

# **Addendum Number 1**

**Malden Regional Airport**

**New Beacon and Lightning Protection Improvement Project**

**Project No. 14-079A-1**

**September 3, 2015**

**Malden Regional Airport  
New Beacon and Lightning Protection Improvement Project  
Project No. 14-079A-1  
Addendum Number 1  
September 3, 2015**

This Addendum is herewith made a part of the Contract Documents of the above issued project, and is issued to amend and supplement the July 31, 2015 drawings and specifications as follows:

The contractor shall acknowledge receipt of the addendum in the bid proposal form. Failure to acknowledge receipt of the addendum on the Proposal Form, on page 144, may disqualify a bid. Contractor is advised the information submitted in the bid package to the owner shall **include pages 142 – 151.**

PRE-BID ATTENDEES & MINUTES

See attached list of attendees, meeting minutes, geotechnical report and plan holder list.

PROPOSAL FORM

Replace: Proposal Form/Bid Schedule, page 142 of the documents with the new bid schedule (page 142) attached to this addendum.

SPECIFICATION REVISIONS/ CLARIFICATIONS

General

Add: of equal importance to completing the work, the contractor is responsible to continuously clean the pavements and work areas affected by his or her operations and execution of the work of all debris, waste, construction materials, deposits left from vehicle tracking, etc.

The contractor shall clean the work areas continuously during the project.

The contractor is responsible to reseed all disturbed areas.

Section L-110-3.1

Add/Clarification to Paragraph 17: It is the contractors responsibility to locate all buried cables & existing utilities in the areas of work including all airfield edge lighting circuit cables and power & control cables for navigational aid (NAVAIDS – REIL's, VASI's, wind cone, segmented circle, etc.) equipment prior to disturbance of ground.

Section L-110-3.7

Delete: Sentence 4 - any reference to MO-901, Seeding and MO-908, Mulching.

PLANS REVISIONS/CLARIFICATIONS

Sheet 2, Site Plan

Clarify: When both runways are closed, Contractor shall furnish two (2) pair of Runway Closure X's.

Sheet 13 of 15

Revise:

Revise the alignment of the buried power cable into the building for the new airport beacon (to the north of the location shown); therefore reducing the number of required sidewalk crossings of the buried cable in PVC conduit to one (1).

Sheets 14 & 15, Beacon Details 1 & 2.

Revise: 3/4" GRSC to Schedule 40 PVC Pipe.

Sheet 15, Beacon Details 2

Add: Well graded crushed rock shall be a MoDOT Type 5 and compacted in place.

Sheet 16, Electrical Details 1

Revise: 30" depth L-867 Base, Class 1. The contractor is responsible to furnish and install L-867, Class 1 base cans, sized to comfortably house the surge arrester equipment and necessary cable splices/connectors specified; however the minimum can dimensions are as follows: 12" diameter and 24" depth.

Add: The Counterpoise guard wire will be installed 3.25' off the edge of usable Runway 14-32 pavement in the paved shoulder. The engineer may adjust the exact offset distance from the runway edge in the field as conditions dictate. However the counterpoise guard wire location is limited to between the edge of usable runway pavement edge and the runway edge lights which are located 7.5' off the edge of Runway 14-32 pavement.

The counterpoise guard wire must be installed a minimum of 8" below grade and the trench/cut backfilled with approved material. Backfill in paved shoulder must be finished even with the runway surface or slightly mounded for settlement.

Backfill in paved shoulder must consist of a bituminous surface course material or a flowable concrete backfill material (CLSM). Bituminous material shall be compacted by tamping down into place. Excess materials and any residue from the installation and backfill shall be cleaned and removed from the pavement surface. The backfill materials & source shall be approved by the engineer. The minimum thickness of the bituminous surface course or flowable backfill material thickness at the surface (surface cap) shall be four (4) inches. The balance of the backfill between the 4" surface cap and the counterpoise cable shall be with a quarry produced sand approved by the engineer.

Backfill in turf shall be with originally excavated material and finished slightly mounded with the ground surface for settlement.

