CORRE, INC.

October 12, 2011

TO: Wisconsin Department of Transportation
Division of Transportation System Development
Bureau of Structures

FROM: CORRE, Inc.

SUBJECT: Updated Quality Assurance/Quality Control Plan

This document is being provided to update our previously submitted Quality Assurance/Quality Control Plan based on staffing changes in our company. This updated plan removes the use of outside sources as part of the QA/QC procedure due to the addition of team members with extensive experience designing and constructing structures for the Wisconsin Department of Transportation.

Quality Assurance (QA) is about proper planning, training, monitoring and documentation. The goal of our QA program is to produce structure designs and plans at a high level of quality that our clients will recognize.

The philosophy of this QA program is to ensure that junior level engineers have proper mentoring, guidance, and input during design and plan development and that senior level engineers are utilized to ensure the final product complies with applicable codes and standards, meets goals established for each project, and meets or exceeds industry standards for level of care.

There are typically two major milestones for structure plan development: 1.) preliminary plans and 2.) final plans. Extensive checklists will be utilized by designers and technicians to ensure major items are covered and checked in the development of computations and plans for these major milestone submittals. A sample of these checklists is included in the appendices. A thorough review will also be completed by senior level engineers to ensure the goals of the QA program, noted above, are met. CORRE, Inc. will utilize a Quality Control (QC) Verification system to ensure the QA program is properly implemented for all projects. A copy of the QC Verification system/form is included in the appendices.

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The Quality Control Team will consist of the following roles:

1. **Designer or Technician**: This person will be responsible for preparing the design, plans, quantities, etc. An established procedure with extensive checklists and design software will be utilized to ensure these items are prepared accurately.
2. **Senior Technical Reviewer**: This person will be responsible for an in-depth review of the design, plans, quantities, etc. The person utilized for this role will have a significant amount of experience with similar work.
3. **Project Manager**: The review this person performs will be to ensure project specific parameters are incorporated into the design, plans, quantities, etc. This would include verifying that the most current alignments, profiles, typical sections are utilized as well as verifying items such as aesthetics, lighting, etc. have been accurately incorporated in the work. At times, the same person may perform the role of the Senior Technical Reviewer and the Project Manager.
4. **QA/QC Manager**: This person will ensure that the Quality Control has been implemented for the project and will perform reviews to ensure items are reasonable, biddable, and constructible.

We believe the implementation of the QA/QC System outlined in this document will ensure that our structure designs and plans comply with applicable codes and standards, meet the goals established for each project, and meet or exceed industry standards for level of care.

List of Appendices:

Appendix 1 - QA/QC Verification Summary Sheet
(Included in e-submittal)

Appendix 2 - Internal QC Verification Form
(Internal form kept with project documents)

Appendix 3 - Sample Preliminary Bridge Checklists
(Internal form kept with project documents)

Appendix 4 - Sample Final Bridge Checklist
(Internal form kept with project documents)

APPENDIX 1

QA/QC VERIFICATION SUMMARY SHEET

CORRE, INC.

QA /QC Verification Summary Sheet

Prepared for: Wisconsin Department of Transportation
Division of Transportation System Development
Bureau of Structures

Prepared by: CORRE, Inc.

WisDOT Project ID: _____ CORRE Project No.: _____

Project Name: _____

County: _____

Structure No.: _____

Structure Description: _____

This document verifies that structural engineering services under the Design Engineering Services Contract for the subject project have been performed in accordance with generally accepted standards of the engineering profession, requirements contained in the Department's Facilities Development Manual and the Department's LRFD Bridge Manual.

This document also verifies that CORRE, Inc.'s Quality Assurance/Quality Control (QA/QC) Program has been followed for the subject project.

Signatures:

Design Engineer:

_____

_____
(Printed Name)

Date: _____

Project Manager:

_____

_____
(Printed Name)

Date: _____

QA/QC Manager:

_____

_____
(Printed Name)

Date: _____

Senior Technical Reviewer:

_____

_____
(Printed Name)

Date: _____

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APPENDIX 2

INTERNAL QC VERIFICATION FORM

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Project Description:	
Project ID.:	
Structure Number	

INTERNAL QUALITY CONTORL VERIFICATION FORM

Task Description	Designer or Technician	Completion Date	Senior Technical Reviewer	Completion Date	Project Manager	Completion Date	QA/QC Manager	Completion Date
Preliminary Design Computations								
Preliminary Structure Plans								
Preliminary Submittal Documents								
Final Design Computations								
Final Structure Plans								
Quantity Computations								
PS&E Documents								

QA/QC PLAN & PROCEDURES

Design Computations

Designer - Completes design and signs off once completed. Comps to include code references and WisDOT Policy items. Forwards comps with a finalized design summary to Senior Technical Reviewer when complete.

