th, 2013

LOCATION:
Ottawa, Ontario

BACKGROUND

- 4 East and Westbound Bridges located at Kirkwood and Carling Avenues in Ottawa originally constructed in 1959
- After minor repairs and rehabilitation in 1983 and 2002 the bridge decks exceeded their design life
- Ministry of Transportation Ontario procured $18M rehabilitation contract



BACKGROUND

- Moving 400 Tonnes of Thin Slab Bridges
- The Procedure Lasted 14 Hours
- Fastest Rapid Bridge Replacement Time in Ontario
- 7 Rapid Replacements Carried Out in Ontario to Date
- Required a temporary limited interest(TLI) from adjacent land owner

SCOPE OF WORK

- Rapid replacement and rehabilitation of four 55-year-old bridges
- Widening of substructures to accommodate an extra traffic lane
- Construction of 4 replacement bridges in an adjacent lay down areas
- Resurfacing of asphalt and site restoration

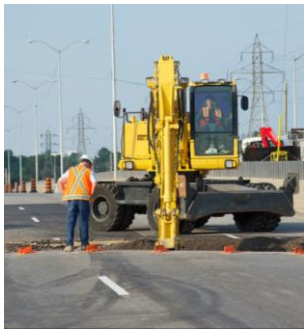
OPERATIONAL CONSTRAINTS

- All bridges had to be replaced between July 5th, 2013 and August 26th, 2013
- Close one lane at 5:00pm; full closure at 6:00pm (Saturday)
- Median lane in each direction must be open by 11:00am (Sunday); lane 2 in each direction to be open by 12:00pm
- Remaining lanes and ramps must be open by 6:00am (Monday)
- Only base course asphalt is required

INCENTIVES & DISINCENTIVES (Lane Closures Pre & Post Bridge Moves)

Penalty For Early Closure

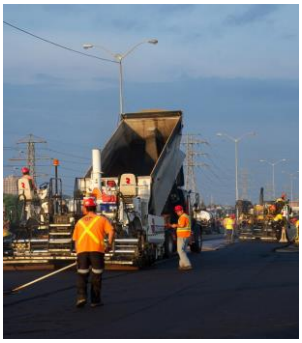
- On each occasion when the Contractor closes lanes to traffic earlier than the specified times, an initial penalty of $ 1,000.00.
- Thereafter, a further penalty of $ 100.00 per minute will be assessed against the Contractor for every minute outside the permitted closure window that the traffic lanes are not open to traffic.



INCENTIVES & DISINCENTIVES (Lane Closures Pre & Post Bridge Moves)

Penalty For Late Opening

- On each occasion when the Contractor fails to reopen the traffic lanes by the specified time, an initial penalty of $ 10,000.00 will be applied.
- If traffic lanes are not open within 15 minutes of the specified time, a further penalty of $ 1,000.00 will be assessed.
- Thereafter, a further penalty of $ 100.00 per minute will be assessed against the Contractor for every minute that the traffic lanes are not open to traffic.



INCENTIVES & DISINCENTIVES (Bridge Move Weekends)

Incentive For Opening Lane 1 (Median Lanes) or Lane 3 (Outside Through Lanes)

- If eastbound and westbound median are completed to a usable facility by 11:00a.m. Sunday, the Contractor receives an incentive of $20,000.00.
- In the event that all work required in opening of either the eastbound and westbound median lanes or the outside through lanes to public traffic is completed prior to 11:00 a.m. Sunday, the Contractor receives an additional incentive of $5,000.00 per each 15-minute period earlier opening to a maximum of four periods, for a total maximum of $20,000.00.
- The total maximum incentive is $40,000.00.

INCENTIVES & DISINCENTIVES (Bridge Move Weekends)

Disincentive for Not Opening Lane 1 (Median Lanes) or Lane 3 (Outside Through Lanes)

- If eastbound and westbound median lanes are NOT completed prior to 11:01 a.m. Sunday, a penalty of $20,000.00 to the Contractor.
- After 11:01 a.m. Sunday, a additional penalty of $5,000.00 per each 15-minute period to a maximum of four periods, for a total maximum of $20,000.00.
- The total maximum disincentive is $40,000.00.