**End of Addendum 1**

**Insert Replacement Page 142 Proposal Form/Bid Schedule**

**PROPOSAL FORM (Addendum No 1.)**  
**MALDEN REGIONAL AIRPORT**  
**State Block Grant Project No. 14-079A-1**

TO: City/County Manager Airport Manager – Barbara Crayne

The undersigned, in compliance with the request for bids for construction of the following Project:

**New Beacon and Lightning Protection Improvement Project**

hereby proposes to furnish all labor, permits, material, machinery, tools, supplies and equipment to faithfully perform all work required for construction of the Project in accordance with the project manual, project drawings and issued Addenda within the specified time of performance for the following prices:

<b>BASE BID</b>							
BID ITEM	FAA or MoDOT SPEC.	ITEM DESCRIPTION	APPROX. QUANTITY AND UNITS	UNIT PRICE		EXTENSION	
				DOLLARS	CTS	DOLLARS	CTS
1	MO-100-5.1	Mobilization	1 LS				
2	MO-101-5.1	Airport Rotating Beacon (In Place)	1 EA				
3	MO-108-5.1	Counterpoise Guard Wire	17,100 LF				
4	MO-108-5.2	Ground Rod Installation	39 EA				
5	MO-110-5.1	Directional Boring for Counterpoise Installation	750 LF				
6	MO-125-5.1	Field Lightning Surge Arrestor	8 EA				
7	MO-125-5.2	Splice Can	8 EA				
<b>TOTAL BID (Base Bid)</b>							

**ACKNOWLEDGEMENTS BY BIDDER**

- a. By submittal of a proposal, the BIDDER acknowledges and accepts that the quantities established by the OWNER are an approximate estimate of the quantities required to fully complete the Project and that the estimated quantities are principally intended to serve as a basis for evaluation of bids. The BIDDER further acknowledges and accepts that payment under this contract will be made only for actual quantities and that quantities will vary in accordance with the General Provisions subsection entitled "Alteration of Work and Quantities".

**Insert Pre-bid Meeting Summary**

**Meeting Summary**  
**Malden Regional Airport**  
**New Beacon and Lightning Protection Improvement Project**  
**Project No. 14-079A-1**  
**August 19, 2015; 2 pm**

*Note: What follows is intended to be a summary of the discussions that occurred at the meeting, and every attempt has been made to make them accurately reflect the discussions. However, these are not intended to be “meeting minutes.” Items in italics are points that were emphasized at the meeting.*

→ **Sign-in sheet.** See attached for sign in sheet and list of attendees.

→ **Project/Plans.** Dave Nauman (DN) briefly described the scope of work for the project.

- The projects consists of New Airport Beacon and Lightning Protection, counterpoise for the Runway 14/32 circuit, and includes Taxiway T-2 West, Taxiway T-4 and Taxiway T-5 West, which was installed in 2007. The limits of work are shown on plan Page 2 and Plan Page 4
- The specific proposed improvements are listed as follows:
  - New Airport Beacon and Drilled Shaft Foundation. The source of power for the beacon is 110 VAC, and the source of power is inside the airport terminal building.
  - Installation of Counterpoise Circuit on the 14/32 Circuit. *DN briefly discussed the presence of “paved” shoulders and whether the plowing-in method could be used to efficiently install the counterpoise. Concern is regarding the disturbance of the existing asphalt. DN asked for input from those present regarding economical and efficient methods to install and backfill the counterpoise in the existing “paved shoulder.” This was also discussed briefly during the site visit phase of the pre-bid meeting. CMT will issue more information on this in the addendum.*
  - Installation of Field Surge Arrestors in new light cans. The field surge arrestors are included as another means to minimize lightning damage to the airport lighting circuit. *These are located periodically along the circuit at a prescribed separation.*
  - Installation of Ground Rods along counterpoise circuit. *Located periodically along the circuit.*
  - Directional Boring for Counterpoise Circuit. *Counterpoise installed under usable airport runway and taxiway pavements must be installed without disturbing the surface.*
  - Connection of counterpoise to existing Light Can Bases and Stakes. *The counterpoise circuit has to be connected to all light cans (grounding lug) and stakes (bolted connection).*
- Construction Activity Plan – Project Phase. *Stressed that the need to keep airport active at all times is a top priority of the airport and therefore will be for the contractor as well. [MUST KEEP AIRPORT ACTIVE]*
  - Three (3) Phases and five (5) Work Areas
    - a. Phase 1 – Closure of Runway 14/32, Taxiway T-2 West, Taxiway T-4 and Taxiway T-5 West. Runway 18/36 Divides Work. Pages 4 & 5. *Bulk of Work*
    - b. Phase 2 Closure of Runway/Runway Intersection and Runway 18/36/Taxiway T-5 intersection. A maximum of three (3) 12 hour days is allowed for this work, and the runway must be open at night. *Runway 18/36 must always be open at night.*
    - c. Phase 3 – New Beacon – Can be done concurrent with Phases 1 & 2.

