

Research Report  
KTC -13-11/SPR443-12-1F

# **Evaluation of Mechanically Stabilized Earth (MSE) Walls for Bridge Ends in Kentucky; What Next?**

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### **Kentucky Transportation Center**

176 Oliver H. Raymond Building

Lexington, KY 40506-0281

(859) 257-4513

*fax* (859) 257-1815

**[www.ktc.uky.edu](http://www.ktc.uky.edu)**

# **EVALUATION OF MECHANICALLY STABILIZED EARTH (MSE) WALLS FOR BRIDGE ENDS IN KENTUCKY; WHAT NEXT?**

by

**Charlie Sun**  
*Research Engineer*

**Clark Graves**  
*Program Manager*

**Kentucky Transportation Center  
College of Engineering  
University of Kentucky**

**in cooperation with the  
Kentucky Transportation Cabinet  
The Commonwealth of Kentucky  
and  
Federal Highway Administration**

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## EXECUTIVE SUMMARY

Because of the advantages of more rapid construction and lower cost of MSE wall abutments as compared to conventional concrete abutments, 80% of states/provinces (33/41), who participated nationwide MSE wall status survey, used MSE wall as abutment in their highway construction. Majority states/provinces (30/33) use galvanized steel as reinforcement in the MSE wall as an abutment. An interesting survey result is that fourteen (14) states/provinces use geogrid and five (5) states/provinces use geotextile as reinforcement in the MSE wall abutment construction. More interesting survey result is that one state is implementing GRS-IBS system. All the states/provinces (33/33), who used MSE wall as abutment, allowed MSE wall footing built on soil. Only seven (7) states/provinces allowed bridge beams/girders bearing on MSE wall itself directly. There are MSE wall abutment failures in 36% (12/33) states/provinces. Seven (7) states/provinces have failure type "Settlement/washout of backfill material". Twenty-four (24), which is 73% out of 33, states/provinces have guidelines for building MSE wall abutments. Only two (2) states/provinces have maintenance inspector's handbook for MSE wall abutments.

To aid in the rating process for maintenance, a preliminary web application for the MSE Wall Abutment Inspection/Rating In KY has been developed. In efforts to assist users of MSE Wall Abutment Inspection/Rating In KY web application many of handy features in the web application are highlighted, and various graphical user interfaces of the web application are illustrated and described. This web application is ready for inspectors to explore when they inspect and rate MSE wall abutments in Kentucky.

Fifty-six (56) MSE wall abutment sites in Kentucky are inspected and rated. Most of the heights for MSE wall abutments (52/56) were less than 30 ft.; only four (4) MSE wall abutments had heights larger than 30 ft.; the maximum height of MSE wall was 37 feet. Based on preliminary visual inspection, there were visible damage, deterioration, or deformation on nine (9) MSE wall abutment sites; vegetation protruding from face on nineteen (19) MSE wall abutment sites. Majority of MSE wall abutments (45/56) were rated as "Excellent" condition; rest of the abutments were rated as "Good" condition; none were rated as "Fair" or "Poor" condition. All the inspection/rating results and pictures taken from inspections were inputted in the MSE Wall Abutment Inspection/Rating In KY web application. All the data are available for both registered and non-registered users.

The design guidance and construction & maintenance inspector's handbook were developed mainly based on Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Design and Construction Guidelines, Publication Number Vol. I - FHWA-NHI-10-024, and Vol. II - FHWA-NHI-10-025 2009, LRFD Bridge Design Specifications, 4th Edition, with 2008 and 2009 Interims published by American Association of State Highway and Transportation Officials (AASHTO), Washington, D.C. 2007. It is expected to assist Kentucky design engineers, specification writers, and estimators with the selection and design of Mechanically Stabilized Earth (MSE) wall abutments by using the guidance and handbook compiled from this study.

# **1. INTRODUCTION**

## **1.1 Background**

Retaining structures are essential elements of every highway design. For many years, retaining structures were almost exclusively made of reinforced concrete and were designed as gravity or cantilever walls which cannot accommodate significant differential settlements unless founded on deep foundations. When the height of retaining structures increases and poor subsoil conditions exist, the cost of reinforced concrete retaining walls increases rapidly. MSE walls offer significant technical and cost advantages over conventional reinforced concrete retaining structures at sites with poor foundation conditions.

The first reinforced earth bridge abutments were constructed in France in 1969 and in the United States in 1974. These MSE structures were "true" abutments where the bridge beams rested on a spread footing beam seat bearing directly on the reinforced backfill. Mixed abutments, with piles supporting the beam seat, were developed later. One of the first true abutments in France carried a remarkable 76 m span; spans up to 72 m have been constructed in the U.S. After a long period of building only a few dozen MSE abutments per year, usage has increased rapidly since the late 1990s, as owners and engineers have become more familiar with and have developed greater confidence in this technology. Approximately 600 MSE abutments (300 bridges) are now constructed annually in the U.S., with 25% being true abutments supported directly on the reinforced soil (Anderson, et al., 2005). The main reasons for this growing usage are more rapid construction and lower cost of MSE abutments as compared to conventional concrete abutments.

## **1.2 Problem Statement**

Mechanically Stabilized Earth (MSE) walls are widely used in bridge ends nationwide. By placing tensile reinforcing elements (inclusions) in the soil, the strength of the soil can be improved significantly such that the vertical face of the soil/reinforcement system is essentially self supporting. The use of a facing system to prevent soil raveling between the reinforcing elements allows very steep slopes and vertical walls to be constructed safely. Currently, KYTC has no design guidelines for using MSE walls. There are limited applications of MSE walls in Kentucky and KYTC does not practice the design of these structures. Several issues surrounding MSE walls in Kentucky remain unclear -- including, cost savings, the site conditions where they should or should not be utilized, what are the maximum heights permitted, the overall stability with long-term performance, newer, more robust materials, and various methods of constructing these walls.

## **1.3 Objectives**

This investigation will develop a better understanding the practice of using MSE walls in Kentucky. It will provide guidelines to assist design engineers, specification writers,

construction inspectors and maintenance personnel with the selection, design, construction and maintenance of MSE walls at bridge ends, and the monitoring of their long-term performance. Also, the guidelines will provide valuable information for decision making within KYTC when they are recommended as a design alternative.