INCENTIVES & DISINCENTIVES (Bridge Move Weekends)

Incentive for Opening Lane 2 and the Ramps

- If Lane 2 and ramps are completed by prior to 12 noon, Sunday, the Contractor receives an incentive of $20,000.00.
- In the event that work required in opening lane 2 and the ramps to public traffic to a usable facility is completed prior to 12 noon, Sunday, the Ministry will pay to the Contractor an additional incentive of $5,000.00 per each 15-minute period to a maximum of four periods, for a maximum of $20,000.00.
- The total maximum incentive is $40,000.00.

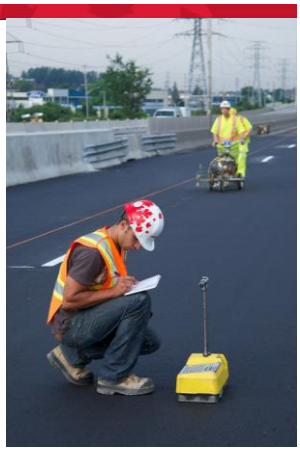
INCENTIVES & DISINCENTIVES (Bridge Move Weekends)

Disincentive for Not Opening Lane 2 and the Ramps

- In the event that all work required in opening lane 2 and the ramps to public traffic is NOT completed to a usable facility prior to 12:01 p.m. Sunday, the Ministry will deduct from its payments to the Contractor $25,000.00.
- In the event that all work required in opening lane 2 and the ramps to public traffic is NOT completed to a usable facility prior to 12:01 p.m., Sunday, the Ministry will deduct from its payments to the Contractor an additional $10,000.00 per each 15-minute period thereafter until 5:00 p.m., Sunday to a maximum of $200,000.

INCENTIVES & DISINCENTIVES

- What does all this mean?
- If things go great, the contractor receives $80,000 incentive per weekend
- If things go very badly then the contractor is penalized $280,000 per weekend



HIGHLY DETAILED PLANNING REQUIRED FROM START TO FINISH

WHY?

PRE-RAPID BRIDGE REPLACEMENT

- Six-months of non-stop planning and pre-rapid lift work
- Strategic resource management of equipment and labour
- Developed a plan with 5 minute milestones with comprehensive if-then-else mitigation measures
- Several field engineers whose sole responsibility was to track and report progress to Superintendent

GEOTECH

- *"The temporary supports located in the construction staging area shall have adequate foundation capacity to prevent settlement before, during and after the construction of the superstructure.*
- *The maximum permissible settlement at any point in the temporary structure shall be 4 mm and the maximum differential settlement between any two points in the temporary structure shall be 2 mm."*

GEOTECH

- Maximum factored axial leg load, Carling Ave Structure: 183 kN
- Maximum factored axial leg load, Kirkwood Structure: 164 kN
- Self-Propelled Modular Transporters (SPMT): 100 kPa

GEOTECH

Temporary Structures

- "hi-load" concrete sill pads, size 1.2 m x 1.2m
- Using the dimensions of the sill pad and the loading values ,contact stresses of 127 kPa (Carling Ave Structure) and 114 kPa (Kirkwood Structure) were calculated at the top of the granular pad. At the natural ground surface, below a 0.6 m thick granular pad, the contact stresses were calculated to be 56 kPa (Carling Ave Structure) and 51 kPa (Kirkwood Structure).
- The ULS factored bearing resistance for the native material, based on the geotechnical information provided, was 100 kPa. Therefore, the applied bearing stresses of 56 kPa and 51 kPa were acceptable.

GEOTECH

Self-Propelled Modular Transporters (SPMT)

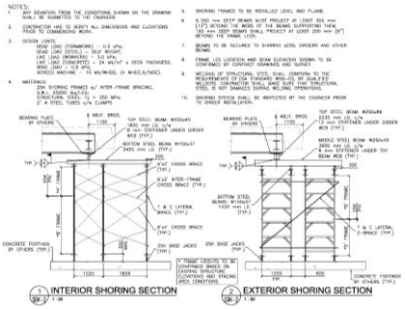
- Based on the loading provided, the SPMT, under loading during transport of the bridges, will have a maximum contact stress of 100 kPa. At the natural ground surface, below a 0.6 m thick granular pad, the contact stress is calculated to be 40 kPa.
- The ULS factored bearing resistance for the native material, based on the geotechnical information provided, is 100 kPa. Therefore, the applied bearing stress of 40 kPa is acceptable.