## → Bids

- Due Tuesday September 8, 2015, at Malden Regional Airport Conference Room, 3075 Mitchell Drive, Malden MO – **2:00 PM CDT**. *Prevailing local time.*
- DBE Goal is **0%**
- *Make sure you submit the minimum bid information with proposal package.* Minimum proposal information is the following:
  - Proposal Pages 142 – 151
  - *Any addenda issued.*
  - Bid Bond
  - Buy American waiver requests, Pages 145 – 146. *Dave Nauman encouraged those present to call regarding filling out the Buy American information on the proposal.*
  - Worker Eligibility Affidavit and E-Verify Memorandum of Understanding, Page 148
  - Proper Signatures on last page of Proposal Form, Page 151. *Mistakes can render the bid proposal non-responsive.*
  - *Make sure you fill in all items – call if questions.*
- The City of Malden, MO reserves the right to reject any or all bids, as determined to be in the best interest of the City.

## → Wages

Project includes Bacon Davis Prevailing Wage Requirements – higher of state or federal wages prevail. *Need to submit Certified Payrolls weekly for Prime and Sub contractors.*

## → Contractor's Operational Requirements

- FAA AC150/5370-2F – Operational Safety on Airports During Construction, *See project manual Page 200. Contractor will have to become familiar with this manual and with the rules of operating safely on an airport during construction.*
- FAA AC150/5210-2D – Painting, Marking and lighting of Vehicles used on airports, *See Page 258 of project manual.*
- After award of Project, Contractor must submit a Safety Plan Compliance Document (SPCD) in accordance with FAA AC 150/5370-2F.
- All work shall stay clear of the Active Taxiway and Runway Object Free Areas. Contractor furnishes, maintains and places barricades with red beacons.
- Airport Orange/ White Flags or yellow flasher/strobe light on all Vehicles and Equipment.
- Contractor to provide Airport Radios for key personnel
- Site Access and Parking. *Personal vehicles not allowed on the field.*

## → Bidding Schedule / Grant Process

*This is a possible schedule – hopefully the award and contracts will move quicker than as indicated below.*

August 19, 2015	Pre-Bid Meeting
September 8, 2015	Open Bids
September 15, 2015	Airport Board Meeting
September 21, 2015	City Council Action
October 20, 2015	Award Project
November 20, 2015	Start Work



## → Construction Time Frame

- 35 Calendar Days from the dated of the Notice-to-Proceed.
- Calendar Days are not expected to be suspended. Assume you will start and finish work within 35 calendar days. Although some flexibility when you begin.
- Liquidated Damages of \$750 per day for each day over the allowed calendar days allowed and \$750 for every 4 hours Runway 18/36 is closed over allotted time allowed.
- A mandatory Pre-Construction meeting will be held before work is started.