## 2. PRIMARY REFERENCE SOURCE FOR MSE WALLS

A mechanically stabilized earth (MSE) wall behaves as a flexible coherent block able to sustain significant loading and deformation due to the interaction between the backfill material and the reinforcement elements. The Federal Highway Administration (FHWA) has adopted *Mechanically Stabilized Earth Walls and Reinforced Slopes, Design and Construction Guidelines*, by Elias et al. as their current guidelines for MSE wall design and construction. These guidelines are the reference text used for the FHWA NHI courses No. 132042 and 132043 on Mechanically Stabilized Earth Walls and Reinforced Soil Slopes and reflects current practice for the design, construction and monitoring of these structures. These guidelines are prepared to enable the engineer to identify and evaluate potential applications of MSE walls and Reinforced Soil Slopes (RSS) as an alternative to other construction methods and as a means to solve construction problems. The scope is sufficiently broad to be of value for specifications specialists, construction and contracting personnel responsible for construction inspection, development of material specifications and contracting methods. With the aid of these guidelines, the engineer should be able to properly select, design, specify, monitor and contract for the construction of MSE walls and RSS embankments.

These MSE walls and RSS Design and Construction Guidelines which are update of the current FHWA NHI-00-043, have evolved from the following AASHTO and FHWA references:

- AASHTO LRFD Bridge Design Specifications, 4<sup>th</sup> Edition, 2007, with 2008 and 2009 Interim Revisions.
- *Earth Retaining Structures*, by B.F. Tanyu, P.J. Sabatini, and R.R. Berg, FHWA-NHI-07-071 (2008).
- AASHTO LRFD Bridge Construction Specifications, 2<sup>nd</sup> Edition, 2004, with 2006 Interim Revisions.
- *Geosynthetic Design and Construction Guidelines*, by R.D. Holtz, B.R. Christopher, and R.R. Berg, FHWA HI-07-092 (2008).
- *Guidelines for Design, Specification, and Contracting of Geosynthetic Mechanically Stabilized Earth Slopes on Firm Foundations*, by R.R. Berg, FHWA-SA-93-025, January 1993.
- *Reinforced Soil Structures - Volume I, Design and Construction Guidelines - Volume II, Summary of Research and Systems Information*, by B.R. Christopher, S.A. Gill, J.P. Giroud, J.K. Mitchell, F. Schlosser, and J. Dunnicliff, FHWA RD 89-043 (1990).
- *Design and Construction Monitoring of Mechanically Stabilized Earth Structures*, by J.A. DiMaggio, FHWA, (1994).
- AASHTO Bridge T-15 Technical Committee unpublished working drafts for the update of Section 11.0 of the AASHTO LRFD Bridge Design Specifications.



### 3. NATIONWIDE MSE WALL STATUS SURVEY

The survey invitations were sent to forty-nine (49) states in USA and five (5) provinces in Canada. Thirty-nine (39) states in USA and two (2) provinces in Canada responded to the invitations. The following are detailed responses to the survey questions.

Question 1. Currently, are Mechanically Stabilized Earth (MSE) Walls built as bridge ends (abutment) in your state?

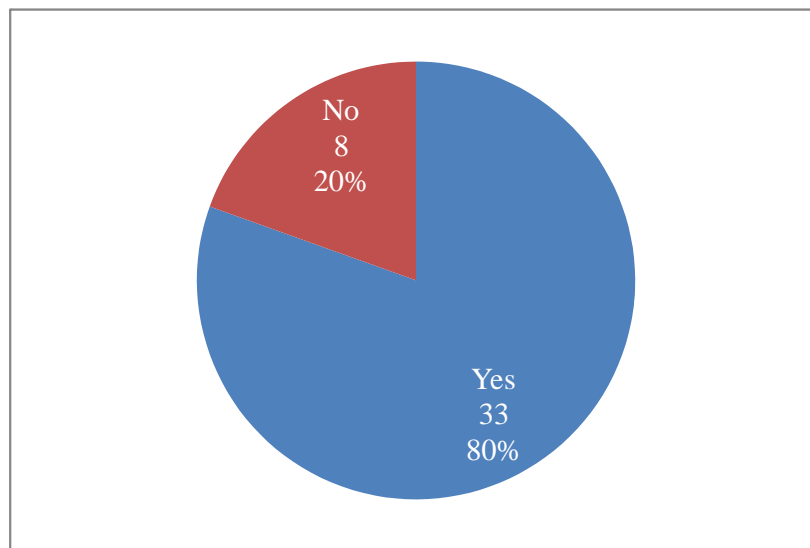


Figure 1. How Many States/Provinces Use MSE Wall as Abutment

Question 2. Has your state built MSE wall abutments before? (For states/provinces do not use MSE wall as abutment)?

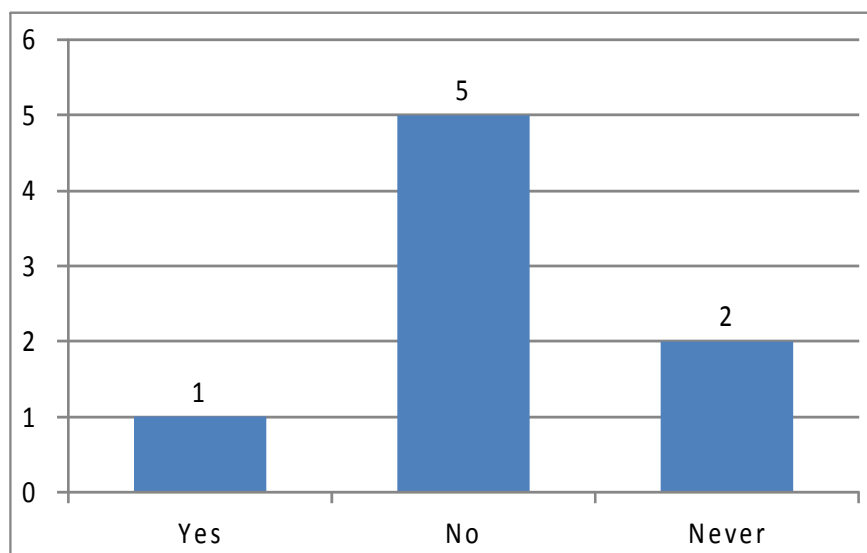


Figure 2. How Many States/Provinces Use MSE Wall as Abutment before

Question 3. In your state, MSE wall abutments are built for:

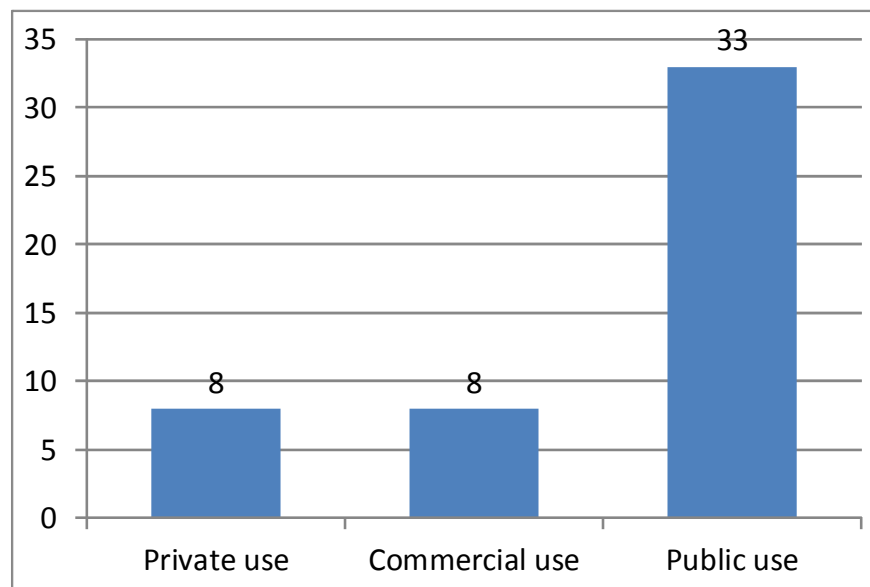


Figure 3. Who Will Use MSE Wall Abutments

Question 4. What types of reinforcements were used in the MSE wall as an abutment?

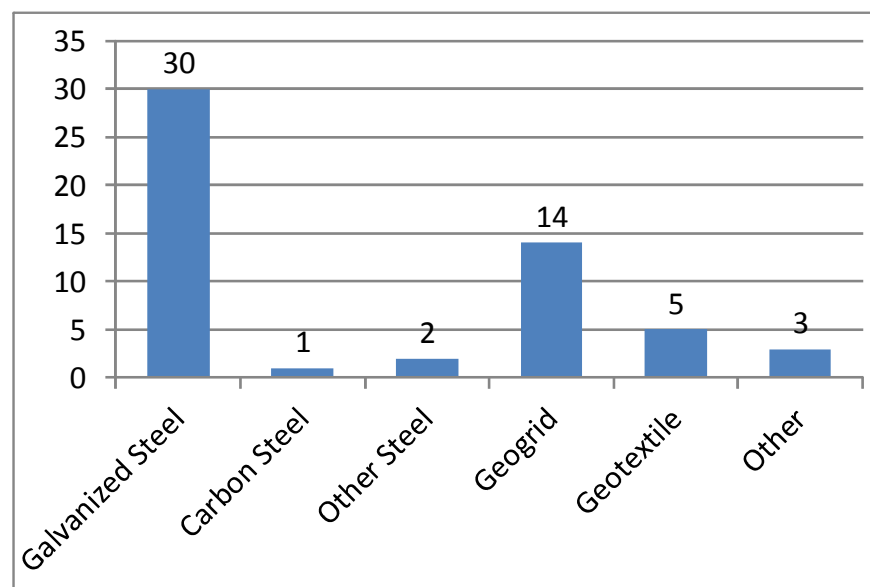


Figure 4. Types of Reinforcements Were Used in the MSE Wall Abutments

Question 5. What type of backfill materials was used for the MSE wall as an abutment?

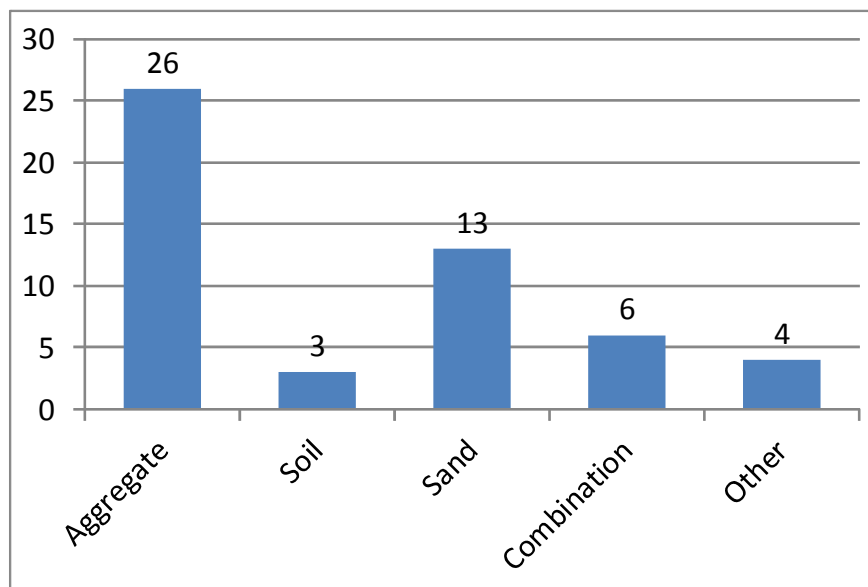


Figure 5. Types of Backfill Materials Were Used in the MSE Wall

Question 6. What is the maximum height for the MSE wall abutment?