SURVEY PRECISION

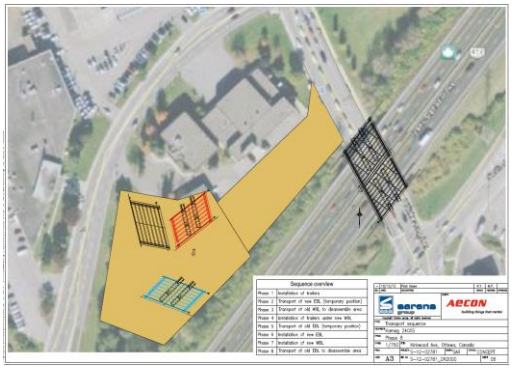
- Strategic surveying techniques
- Double-checking the numbers
  - Skew angles
  - Bearing elevations
  - Span lengths
- Ensuring the optimal level of detail & accuracy is achieved
- Getting the right fit

TEMPORARY SHORING

- Standard 25K shoring frames were used
- Differential elevation was critical
- Choice of temporary shoring system greatly impacts how old bridges will be demolished



DETAILED PLAN OF SPMT MOVES



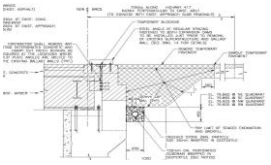
SEQUENCE OF OPERATIONS

- Pre-rapid Lift
- Rapid Lift
- Post Rapid Lift

Pre-Rapid Lift Operations

To be completed during 3 weekends in lane closures

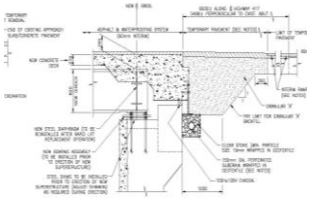
- Removal of the approach slabs and asphalt;
- Earth excavation;
- Saw-cutting and stabilizing of the ballast walls;
- Backfilling to the existing structure ballast walls including sub-drain installation and connection to
- Sub-drain below; and
- Placement of temporary hot mix asphalt.



Rapid Lift Operations

To be completed on a weekend with full lane closure

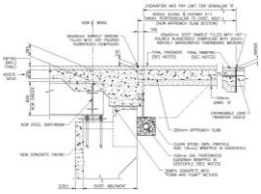
- Earth excavation;
- Removal of the existing EBL and WBL superstructures (including the attached ballast walls) from their existing location and transportation to the construction staging area for dismantling
- Transportation and erection of the new EBL and WBL superstructures from the construction staging area to their permanent location;
- Granular backfilling to the structure;
- Placement of hot mix asphalt on structures and lanes 1, 2 and 3, and corresponding shoulders;
- Placement of hot mix asphalt on approaches except for exterior portions of eastbound and westbound structures
- Installation of temporary concrete barriers



POST Rapid Lift Operations

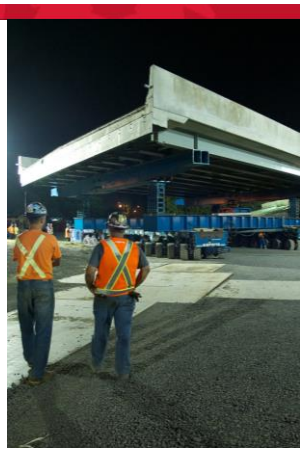
To be completed during 3 weekends in lane closures

- Earth excavation (including saw-cutting and removal of hot mix asphalt);
- Grading and placement of granular base for approach slabs;
- Construction of approach slabs using rapid set concrete (or alternatively precast approach slabs);
- Placement of hot mix asphalt on approach slabs and in the exterior portions of the eastbound and westbound structures (e.g. future Lane 4 and shoulder).
- Placement of median barrier walls on approach slabs using rapid set concrete and including electrical embedded work.