## → Specifications/Things to Notice

- Specifications are FAA/MoDOT aviation specifications. Airports often rely on the MO Highway Standards (MSSHC 2011) specifications for materials primarily for paving materials. Airports rely on FAA standard specifications for construction methods and payment. *Beware FAA specifications are unique and unlike other specifications you may be used to. Any state or federal project will have a large volume of paperwork to complete. Be prepared - this project is no different.*
- *The maximum bid price for the Mobilization pay item is 10% of the total contract amount. If you bid over 10% for mobilization be aware of the payout limitations on page 162.*
- Finishing around the Beacon Site. *Contractor will have to finish the beacon site with aggregate and edging.* Page 171.
- Exothermic Bonding is required for all connections - *except for inside of cans and to stakes where grounding lugs and bolts are specified respectively.* Page 176.
- Testing Circuits for shorts and continuity. Page 181. *Both circuits (14/32 and 18/36) will need to be megged before and after the work and results recorded.*
- Ground rods must be tested for impedance to ground and recorded.
- Contractor provided, placed and maintained Closure X's. *Contractor must furnish, place, maintain and remove up to two sets of closure X's when both runways are closed.*
- Runway 18/36 must always be open at night.
- *Pay attention to the Buy American check box on the proposal sheet # 146.*
- Note insurance requirements on Page 82; the City and MoDOT must be listed as additional insured.
- Contractors must obtain a City Contractors License from the City of Malden – see Page 87.
- Following is a list of paperwork that has to be provided before the contractor will be eligible to receive the Notice to Proceed:
  - Buy American for all Items. Page 74 and 145; *Note the check box.*
  - Schedule, Page 52
  - QC Plan, Page 50
  - Contractors Safety Plan Compliance Document (SPCD) proving you understand the safety requirements and will abide by them. Plan Sheet 3.
- Prior to close out and release of retainage the contractor must submit the information shown on Page 48; warrantee's, final settlement letter/form.
- Shop drawings will need to be submitted following the rules on Pages 28 & 52.

## → Questions / Comments

1. Barb Crayne mentioned the City License can be obtained at City Hall, and fee is \$100.
2. Barb Crayne mentioned the importance to have a sweeper on site and continuously clean the pavements.
3. Barb Crayne emphasized the listing of City of Malden and MoDOT as additional insured on the insurance submittals from the contractor.

4. *The contractor is responsible to continuously pick up debris during the course of the work. DN will add this to the addendum – possibly require a sweeper.*
5. *Shawn Koch asked if the improvement of the beacon site is incidental to the beacon lump sum price. DN confirmed that was correct.*
6. *DN said addendum will be issued one week before bids are due at the latest.*
7. *Shawn Koch asked if the counterpoise can be attached to the base cans with the ground lug. DN confirmed this was correct and exothermic welds are not required in this case.*
8. *Both Shawn Koch and Craig Amerlan inquired about the GRS shown in the beacon foundation. DN said he will check on this and respond in addendum.*
9. *DN said he will provide the geotechnical report as part of the addendum.*

*As noted at the beginning, this is intended to be a summary of the discussions that occurred at the meeting. However, these are not intended to be “meeting minutes.” If you remember anything differently or believe something that was discussed is not reflected herein please advise.*

*Dave Nauman, 314-571-9056, dnauman@cmtengr.com*

**Insert Pre-bid Attendees List**

MALEDEN Conference Room

8/19/2015

Sign-IN Sheet For Pre-Bid MEETING

NEW BEACON AND Lightning Protection Improvement  
PROJECT

	<u>NAME</u>	<u>Phone</u>	<u>EMAIL</u>
1.	Darrell B. GATH	573-526-7913	darrell.gath@modot.mo.gov
2.	Craig Amerlan	573-429-4701	camerlan@outlook.com
3.	Jeff Alford	573-686-1323	jalford@r1persons.com
4.	Barb Crayne	573-281-0059	airport@maldenmo.com
5.	DAVE NAUMAN	314-571-9056	DNAUMAN@CENTENG.COM
6.	Shawn Koch	573-313-2444	shawn@KochElectricInc.net
7.			
8.			

**Insert Plan Holder List**

**MALDEN REGIONAL AIRPORT  
NEW AIRPORT BEACON AND LIGHTING PROTECTION IMPROVEMENT  
PLAN HOLDERS LIST**

CMT Job No. 14488-01-00

Fee = \$15

PROJECT NO. 14-079A-1

Last Updated: 8/11/2015

	Company	Contact Name	Qty Plans & Specs	Date Sent
1	Malden Regional Airport 3077 Mitchell Drive Malden, MO 63863	Barbara Crayne	1	7/26/2015
2	RL Persons Construction, Inc. 3025 Cravens Rd. Poplar Bluff, Mo 63901 (P) 573-686-1323 (F) 573-686-1397	Shaun	1	8/11/2015
3	Koch Electric, Inc. 26688 US Hwy. 61 Scott City, MO 63780 (P) 573-313-2444 Email: shawn@kochelectricinc.net	Shawn Koch	1	8/11/2015
4	Ewing Signal Construction, LLC 1730 N. Gregory Dr. Nixa, MO 65714 (P) 417-724-9405	Sam Cook	1	8/11/2015
5				
6				
7				
8				
9				
10				
11				
12				