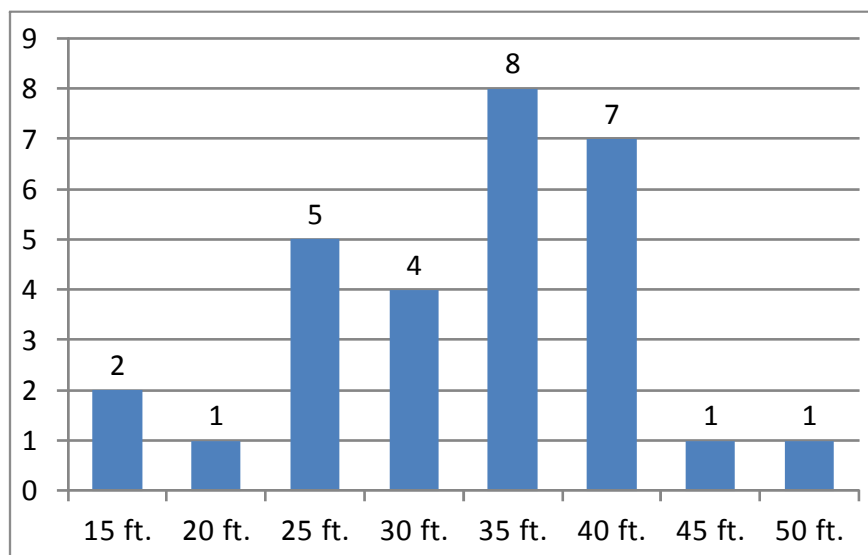


Figure 6. The Maximum Height for the MSE Wall Abutments

Question 7. For foundation, MSE wall footing is allowed to build on:

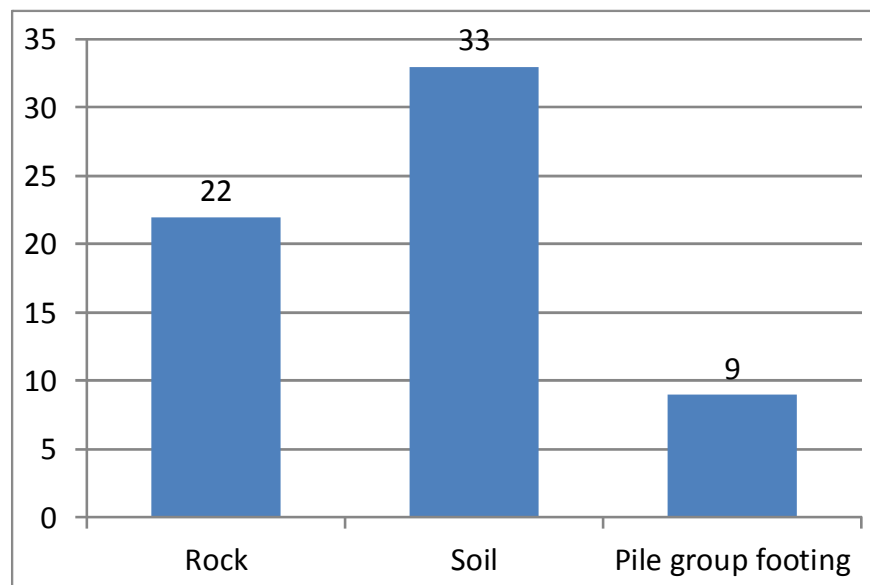


Figure 7. MSE Wall Footing Is Allowed to Build on

Question 8. Bridge beams/girders are bearing on:

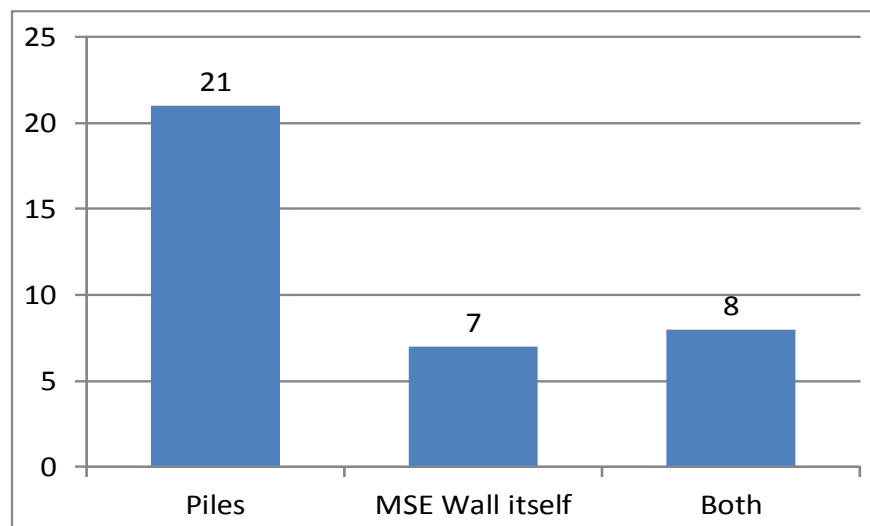


Figure 8. Bridge Beams/Girders Are Bearing on

Question 9. Are there any MSE wall abutment failures in your state?

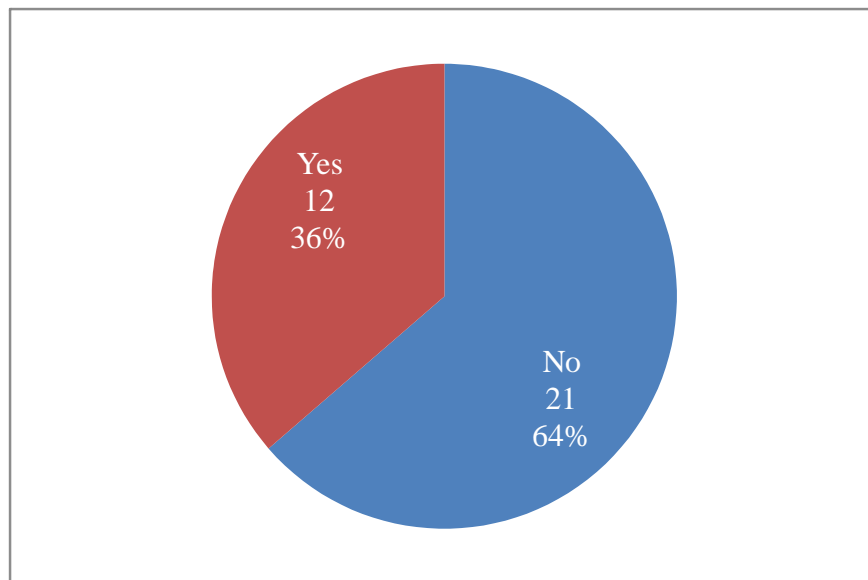


Figure 9. MSE Wall Abutment Failures in States

Question 10. If "Yes", how many?