NIGHT WORK

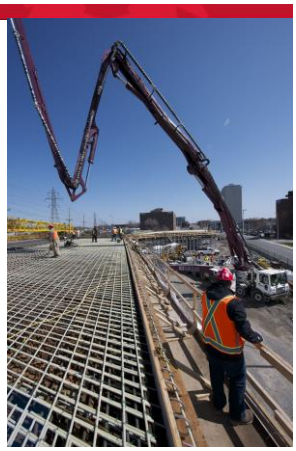
- Working at night, enabled minimal traffic disruption
  - An estimated 136,000 vehicles travel Highway 417's bridges on a daily basis
  - Commuter friendly technology
- Alternate techniques construct bridges section by section in long term lane closures, creating major traffic delays



NIGHT WORK (On Weekends)

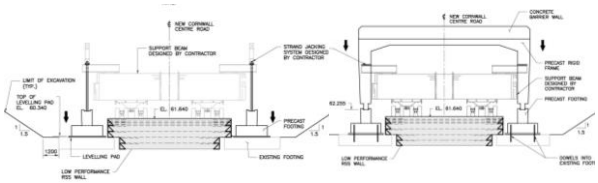
FUTURE OF RAPID BRIDGE DEPLOYMENT

- Less traffic disruption and greater public satisfaction
- Cost and time benefit savings
- Becoming the standard bridge replacement technique in heavily travelled highways



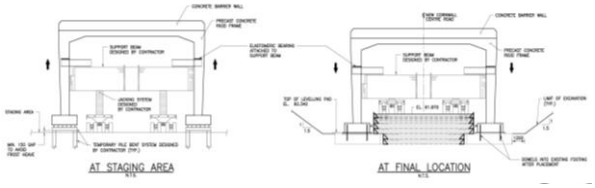
FUTURE OF RAPID BRIDGE REPLACEMENT Two Lift Pilot Project for Rigid Frame Bridge

- Lift/transport & place precast footings
- Pressure grout gaps between leveling pads and underside of new footings
- Drill & install dowels
- Lift/transport and dry-fit rigid frame on new fittings; repeat dry-fit and grinding until full contact has been made between surfaces
- Grout key immediately prior to final lowering upon attaining requisite contact area criteria



FUTURE OF RAPID BRIDGE REPLACEMENT
Single Lift Pilot Project

- Rigid frame bridge transported complete with footings from adjacent yard
- New bridge temporarily set on shim plates; space between bottom of new footings and top of existing footings is pressure grouted
- New footings are doweled into existing bridge footings



RAPID BRIDGE REPLACEMENT
Eragny France

BRIDGE REPLACMENT
Eragny France

- Finger installed in lifting pocket in wall of precast bridge

RAPID BRIDGE REPLACEMENT
Eragny France

http://youtu.be/veLp4MrljEM

MAMMOET

THE BIGGEST THING WE MOVE IS TIME

ABC STRUCTURAL SLIDE & MOVE WORKSHOP

PROCURING TRANSPORT AND LIFT SOLUTIONS

ABC STRUCTURAL SLIDE & MOVE WORKSHOP

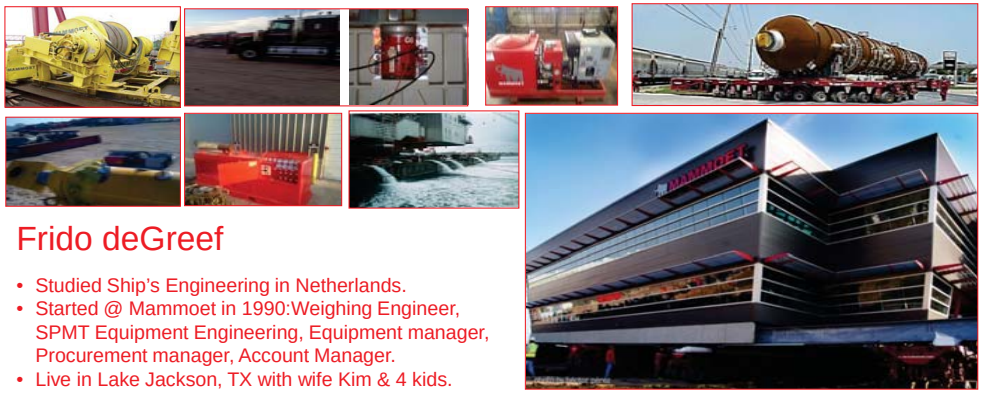
MDOT, DECEMBER 9TH, 2013

AGENDA

- Introduction: *Mammoet & Frido deGreef*
- Pro's of ABC: *Move by example*
- ABC move methods: *Vertical, Horizontal, Monitoring*
- What goes up must come down: *Removal of old structures*
- Procuring ABC lifting & transportation solution Cost, quality,