## **Geotechnical Report**

**SOIL BORINGS AND  
LABORATORY TESTS  
MALDEN REGIONAL AIRPORT  
MALDEN, MISSOURI  
PROJECT # 14-079A-1  
AIRPORT BEACON AND LIGHTING PROTECTION  
CMT JOB# 1448-01**

Prepared for:

Crawford, Murphy, and Tilly, Inc.  
Gateway Tower  
One Memorial Drive, Suite 500  
St. Louis, Missouri 63102

Prepared by:

**HOLCOMB FOUNDATION ENGINEERING CO.**  
Carbondale, Illinois  
618-529-5262

April 16, 2015

HFE File Number: H-14290



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# Holcomb Foundation Engineering Co., Inc.

SOILS • BITUMINOUS • CONCRETE • ENGINEERING AND TESTING

SHIPPING ADDRESS  
393 Wood Road  
Carbondale, IL 62901

MAILING ADDRESS  
PO Box 88  
Carbondale, IL 62903

PHONE 618-529-5262  
TOLL FREE 800-333-1740  
FAX 618-457-8991

April 16, 2015

Crawford, Murphy, and Tilly, Inc.  
Gateway Tower  
One Memorial Drive, Suite 500  
St. Louis, Missouri 63102

Attention: Mr. Dave Nauman

Re: Soil Borings and Laboratory Tests  
Malden Regional Airport  
Malden, Missouri  
Project No. 14-079A-1  
Airport Beacon and Lightning Protection  
CMT Job # 14488-01  
HFE File H-14290

Dear Sir:

In accordance with your instructions, we have performed a subsurface exploration for the above referenced project. This project is to consist of a new beacon for Malden Regional Airport in Malden, Missouri.

On April 10, 2015, we drilled one soil boring for this project. The boring is located as indicated on the enclosed Boring Location Diagram. The boring was drilled with a CME-550 drill rig advancing 3.25" ID hollow stem augers. During drilling operations, the subsoils were sampled with a split barrel-sampling device in accordance with ASTM D-1586. The apparent ground water level in the borehole was also measured during and upon completion of drilling operations.

In the laboratory, the soil samples were subjected to visual classifications and moisture content determinations. Unconfined compressive strength tests were performed on all cohesive soil samples. Results of all field and laboratory tests are presented on the enclosed Boring Logs.

Subsurface conditions encountered at this site consist of four inch mantle of topsoil overlying 16 feet of brown fine to medium grained sand (SP classification). Below the brown sand lies a gray fine to medium grained sand (SP) that extends down to at least the bottom of the soil borings.

The upper 16 feet of sand has corrected ( $N_{160}$ ) values of 10 to 43 blows per foot, averaging 19 bpf. Moisture contents vary from 14 to 25 percent, averaging 20 percent. These soils have a moderate to low settlement potential.

The sand between 16 and 30 feet has corrected standard penetration test values of 7 to 33 blows per foot, averaging 23 blows per foot. Moisture contents vary from 15 to 22 percent, averaging 19 percent. This sand also has a moderate to low settlement potential.

Ground water was encountered at a depth of 3.5 feet, and at 3.0 feet upon completion of drilling operations.

Based upon the soil borings and seismic design criteria provided by the I.B.C., this location has a site classification type "D" profile. Based upon this profile, the spectral response acceleration coefficients have been determined as follows:

$$0.2 \text{ Second Period: } S_{ms} = 1.727 \text{ g} \times 1.0 \text{ (Soil Factor } F_a) = 1.727$$

$$1.0 \text{ Second Period: } S_{m1} = 0.620 \text{ g} \times 1.5 \text{ (Soil Factor } F_v) = 0.930$$

The recommended design spectral response factors are as follows:

$$S_{Ds} = 1.151 \text{ g} \quad S_{D1} = 0.620 \text{ g}$$

These values were obtained from the IBC Section 1615 and the USGS Earthquake Hazards Program based upon the latitude and longitude of this site. The response spectrum graphs are enclosed in this report.