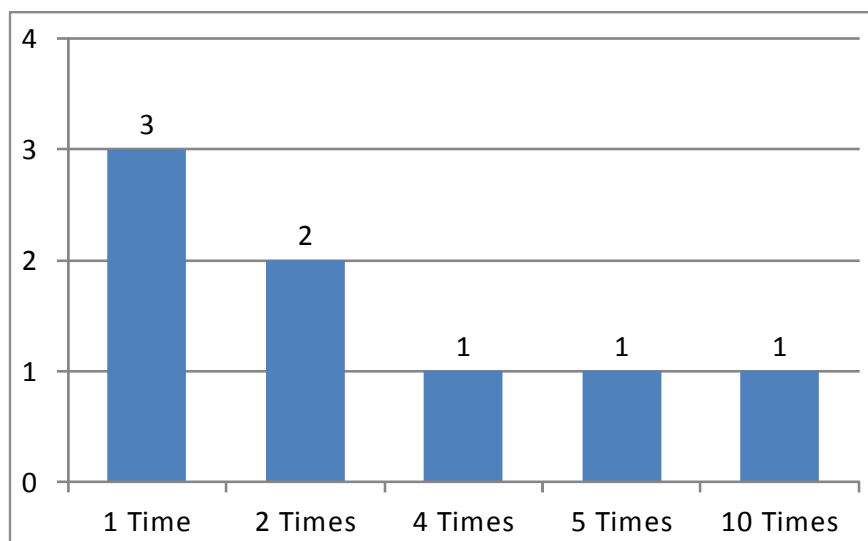


Figure 10. MSE Wall Failure Frequency Distribution

Question 11. If “Yes”, what types of MSE wall abutment failures do you have?

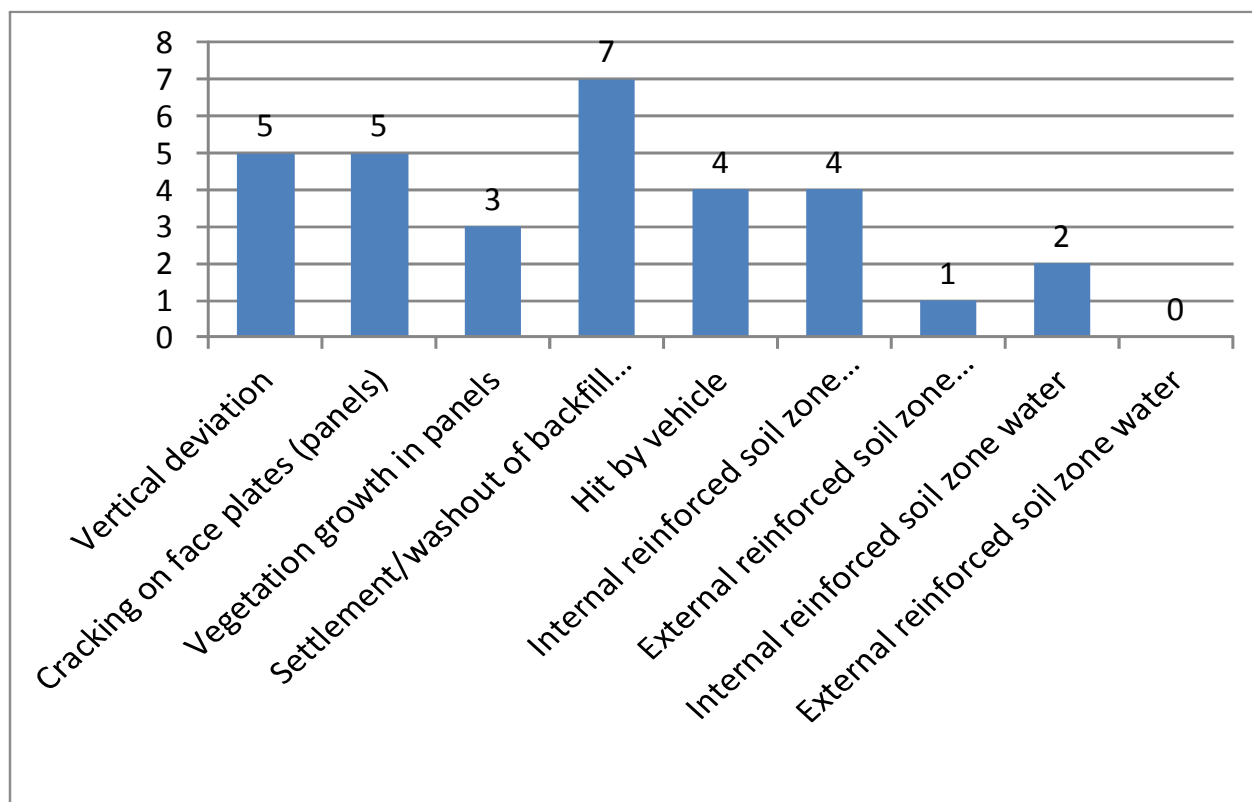


Figure 11. MSE Wall Abutment Failures Type Distribution

Question 12. Is there any formalized maintenance rating system for MSE wall abutments in your state?

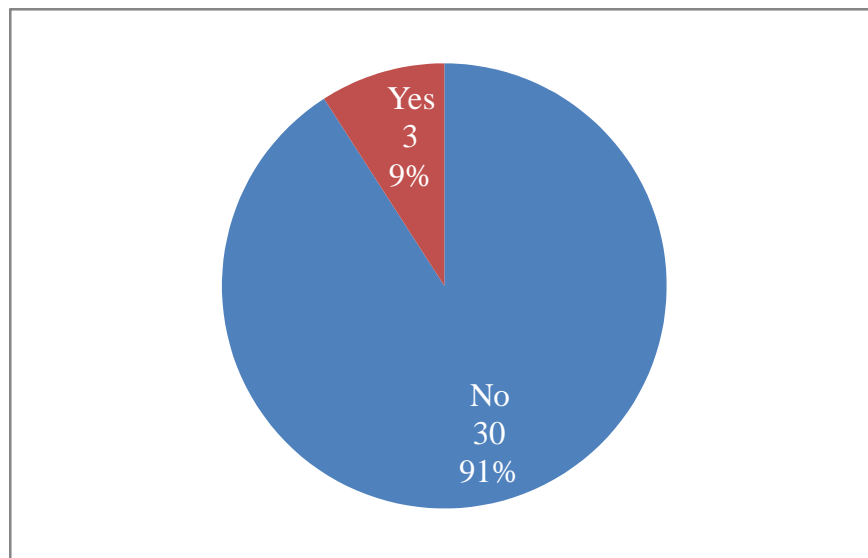


Figure 12. Formalized Maintenance Rating System in States

Question 13. Are there guidelines for building MSE wall abutments in your state?