MAMMOET

INTRODUCTION: Frido deGreef



Frido deGreef

- Studied Ship's Engineering in Netherlands.
- Started @ Mammoet in 1990:Weighing Engineer, SPMT Equipment Engineering, Equipment manager, Procurement manager, Account Manager.
- Live in Lake Jackson, TX with wife Kim & 4 kids.

First civil job: small church in Germany; 45 x 45ft; 300 ton

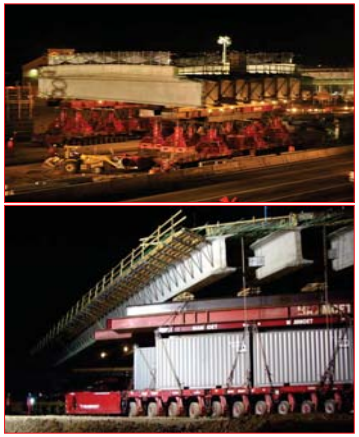
MAMMOET

INTRODUCTION: MAMMOET USA, INC.

Global coordination with local experience

Incorporated 1989	
Employees:	~400
Cranes:	>35 (440-3300ton)
SPMT's:	>500 axle lines
Conventional Lines:	>400 axle lines

Locations: Rosharon, TX; Houston, TX; Port Allen, LA; New Iberia, LA; Atlanta, GA; Vancouver, WA; Rockdale, IL



We live where we work!

MAMMOET

INTRODUCTION: MAMMOET GLOBAL

Mammoet: A Global Brand With Local Experience

Global Revenues:	USD $1.4B+
Employees:	~5,000
Cranes:	>1,400
SPMT's:	>2,700 axle lines
Conventional Lines:	>1,650 axle lines
Jacking & Skidding:	>40,000 ton capacity
Worldwide Offices:	80

London's EYE construction time was cut in half !!

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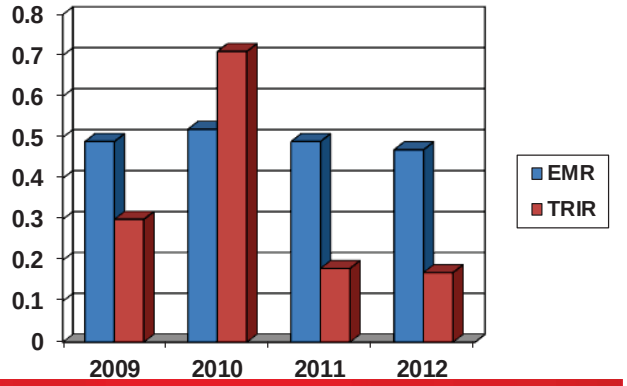
"MAMMOET IS A COMPANY FULLY COMMITTED TO SAFETY"

- **Decreasing EMR/IMR As Workload Increases**

THE TARGET **0** ACCIDENTS/ INCIDENTS



Mammoet USA, Inc.: EMR October 2013: 0.41, TRIR 0.70

MAMMOET

PRO'S OF ABC: Move by example: Mammoet Netherlands

Fact Sheet:

- Weight: approx: 2500ton
- Height: 120ft
- Max 5º allowed
- 10 Stories, 45000 sqft
- Transport: 11/10/2001

Rail Bridge had to be overridden for last 3ft of clearance

MAMMOET

ABC MOVE METHODS

- **VERTICAL**
  - Cranes
  - Tower Systems
    - Strand Jacks
    - Gantry systems
  - Jacking
    - Climbing Jacks
    - Titan Systems
    - JS 500
- **HORIZONTAL**
  - Trailers
    - SPMT's
    - Conventional Trailers
  - Skidding
  - Barging
- **MONITORING**

- Possibility for use in demolition / removal projects. Major savings possible if in combination with installation!!