It is understood the project is to consist of a new beacon approximately 55 feet high and weighing about 2500 pounds. Design parameters for drilled shaft or auger cast pile design are as follows:

Depth (ft.)	<u>0-13</u>	<u>13-30</u>
Phi Angle (deg.)	32	34
Undrained Strength	N/A*	N/A*
Saturated Unit Weight (Lb. /Ft <sup>3</sup> )	115	120
Equivalent Skin Friction (Lb. /Ft <sup>2</sup> )	470	750
Soil Modulus (k values) (Lb. /In <sup>3</sup> )	60	125
Soil Bearing Pressure (Lb. /Ft <sup>2</sup> )	2000	4000

\*- N/A – Not Applicable

It should be noted that due to the high ground water table at this site, casing or mud drilling will be necessary to install drilled shafts since the sand will become "quick" if the excavation extends into the ground water due to hydrostatic pressure. As an alternative to casing or mud drilling, well points may be used to dewater the excavation, however this can be costly. If casing or mud drilling are used, they must be removed from the excavation during placement of concrete if skin friction bearing is used for support of the beacon.



As an alternative to drilled shaft or auger cast piles, in the southeast Missouri area 14 inch diameter concrete filled metal shell piles are common, and may be feasible for support of the beacon. The pile should be sized according to current LRFD design policy in coordination with the pile table enclosed. Once the necessary factored resistance available ( $R_f$ ) is determined from the structural loadings, the nominal required bearing ( $R_n$ ) and estimated pile lengths can be determined using this table.

### Pile Design Table

#### Boring No. 1

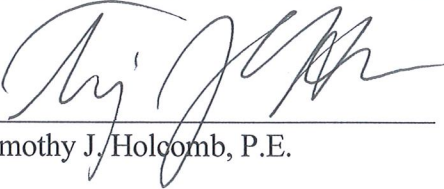
<u>R<sub>n</sub> (kips)</u>	<u>R<sub>f</sub> (kips)</u>	Seismic <u>R<sub>f</sub> (kips)</u>	<u>Est. Length (ft.)</u>
Steel Metal Shell 14" w/0.25" Walls			
54	30	21	8
84	46	46	18
199	109	161	25
242	133	205	30

Settlements of skin friction piles are estimated at about 0.25 inch at this site. During installation, it is recommended the bearing capacity of the piles is verified using the WSDOT pile formula or another recognized dynamic pile driving formula.

Attached herewith are the Boring Location Diagram, Boring Log, and Seismic Response Spectrum Graphs. If you have any questions, please feel free to contact me at your convenience.

Sincerely,

**HOLCOMB FOUNDATION ENGINEERING CO.**

  
\_\_\_\_\_  
Timothy J. Holcomb, P.E.



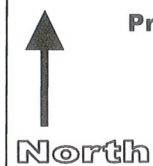


*Project:*  
**Proposed Beacon  
Malden Regional Airport  
Malden, Missouri**

*Client:*  
**Crawford, Murphy & Tilly, Inc.  
St. Louis, Missouri**

## **Boring Location Diagram**

21 of 25



**Project No. H-14290**

**April 10, 2015**

**Not to Scale**



# LOG of BORING 1

Unconfined Compressive Strength (Tons/Sq. Ft.)		Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
1 2 3 4 5 6	Water Content (%)					
Standard N Penetration, Blows/Ft.		Surface Elevation				
10 20 30 40 50 60	-----○-----					
						4" Topsoil
		5	1	ss		Brown Fine to Medium SAND (SP) with trace clay
			2	ss		
			3	ss		
		10	4	ss		Brown Fine to Medium SAND (SP)
			5	ss		
			6	ss		
		15	7	ss		Gray Fine to Medium SAND (SP)
			8	ss		
		20	9	ss		
			10	ss		
		30				End of Boring @ -30.0'
		35				

Ground Water Data	
Ground Water Encountered @ -3.5' During Drilling and @ -3.0' Upon Completion.	
Project: Proposed Beacon Malden Regional Airport Malden, Missouri	Date of Boring April 10, 2015
Client: Crawford, Murphy & Tilly St. Louis, Missouri	Project No. H-14290