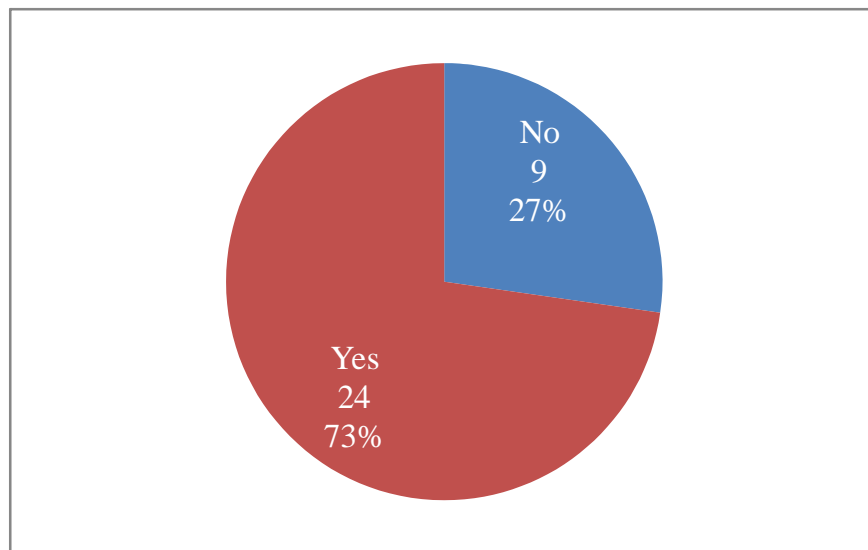


Figure 13. Guidelines for Building MSE Wall Abutments

Question 14. Is there any maintenance inspector's handbook for MSE wall abutments in your state?

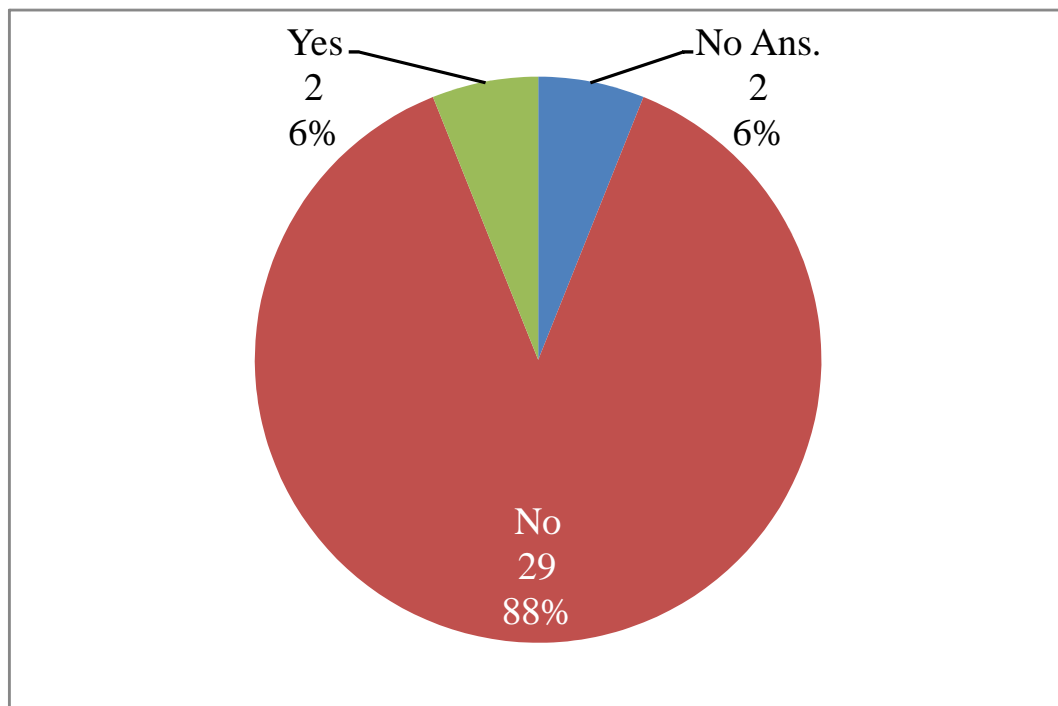


Figure 14. Maintenance Inspector's Handbook for MSE Wall Abutments

### 3.1 General Information

From Figure 1, 80% (33/41) of states/provinces used MSE wall as abutment. All the states/provinces (33/33), who used MSE wall as abutment, built MSE wall abutments for public use (Figure 3). Also, eight (8) states/provinces built MSE wall for private and commercial use (Figure 3).

### 3.2 Materials Used for MSE Wall Abutment

Majority states/provinces (30/33) used galvanized steel as reinforcement in the MSE wall as an abutment (Figure 4). Fourteen (14) states/provinces used geogrid and five (5) states/provinces used geotextile as reinforcement in the MSE wall as an abutment (Figure 4). Most of the states/provinces (26/33) used aggregate as backfill materials for MSE wall abutment (Figure 5). Thirteen (13) states/provinces used sand and one (1) state used lightweight material (filled in other material) as backfill material in the MSE wall abutment (Figure 5).



### 3.3 Maximum Height for MSE Wall Abutment

Majority states/provinces (27/33) limited the maximum height for the MSE wall abutment equal to or less than 40 feet; only one (1) state allowed the maximum height of 50 feet; and one (1) state allowed the maximum height of 45 feet (Figure 6).

### 3.4 Foundation for MSE Wall Abutment

All the states/provinces (33/33), who used MSE wall as an abutment, allowed MSE wall footing to be built on soil (Figure 7). Twenty-two (22) states/provinces allowed MSE wall footing to be built on rock (Figure 7). Nine (9) states/provinces allowed MSE wall footing to be built on pile group (Figure 7).