Senior Technical Reviewer - Checks calculations or performs independent calculations for verification of results. Ensures codes/WisDOT Policy items are addressed. Meets with Designer to resolve questions/comments. Forwards to Project Manager once review process is complete.

Project Manager - Reviews design to ensure project specific parameters and goals are accurately incorporated. Confirms geometric parameters are current. Once review is complete, forwards to QA/QC Manager.

QA/QC Manager - Performs a cursory review of calculations to ensure results are "reasonable." May perform independent checks for verification. Meets with design team to resolve questions/comments. Signs form once all questions/comments have been addressed.

Structure Plans

Technician - Completes plans using QA/QC'd finalized design summary, checklist, standard details, and similar plans. Completes mark-ups returned by reviewers. Highlights mark-ups as they are completed. Signs off once review comments from Designer and Senior Technical Reviewer are completed.

Designer - Checks plans using QA/QC'd finalized design summary, checklist, standard details, and similar plans. Performs detailed review of all plan content. Red lines all changes and highlights correct items. Returns mark-ups to technician and backchecks modifications. Process continues until plans are complete. Once complete, signs off and forwards plans to Senior Level Reviewer.

Senior Technical Reviewer - Performs a detailed review of the plans. This includes checking dimensions, rebar lengths, etc. and verifying plans comply with design. Red lines all changes and highlights correct items. Returns mark-ups to Designer and Technican to address comments. Recieves updated plans and backchecks modifications. Process continues until plans are complete. Once complete, signs off and forwards plans to Project Manager.

Project Manager - Reviews plans to ensure project specific parameters and goals are accurately incorporated. Ensures items such as clear roadway width, beam guard attachments, lighting, etc. are covered by the plans. Forwards plans to QA/QC Manager once review process is complete.

QA/QC Manager - Reviews plans for reasonableness/constructability/bidability. Meets with design team to resolve questions/comments. Signs off once all questions/comments have been addressed.

Note: copies of checklists and checked (red lined/highlighted) plan sets to be stored until construction is complete.

Quantity Computations

Designer - Completes quantities and signs off once completed. Ensures plans and finalized quantity comps match. Forwards comps to Senior Technical Reviewer when complete.

Senior Technical Reviewer - Checks computations or performs independent computations for verification of results. Meets with Designer to resolve questions/comments. Forwards to Project Manager when complete.

Project Manager - Reviews quantities to ensure project specific parameters and goals are accurately incorporated. Ensures that bid items cover all required work. Also, performs a "reasonableness" check of the quantities.

QA/QC Manager - Performs a cursory review of computations to ensure results are "reasonable." May perform independent checks for verification. Meets with design team to resolve questions/comments. Signs form once all questions/comments have been addressed.

PS&E Documents

Designer - Completes special provisions, cost estimates, etc. and signs off once completed. Checks for consistency between plans/bid items/PS&E documents. Forwards documents to Senior Technical Reviewer when complete.

Senior Technical Reviewer - Checks documents and reviews for consistency with plans/bid items/PS&E documents. Meets with Designer to resolve questions/comments. Forwards to Project Manager when complete.

Project Manager - Reviews documents to ensure project specific parameters and goals are accurately incorporated. Ensures that the documents cover all required work. Forwards to QA/QC Manager once documents are finalized.

QA/QC Manager - Reviews documents. Meets with design team to resolve questions/comments. Signs form once all questions/comments have been addressed.

APPENDIX 3

SAMPLE PRELIMINARY BRIDGE CHECKLISTS

CORRE, INC.