# USGS Design Maps Summary Report

## User-Specified Input

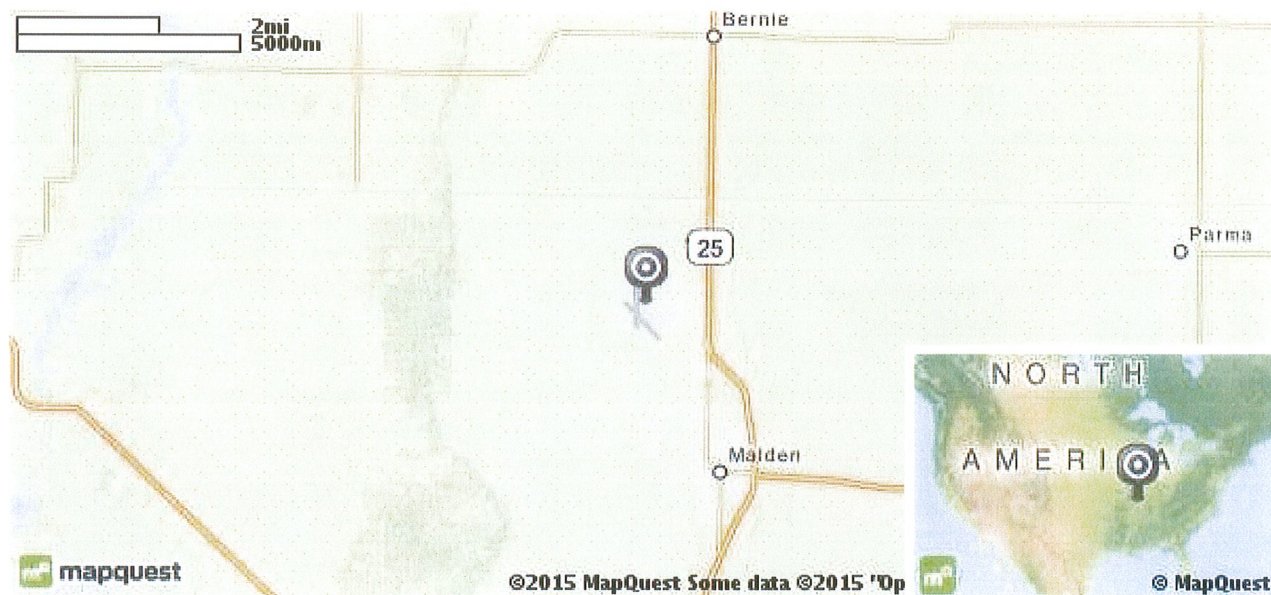
**Report Title** Malden Airport Beacon  
Thu April 16, 2015 15:25:44 UTC

**Building Code Reference Document** 2012 International Building Code  
(which utilizes USGS hazard data available in 2008)

**Site Coordinates** 36.60004°N, 89.98964°W

**Site Soil Classification** Site Class D – “Stiff Soil”

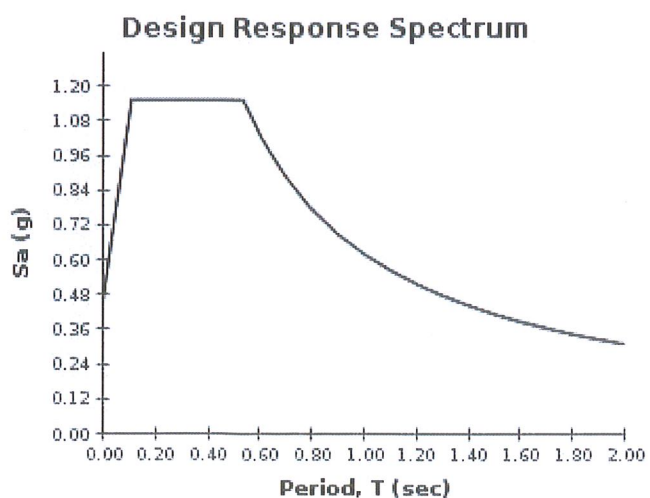
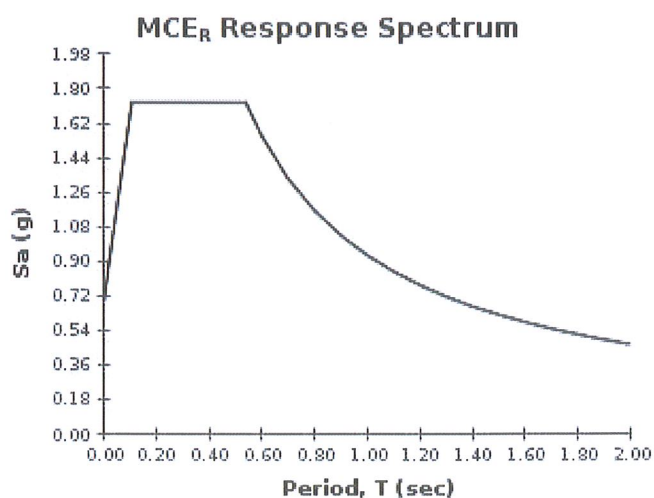
**Risk Category** I/II/III