### 3.5 What Are Bridge Beams/Girders Allowed on

Twenty-one (21) states/provinces allowed bridge beams/girders bearing on piles; seven (7) states/provinces allowed bridge beams/girders bearing on the MSE wall itself directly; eight (8) states/provinces allowed bridge beams/girders bearing on both piles and the MSE wall itself (Figure 8).

### 3.6 MSE Wall Abutment Failure and Failure Type

There were MSE wall abutment failures in 36% (12/33) states/provinces (Figure 9). Failure reached 10 times in one (1) state (Figure 10). Seven (7) states/provinces had failure type "Settlement/washout of backfill material" (Figure 11). There was not a failure type "External reinforced soil zone water" (Figure 11).

### 3.7 Rating System, Guidelines, and Handbook Availability

Three (3) states/provinces had formalized maintenance rating system for MSE wall abutments (Figure 12). Twenty-four (24), which is 73% out of 33, states/provinces had guidelines for building MSE wall abutments (Figure 13). Only two (2) states/provinces had maintenance inspector's handbook for MSE wall abutments (Figure 14).

### 3.8 Comments from Respondents

Sixteen states/provinces provided more detail in their comments, see Table 1. Two (2) states emphasized reinforcement for MSE wall (Alabama and Texas); four (4) states clarified inspection and rating system (Delaware, Florida, Nebraska, and Oregon); four (4) states stated bridge abutment supported by piling penetrating through the MSE structural fill (Alabama, Kansas, Michigan, and Tennessee); South Carolina followed AASHTO and FHWA specifications and guidelines very closely for its design and construction requirements. Colorado was implementing MSE or GRS-IBS system.

**Table 1. Comments from Respondents**

State	Comments
Alabama	MSE wall abutments have increased over the last few years. ALDOT usually drive piles first and then build MSE wall using reinforcing strips to be able to get required reinforcing around piles. We have been told that geogrid can be used, but we have recently eliminated the use of geogrid due to having to cut and place the geogrid around the driven piles which can cause failures if not done properly. Being able to move the reinforcing strips 15 degrees makes placing reinforcing around the piling much easier with less opportunity for mistakes.
Colorado	We are implementing MSE or GRS-IBS systems.
Delaware	MSE walls are rated as part of the bridge when biannual inspections occur. There is no formalized rating system or inspection handbook for MSE walls, but they do get inspected and rated. Also, while we have no state specific guidelines for designing MSE walls, we use FHWA publications in conjunction with the AASHTO LRFD Bridge Design Specifications. We have had no failures in our state, but we are <b>interested</b> in the findings from this survey. Thanks!
Florida	MSE Abutments are observed for distress during bi-annual bridge inspections.
Kansas	Most of our issues are traced to the combination of an integral abutment supported by piling penetrating through the MSE structural fill and not isolated from the fill by a corrugated metal pipe casing.
Michigan	In late 1980's we had an MSE abutment settle at one location. The bridge, which was supported in the MSE fill on spread footings, also settled. Virtually all MSE abutments constructed after that time had bridge supported on pile foundations.
Montana	The Montana DOT has a few MSE wall bridge abutments, but not very many that I am aware of. Generally, of those that we have constructed, a good majority have been on projects constructed in urban areas. We do not have a lot of urban areas, or many project in the urban areas. Overall, we have had good success with our MSE bridge abutments and MSE walls in other locations.
Nebraska	We just recently started an inventory and inspection program for all our retaining walls on State Right of Way. We utilize a rating system and a database to monitor retaining wall maintenance and repair needs.
Nevada	We are currently reconsidering due to changes in FHWA opinion on the subject.
New Mexico	Bridge beams/girders are bearing on: MSE wall itself. ... to clarify; beam seat bears on spread footing which bears on reinforced soil mass ~ 2 ft below top of coping; minimum toe offset from back of panel 30 inches. Minimum soil reinforcement ratio is 1:1 for overall height of Bridge p.g. and bottom of MSE wall; also checked for global stability. All MSE abutments have wingwalls that have same top of coping elevation as that under the bridge itself; offset to allow for 2:1 slopes from shoulder to wingwall. All MSE abutments have concrete slope

	protection to top of coping with a drainage invert behind the coping and rip-rap drainage rundowns at ends of wingwalls.
Oregon	Please note ODOT is just starting to incorporate MSE walls (including MSE wall abutments) into our assets management system. At the present time we do not have an approved MSE wall rating system or maintenance inspector's handbook.
South Carolina	We follow AASHTO and FHWA specs and guidelines very closely for our design and construction requirements. Our SCDOT website has specs and details if needed.
Tennessee	To clarify my answers, TDOT does use MSE walls at bridge ends to support the embankment fill but the actual bridge abutment does not bear on the top of the MSE wall. The bridge abutment would be founded on piles either driven through or pre-placed in the MSE select backfill area.
Texas	In my knowledge, we have built only two MSE integrated abutments. One wall with strip reinforcements and one with grid type metallic reinforcements. The most recent structure (built in 2003) was designed in this fashion to account for expected deep seated settlement. This structure was to have a service life not to exceed 10 to 15 years.
Washington	We really only have one bridge constructed to date bearing on the MSE wall. It was part of a Design Build Project on SR-405. Accordingly, I have very little information on the wall.
Wisconsin	We have had a few small issues with MSE abutment walls, but not 'failures'. Issues have included cracked panels, slight loss of backfill material, wall alignment issues. MSE abutment walls have used typical precast panels, or wire-faced MSE walls with full-height precast panels.

#### 4. MSE WALL ABUTMENT CONDITION RATING WEB APPLICATION

To aid in the rating process for maintenance, a web application for the MSE Wall Abutment Inspection/Rating In KY has been developed in this study. Some handy features such as sharing pictures and files on line, and showing sites on Google map, drilling down to specific locations for details from map point were built into this application. A link from MSE wall rating web application to KYTC Geotechnical Report Database was created. It was decided that it was convenient for user to get correct geotechnical report corresponding to the current job site. Corresponding shop drawings or as-built plans were uploaded to the MSE wall rating web application as well.