- **Considerations**:

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering					
Specialism					
Availability (2014-2020					
Mob / Demob					
Installing of equipment					
Speed of execution					
Demolition possibilities					
OVERALL IMPACT TO BUDGET					

MAMMOET

PRO'S OF ABC: Move by example: Mammoet USA

Fact Sheet:

- Weight: approx: 1200 ton
- Fully functional within 2 weeks after move
- Max 2º slant allowed
- 2 Stories, 32,000 sqft
- Transport: 12/17/2011

Total distance transported: ½ mile in 4 hours

MAMMOET

ABC MOVE METHODS

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  - Skidding
  - Barging
- **MONITORING**

- **Considerations**:
- Ground Pressure
- Lifting points
- Chart / Overweight

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering			X		
Specialism				X	
Availability (2014-2020)		X			
Mob / Demob	X				
Installing of equipment		X			
Speed of execution				X	
Demolition possibilities				X	
OVERALL IMPACT TO BUDGET		X			

Rigging needs to be engineered, tested and certified

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- **Considerations**:
- Ideal for hard to reach area's
- Extreme savings when implemented early in design phase
- Computer controlled slow lift
- Can be used for bridge removal

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering		X			
Specialism	X				
Availability (2014-2020)		X			
Mob / Demob				X	
Installing of equipment			X		
Speed of execution			X		
Demolition possibilities			X		
OVERALL IMPACT TO BUDGET			X		

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- **Considerations**:
- 100t-300t-900t capacity per tower, with multiples per tower possible
- Hammerhead tower design ideal for bridges
- Electrical power possible
- Support cranes needed

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering		X			
Specialism	X				
Availability (2014-2020)		X			
Mob / Demob				X	
Installing of equipment			X		
Speed of execution			X		
Demolition possibilities			X		
OVERALL IMPACT TO BUDGET			X		

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- **MONITORING**

- **Considerations**:
- Capacity up to 1250t
- Ideal for lighter deck removal with skidding beams mounted on girders
- Limited lift height
- Needs stable ground

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering			X		
Specialism			X		
Availability (2014-2020)			X		
Mob / Demob				X	
Installing of equipment			X		
Speed of execution			X		
Demolition possibilities			X		
OVERALL IMPACT TO BUDGET			X		

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- **Considerations**:
- Pressure point to both structure as well as support
- Height restricted
- Labor intensive, slow

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering			X		
Specialism			X		
Availability (2014-2020)				X	
Mob / Demob					X
Installing of equipment				X	
Speed of execution		X			
Demolition possibilities		X			
OVERALL IMPACT TO BUDGET				X	

17 **Jacks come from 5-1000ton with strokes up to multiple feet**

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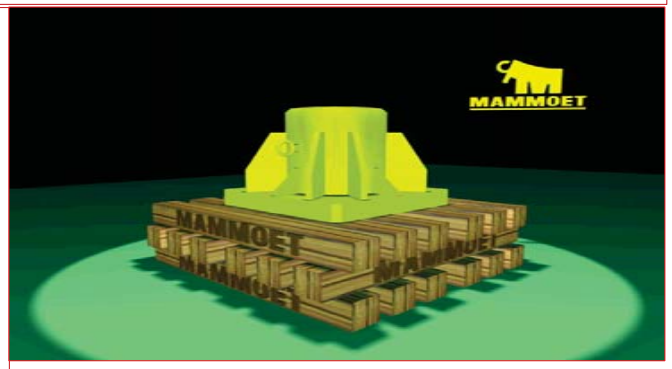

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- Height restricted
- Labor intensive, slow

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering			X		
Specialism			X		
Availability (2014-2020)				X	
Mob / Demob					X
Installing of equipment				X	
Speed of execution		X			
Demolition possibilities		X			
OVERALL IMPACT TO BUDGET				X	

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- **Considerations**:
- Ideal in combination with SPMT's
- Extremely stable & support friendly