PROJECT DESCRIPTION: _____

PROJECT ID: _____

STRUCTURE NUMBER: _____

Preliminary Design	
General Items:	
Initials	Item Description
	Confirm proposed typical section, vertical clearances, and lateral clearances. Ensure concurrence for these items is documented.
	Determine initial girder layout, deck thickness, etc.
	Have soil borings been requested?
	Staged construction required?
	Review existing/proposed utilities and determine their impact on foundation.
	Check freeboard. 2-ft minimum is recommended. If not possible then consider structure type (i.e. slab preferable to girder system)
	Confirm proposed abutment types are based on WBM Figure 12.7-1. Expansion joints should be minimized for maintenance. Therefore, when requirements are on the borderline of expansion vs. semi-expansion, look at modifying to use semi-expansion.
	Foundations. Poor foundation conditions may influence the structure geometry. It may be more economical to use longer spans and fewer substructure units or a longer structure to avoid high approach fills
	Confirm existing piling will not interfere with proposed work. Take into consideration existing piling that are battered.
	Ensure sufficient cover exists on top of proposed pier footings.
Plan View:	
	Verify bridge layout with the reference file of the roadway.

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	Prepare bridge layout for survey and OHW marking. Have OHW marked by DNR before surveying begins (Stream crossing only)
	Verify that all items are dimensioned and check all dimension strings.
	Span lengths and clear widths between parapets are shown.
	Dimensions are shown along reference line for straight bridges and tangent line for curved bridges.
	Stations are indicated at piers, abutments, and end of deck. Also show station for intersection with reference line of roadway beneath for grade separation structures.
	Skew angles and angles of intersect are shown with highways, streets, and railroads.
	Indicate location of minimum vertical clearance
	Direction of station increase
	Show contours of existing ground line (Stream crossing)
	Direction of stream flow and name.
	Outline of slope of new fill
	Extent of slope paving and/or riprap
	Highway number and traffic lanes/direction
	Horizontal clearance dimensions, pavement, shoulder, sidewalk and structure roadway widths
	Paving notch is indicated
	Horizontal curve data. Show station of PC, PT, and PI (if horizontal curve is in limits of structure)
	Median width
	Floor drains and pipe underdrains behind abutments
	Existing structure and number, buildings, underground utilities, pole lines
	Show existing structure in dashed lines on plan view
	Beam guardrail location and wingwall lengths
	North arrow

	Structure number and description
	Name plate location (first wingwall on right as going up station).
	Bearings of reference lines
	Excavation protection for railroads
	Deck lighting
	Utilities on superstructure
	Show underground utilities and overhead lines
Elevation View:	
	Profile of existing groundline or streambed
	Cross-section (show berm slopes at abutments)
	Fixed, Semi-expansion or expansion bearings are indicated
	Top of berm elevation, slope of back slope
	Slope paving concrete or riprap shown
	Vertical scale bar
	Min. depth of footing
	Bottom of footing elevation shown
	Type of piling and pile termination depth is estimated
	Location and amount of minimum vertical clearance
	Normal and highwater elevations (stream crossing only)
	Foundation seal (if required)
	Underground utilites, estimate elevation

	Expansion devices
Cross Section (Half Section if Symmetric):	
	Slab thickness
	Sidewalk, curb height and width
	Type of railing, parapet and description.
	Horizontal dimension tied to reference line
	Girder spacing and estimated depth
	Show crown location
	Show location of the profile grade line. “Point referred to on profile grade line.”
	Cross slopes
	Show width, height, and overhang of parapets
	Show lane and shoulders and their dimensions
	Show out to out width of structure for the top dimension line
	Show clear width of the structure
	Show the deck width for the bottom dimension line (below structure)
	Verify that all dimension strings add up
	“¾” DRIP GROOVE, TYP. TERMINATE 2’-0” FROM SUBSTRUCTURE UNITS”
	Pier with columns shown
	If length of concrete pier cap between outer columns exceeds 60-ft, provide account for temperature changes and concrete shrinkage
	Dimension minimum depth of bottom of footings below ground line or top of rail fro RR crossings
	Utilities on superstructure

	Lighting on or under
Miscellaneous:	
	Profile grade line on structure
	Vertical curve data: Show stations, elevation of PC, PI, PT and centerline of all substructure units on the PGL
	Give substructure stations and elevation on the PGL diagram
	PGL of highway or railroad beneath structure
	Design data
	Traffic data
	Hydraulic data and streambed elevation
	List of drawings
	Benchmarks
	Complete and current Title Block
	Check ID number in upper right corner
	Structure design contact:
	Show temporary sheet piling
	Horizontal curve data
	Show construction stages
	Sketches showing the stage removal and stage construction of the superstructure and limits of removal of the substructure
	Location of the temporary concrete barrier or bridge rail
Estimated Quantities:	
	Enter bid items in order of the standard specification
	Bid items & SPV's

	Note: All items are Category ____
	Quantity units
	"PREFORMED JOINT FILLER" in non-bid items
	"BRIDGE SEAT PROTECTION" in non-bid items for all expansion joint bridges
	Incidental items i.e. cost of concrete inserts is to be included in the price per cubic yard of concrete masonry

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Consultant Preliminary Plan Submittal Check List
(Information to be sent to Bridge Office)

This checklist does not replace the Structure Survey Report form. It is a tool for the project development engineer to ensure a complete submittal. See front sheet of Structure Survey Report for detailed description of items. Also, see section 6.5 of Bridge Manual for further details.