## USGS-Provided Output

$S_s = 1.727 \text{ g}$	$S_{MS} = 1.727 \text{ g}$	$S_{DS} = 1.151 \text{ g}$
$S_1 = 0.620 \text{ g}$	$S_{M1} = 0.930 \text{ g}$	$S_{D1} = 0.620 \text{ g}$

For information on how the  $S_s$  and  $S_1$  values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the “2009 NEHRP” building code reference document.



Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the



## GENERAL NOTES

### **SAMPLE INDENTIFICATION**

The Unified Classification System is used to indentify the soil unless othwerwise noted.

### **RELATIVE DENSITY & CONSISTENCY CLASSIFICATION**

<u>TERM (NON-COHESIVE SOILS)</u>	<u>BLOWS PER FOOT</u>
Very Loose	0-4
Loose	5-10
Firm	11-30
Dense	31-50
Very Dense	Over 50
<u>TERM (COHESIVE SOILS)</u>	<u>QU (tsf)</u>
Very Soft	0.00- 0.25
Soft	0.25-0.50
Firm	0.50-1.00
Stiff	1.00-2.00
Very Stiff	2.00-4.00
Hard	4.00+

### **DRILLING & SAMPLING SYMBOLS**

ss:	Split Spoon-	1 3/8" I.D., 2" O.D.
st:	Shelby Tube-	2.80" I.D., 3" O.D.
au:	Auger Samples	
cs:	Continuous Sampling	2.0" I.D

### **SOIL PROPERTY SYMBOLS**

●	Unconfined Compressive Strength, Qu (tsf)
+	Penetrometer Value, (tsf)
	Plastic Limit (%)
○	Water Content (%)
	Liquid Limit (%)
X	Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2" O.D. Split Spoon

### **PARTICLE SIZE**

Boulders	8in +	Medium Sand	0.6mm to 0.2mm
Cobbles	8in to 3in	Fine Sand	0.2mm to 0.74 mm
Gravel	3in. to 5mm	Silt	0.074mm to 0.0005mm
Coarse Sand	5mm to 0.6mm	Clay	Less Than 0.005mm



## UNIFIED SOIL CLASSIFICATIONS

MAJOR DIVISIONS		SYMBOL		TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	GW	Well graded gravels, gravel-sand mixtures
		GRAVELS WITH FINES	GP	Poorly graded gravels, gravel-sand mixtures
			GM	Silty gravels, gravels-sand silt mixtures
			GC	Clayey gravels, gravel-sand clay mixtures
			SW	Well-graded sands, gravelly sands
		SANDS WITH FINES	SP	Poorly graded sands, gravelly sands
			SM	Silty sands, sand-silt mixtures
		FINE GRAINED SOILS	SILTS AND CLAYS LOW PLASTICITY	SC
ML	Inorganic silts of clayey silts with slight plasticity			
CL	Inorganic clays of low to medium plasticity			
SILTS AND CLAYS HIGH PLASTICITY	OL		Organic silts and organic silty clays of low plasticity	
	MH		Inorganic clays of high plasticity	
	CH		Organic clays of high plasticity	
	HIGHLY ORGANIC SOILS		OH	Organic clays of medium to high plasticity
PT		Peat, humus, swamp soils with high organic contents		