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering			X		
Specialism		X			
Availability (2014-2020)				X	
Mob / Demob			X		
Installing of equipment			X		
Speed of execution		X			
Demolition possibilities			X		
OVERALL IMPACT TO BUDGET			X		

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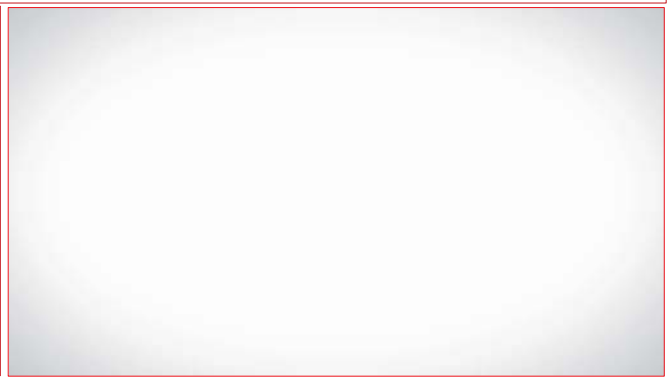

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- **Considerations**:
- Above 33 ft additional bracing needed
- Stable
- Computer controlled jacking
- 500 ton per tower

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering			X		
Specialism			X		
Availability (2014-2020)				X	
Mob / Demob		X			
Installing of equipment			X		
Speed of execution		X			
Demolition possibilities			X		
OVERALL IMPACT TO BUDGET			X		

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- **Considerations**:

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering					
Specialism					
Availability (2014-2020)					
Mob / Demob					
Installing of equipment					
Speed of execution					
Demolition possibilities					
OVERALL IMPACT TO BUDGET					

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- **Considerations**:
- Ground pressure
- Extremely versatile
- Bracing between SPMT's and structure is extremely important
- Air filled tires

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering		X			
Specialism		X			
Availability (2014-2020)	X				
Mob / Demob	X				
Installing of equipment			X		
Speed of execution				X	
Demolition possibilities				X	
OVERALL IMPACT TO BUDGET		X			

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- **Considerations**:
- 30 ton per axle line!!
- 360degree steering
- Spacers available for cost savings
- Titan system combination
- Hydraulic systems can be set up for 3 or 4 point set up.

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering		X			
Specialism		X			
Availability (2014-2020)	X				
Mob / Demob	X				
Installing of equipment			X		
Speed of execution				X	
Demolition possibilities				X	
OVERALL IMPACT TO BUDGET			X		

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- **Considerations**:
- 10ft wide & thus more stable than SPMT if used as single trailer
- Less steering possibilities in most conventional trailer types
- Different loading chart for different types and brands

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering			X		
Specialism				X	
Availability (2014-2020)				X	
Mob / Demob			X		
Installing of equipment			X		
Speed of execution			X		
Demolition possibilities			X		
OVERALL IMPACT TO BUDGET			X		

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- **Considerations**:
- Great solution for value engineering

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering			X		
Specialism			X		
Availability (2014-2020)				X	
Mob / Demob					X
Installing of equipment				X	
Speed of execution		X			
Demolition possibilities			X		
OVERALL IMPACT TO BUDGET				X	

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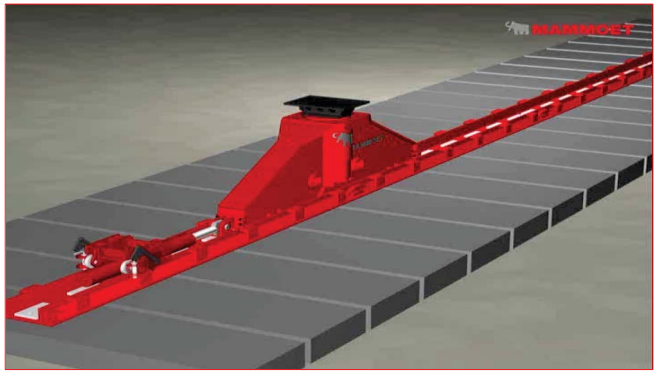

- **Considerations**:
- Great solution for value engineering
- Combination with jacking / installation
- Loads from 100- 750ton