____ Transmittal Letter/Memo	(1 copy) Indicating items enclosed and District Contact.
____ Structure Survey Report	(1 copy) Completed by consultant including all proposed structure information.
____ Small County Map	(1 copy) Indicating location of structure.
____ Prelim. Roadway Plans	(3 copies) Showing existing and proposed profile grade line, proposed horizontal curve data, structure location, and typical section.
____ Contour Map**	(3 copies) with contours labeled, existing structure shown, north arrow, stream direction, and scale 1'': 20'. Show Proposed Structure And Limits of Riprap.
____ Prelim. Structure Plans	(3 copies) Showing dimensions, plan vies, elevation view, section through roadway and subsurface information.
____ Original Photographs	(1copy) Panoramic views upstream and downstream, existing structure, upstream and downstream structure and roadway.
____ Hydraulic Report**	(1 copy) Discussion of hydraulics, design considerations and alternatives considered. See Chapter8, appendix 8-A of Bridge Manual for example. (Disk with Hydraulic Calcs.).
____ Geotechnical Report	Boring logs and foundation recommendations.
____ FEMA Floodplain Map**	(1 copy) Showing location of structure.

** Required only for Water Crossing Structures.

APPENDIX 4

SAMPLE FINAL BRIDGE CHECKLIST

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Project Description:	
Project ID.:	
Structure Number	

FINAL PLANS CHECKLIST

	Technician	Reviewer
General Plan Sheet		
1. Plan View		
Stations: bearings, end of deck slab, interesting of highway ref. Lines		
overall span length, ctr. to ctr. brg, ctr. brg. to back of abutment.		
Rdwy.(under & over) /Struct. /parapet widths		
Median Width		
P.G.L.		
direction of station increase		
limits of slope paving/riprap		
highway direction and number of lanes		
wing length		
beam guard		
existing structure ID and description		
Skew angle		
angle between reference line and centerline of substructures		
horizontal curve data		
proposed structure IDs		
north arrow		
location of point of critical clearance		
name plate and bench mark cap location		
Utilities		
2. Elevation View		
substructure units		
profile of existing ground line		
cross section of highway below showing backslope		
Elevations: top of berm, bottom of footing		
Rate of back slope		
Type of piling		
Location and amount of min. vert. Clearance		
location of underground utilities, size, elevation, kind of material		
location of fixed/expansion/semi-expansion bearings		
vertical scale bar		
3. Traffic Data		
4. List of Drawings		
5. Bench Mark (location, description, elevation)		
6. Title Block		
7. Profile grade lines		
tangent grades		
length of curve		
substructures		
no slope < 0.3%		
8. Design contacts		
Bureau of Structures		
9. Design Data		
10. Foundation Data		
soil bearing pressure		
pile type and capacity		

Cross Section, Quantities, General Notes		
1. Cross Section View		
normal to reference line		
slab thickness		
type of railing		
horizontal dimensions tied to reference line of roadway		
girder spacing		
girder depth		
direction and amount of superelevation		
location of PGL		
location of crown point		
2. Estimated quantities (bid items in order, quantities for each part of structure)		
3. General Notes (see WisDOT Bridge Manual 6.3.2.1.1)		
4. Typical section of roadway under structure		
5. Slope paving (check against current state standard)		
Subsurface Exploration Sheet		
Plan layout		
reference lines		
pier and abutment location		
location of borings		
note		
Elevation view		
profile of existing ground		
show substructure units		
show pile lengths		
soil material, depth, blow count		
Abutment/Wingwalls		
1. Layout Plan		
Body Dimensions		
Wingwall Dimensions		
Dimension Bearing Pads, Shoes, Construction Joints		
Skew Angle		
Keyed construction joint		
Girder Spacing & Angles		
If Maskwall Used, Check to See if Adequate Room for Bearings		
Centerline of Bearing		
Station of Centerline Bearing & Baseline		
angle between wing and body		
2. Layout Elevation		
Backwall Dimensions		
Elevations - Pads		
Elevations - Bottom of Footing		
Elevations - Top of Backwall		
Reinforcement in Body & Backwall		
Keyed construction joint		
Rustications		
Utilities		
Section Cuts		
3. Layout Footing Plan		
Baseline, Ref. Tangent, Stations & Angles		
Dimension from Baseline to Corners		
Pile type, locations, numbered, required driving resistance		
Reinforcement in Footing		
Pipe Underdrain		
North Arrow		
4. Abutment Section - thru body		
Dimensions		
Piles		
Reinforcement		
Pipe underdrain detail		
5. Wingwall Elevation		
Dimensions		
Elevations		
Reinforcement		
Rustications & Construction Joints		
Berm & Slope		
6. Wingwall Section		
Dimensions		
Reinforcement		

7. Wingwall Plan		
Dimensions		
Reinforcement		
North Arrow		
8. Bill of Reinforcement		
9. Bending Diagrams		
10. Anchor Bolt Setting Plan		
11. Waterstop Detail - Sticky		
12. Vert. Const. Jt. - Sticky		
13. Pile Splice Detail - Sticky		
14. Excavation & Backfill Limits (N/A For Sill Abutments)		
15. Notes		
16. Sloped Pad Detail (Prestressed Girder Bridges)		
17. Alternate construction joint detail		
Piers		
1. Layout Plan View		
Dimensions		
Footings		
Cap Steps		
Beam Spacings		
Skew Angle		
2. Layout Elevation		
Lengths of columns		
Elevation-Bottom of Footings		
Elevation-Beam Seats		
Dimension-Bar Steel		
Dimension-Stirrups		
3. Layout Footing Plan		
Dimensions-Pile Spacing		
Dimensions-Pile Numbers		
Dimensions-Reinforcing Steel		
4. Bar Steel Listing and Details		
Dimensions		
Elevations of Beam Seats		
5. Pile Splice Detail (only if different from abutment)		
6. Cross Section thru Column and Pier Cap		
Dimensions		
Elevation of Beam Seats		
Pier Height		
Detail Sheets		
1. Expansion Joint Details (Std. Sheet)		
Check Against Current State Std.		
Add Table; Fill in Title Block		
2. Bearing Details (Std. Sheet)		
Check Against Current State Std.		
Add Table; Fill in Title Block		
3. Railing Details (Std. Sheet)		
Check Against Current State Std.		
Fill in Title Block		
name plate / bench mark cap location detail		
Girder Sheets (Prestressed Girder Bridge)		
1. Side View of Girder		
Stirrup Spacing @ Girder Ends		
Longitudinal Reinforcement @ Girder Ends		
2. Top View of Girder		
Show End of Girder Only		
Show Typical Reinforcement @ End of Girder		
3. Maximum Stirrup Spacing Detail		
4. Section Through Girder		
Dimensions of Girder		
Reinforcement		
5. Strand Pattern Detail		
6. Section @ Abutment		
Dimensions & Reinforcement		
7. Section @ Pier Diaphragm		
Dimensions & Reinforcement		
8. Elevation of Diaphragm		
9. Section @ Diaphragm		
10. Plan View of Diaphragm		
11. Section Showing Threaded Rods & Diaphragm		
12. Location of Draped Strands Detail		
13. Camber Diagram		

14. Slab Forming Diagram		
15. Section @ Exterior Girder		
16. Pilaster Detail & Piers		
17. Bearing Detail @ Abutments & Piers		
18. Notes for Girder Data		
19. General Notes		
20. Expansion Bearing Detail		
Superstructure Sheets		
1. Superstructure Plan View		
diaphragm spacing		
reinforcement location		
North arrow		
reference line		
station & offset at centerline of bearing and PGL		
2. Top of deck elevation table		
3. Legend		
4. Notes		
5. Cross Section Thru Roadway		
normal to reference line		
slab thickness		
type of railing		
horizontal dimensions tied to reference line of roadway		
girder spacing		
girder depth		
direction and amount of superelevation		
location of PGL		
location of crown point		
reinforcement (deck, diaphragm in-span and at abutment)		
6. Slab haunch detail		
7. Section thru parapet		
8. Bill of Reinforcement		
Aesthetic Details		
1. Elevation of abutment & parapet		
2. Concrete staining schedule		
3. Notes		
4. Decorative panel detail		
All Sheets		
1. project state ID		
2. sheet name		
3. sheet number		