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering			X		
Specialism			X		
Availability (2014-2020)				X	
Mob / Demob					X
Installing of equipment				X	
Speed of execution		X			
Demolition possibilities			X		
OVERALL IMPACT TO BUDGET				X	

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- **Considerations**:
- Weather, water level
- Additional equipment needed: ballasting, winching, mooring, tugs
- Deck load calculations
- Can be used for spacing between other barges

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering		X			
Specialism		X			
Availability (2014-2020)		X			
Mob / Demob	X				
Installing of equipment				X	
Speed of execution	X				
Demolition possibilities		X			
OVERALL IMPACT TO BUDGET		X			

Engineering is required on most additional equipment needed

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- **Considerations**:
- Load cells 5-750ton
- Lasers for measuring and / or compare distance
- Strain gauges for stress indication
- Pressure indicators for hydraulic cylinders

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering					X
Specialism			X		
Availability (2014-2020)					X
Mob / Demob					X
Installing of equipment					X
Speed of execution					X
Demolition possibilities				X	
OVERALL IMPACT TO BUDGET					X

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WHAT GOES UP MUST COME DOWN

Most structures can be removed by using same methods as for installation.

Keep in mind:

- Deterioration of structural members for support or lifting
- Weight prediction
- Cost savings when structure is lowered to manageable height for demolition access

Oakland Bay Bridge was lowered for demolition

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- **Considerations**:
- Software written for special projects
- Generic software is available
- Warnings based on parameters indicated by owner / engineering bureau

IMPACT TO YOUR BUDGET	$$$$$	$$$$	$$$	$$	$
Engineering					X
Specialism			X		
Availability (2014-2020)					X
Mob / Demob					X
Installing of equipment					X
Speed of execution					X
Demolition possibilities				X	
OVERALL IMPACT TO BUDGET					X

S.F. Bay Bridge was vertical & horizontal monitored

MAMMOET

PROCURING ABC LIFTING & TRANSPORTATION SOLUTION

Procurement is the acquisition of goods, services or works from an external source.

It is favorable that the goods, services or works are **appropriate** and that they are procured at the **best possible cost** to meet the needs of the purchaser in terms of **quality** and **quantity**, **time**, and **location**.

Corporations and public bodies often define processes intended to promote **fair** and **open competition** for their business while **minimizing exposure** to fraud and collusion.

- From Wikipedia, the free encyclopedia

Lifting and transportation costs can account up to 2-3%

MAMMOET

PROCURING AN ABC LIFTING AND TRANSPORT SOLUTION

- **Best possible cost** practices:
  - Method of lift and / or transport to be reviewed by specialized engineers
  - Support and lifting points to be designed in early stage of engineering
  - Construction of structure as low as possible but with ample space for transportation or lifting access
  - Combine removal and installation of structures with same equipment
  - Involve lifting / transportation contractor in design phase

Savings up to 20-30% of contract value can be achieved MAMMOET

PROCURING AN ABC LIFTING & TRANSPORT SOLUTION

- **Quality & Quantity practices**:
  - Education and experience should be documented for all involved in preparation and execution of project: training, testing, certification of employees.
  - Safety should not be reactive but pro-active: training, pre-employment & random drug screens, kick off, toolbox & lessons learned meetings.
  - Equipment maintenance & repairs according or surpassing guide lines of manufacturers, spare part management, documentation & certification.
  - Communication of whole project through available & clear lines.

Equipment maintenance shows when it stops working MAMMOET

PROCURING AN ABC LIFTING & TRANSPORT SOLUTION

- **Best possible cost avoidances**:
  - Adding extra weight — Extra equipment
  - False work — Transportation
  - Custom made rigging, towers, etc. — Fabrication
  - Extreme deadlines — Labor cost

MAMMOET

PROCURING AN ABC LIFTING & TRANSPORT SOLUTION

- **Quality and quantity avoidances**:
  - Engineering guidelines unclear
  - Poor planning for mob /demob — Site congestion
  - On-site spectators — Liabilty

A safe employee is trained BEFORE entering your site MAMMOET


MAMMOET
THANK YOU FOR YOUR TIME