In this preliminary stage, only following visual rating system was adopted:

- **Excellent** - MSE wall abutment is in perfect condition without any visible damage/deterioration/deformation; without big vegetation protruding from face.
- **Good** - MSE wall abutment is in good condition with small visible damage/deterioration/deformation; or with big vegetation protruding from face.
- **Fair** - There are non-ignorable visible damage/deterioration/deformation on MSE wall abutment and need to pay big attention on it.
- **Poor** - There are significant visible damage/deterioration/deformation on MSE wall abutment and need to fix ASAP; otherwise, it will threaten public traffic.

Similar to National Bridge Inventory (NBI) rating system for bridge decks, superstructures, and substructures, the point rating system like the following can be fulfilled in this MSE wall abutment rating web application if it is needed:

- 9 - Superior to present desirable criteria
- 8 - Equal to present desirable criteria
- 7 - Better than present minimum criteria
- 6 - Equal to present minimum criteria
- 5 - Somewhat better than minimum adequacy to tolerate being left in place as is
- 4 - Meets minimum tolerable limits to be left in place as is
- 3 - Basically intolerable requiring high priority of corrective action
- 2 - Basically intolerable requiring high priority of replacement
- 1 - This value of rating code not used
- 0 - Bridge closed

It is anticipated that there will be two primary users of MSE Wall Abutment Inspection/Rating In KY web application; principal investigators and project administrators. There also will be non-registered viewers. These viewers will have permission to view only the

available information, not to add or edit the data. The primary users will be responsible for maintaining and updating MSE Wall Abutment Inspection/Rating In KY web application with data determined from site location, inspection results, and monitoring the history of a MSE wall abutment while viewers will only be allowed to “view” the information about MSE wall abutments.

In efforts to assist users of MSE Wall Abutment Inspection/Rating In KY web application the following will highlight the web features. Various graphical user interfaces of the web application are illustrated and described below.

#### **4.1 Overall Web Page Setting**

For the user’s convenience, all the functioning web pages on MSE Wall Abutment Inspection/Rating In KY web application are divided to three parts which are Header, Main Body, and Footer (Figures 15 and 16).

The header portion has two different settings for before and after Login. The common contents include web title, date, Search MSE Walls and “go”. It also includes links to: Home, MSE Wall Abutment List, All on Map, FAQ, and Contact Us. Before Login, there are links to Login and Register. After Login, user’s first name will be shown on the top line; link to My Account provides page for modifying user’s own information; Logout is always shown on top right corner; Input New MSE wall leads user to the page to provide MSE wall abutment Information. If the user is an agency, Input New MSE wall link will not show up. If the user is an administrator, User Administration is a special link for her/him. User Administration provides a page to maintain all the users registered to MSE Wall Abutment Inspection/Rating In KY web application.

The Main Body is the area to host different functioning pages, which will be illustrated in detail later.

The Footer provides links to related web sites such as University of Kentucky, Kentucky Transportation Center, Kentucky Transportation Cabinet, and Contact Us. They are handy for all the users.



Figure 15. Overall Web Page Setting 1 – Before Login



Figure 16. Overall Web Page Setting 2 – After Login

## 4.2 Register

When the “Register” tab is clicked, as shown in Figure 17, the user is requested to supply certain types of information, as shown in Figure 17. If an asterisk appears by a field, then the information is required for registration as a user. Information requested includes name, email (which has to be valid and will be used as login ID by the user and sent correspond email by administrator; registering user could check email address availability by clicking on **Check Availability** button), password (created by user), contact phone number, street address, city, state, zip code, organization, and desired user designation. Optional information includes address 2 and description. Information supplied by the user is confidential and maintained in MSE Wall Abutment Inspection/Rating In KY web application. Passwords created by the user are encrypted and saved in web application. All required information must be supplied to become a registered user of MSE Wall Abutment Inspection/Rating In KY web application.

Figure 17. Registration Screen

After the user has entered all the required information and clicked on the Register button, the following screen (Figure 18) appears. It tells the user: “An activation link has been sent to your email address. Please follow the instructions in the email to activate your account.” By checking the submitted email, the user will find an email similar to one shown in Figure 19. By

clicking on the link, the user's account will be automatically activated. An activation screen (Figure 20) will tell user the status of activation. If activation is successful, the registered user can login from screen shown in Figure 20. Or, click on Login link to login application by **Login** page.



Figure 18. Information after Register Button Is Clicked

**Account activation for Kentucky MSE Wall Abutment Rating web application**

World Wide Web Owner <unixstaff@engr.uky.edu>

Sent: Friday, July 12, 2013 7:55 PM

To: [charlie1658@gmail.com](mailto:charlie1658@gmail.com)

Dear Charlie,

Thank you for signing up for a Kentucky MSE Wall Abutment Rating PI account!

With user privilege as a PI, MSE Wall Abutment Rating web application will let you input your new site, input inspection results, rate your visual inspection, and download/use MSE Wall Abutment Rating web application manual on line.

Please verify that you did sign up for this account by clicking on this link.

<http://www.ktc.uky.edu/kvtc/MSEWall/activate.php?id=206&email=charlie1658@gmail.com>

If you did not sign up for this account, take no action, and no account will be created.

Thanks for your interest in Kentucky MSE Wall Abutment Rating web application.

The Kentucky MSE Wall Abutment Rating web application Team

Figure 19. Email Provides a Link to Activate User's Account





Figure 20. Screen after Activating User's Account

### 4.3 Login

The **Login** screen is illustrated in Figure 21 and is the gateway for registered users to MSE Wall Abutment Inspection/Rating In KY web application. The user selects her/his user category from dropdown list first (Figure 21a). After selection, the user finds her/his name from another dropdown list, and may either **Sign In** using her/his Password or send the administrator an email to get new password by clicking on **Forgot Password** if the user forgets the password (Figure 21b).



Figure 21a. Select User Category from Dropdown List



Figure 21b. Login Screen

### 4.4 MSE Wall Abutment Inspection/Rating In KY Web Application Home

After the user logs into MSE Wall Abutment Inspection/Rating In KY web application, a “Welcome” screen appears, as shown in Figure 16. On the left side of this screen, navigation bars appear. These bars allow the user to get information quickly. This Home page is different from the one before login (Figure 15). That one does not have any link in Main Body.

#### 4.5 Search MSE Walls and “go”

As mentioned before, **Search MSE Walls** (Figure 22) is on the **Header** portion of every web page. Users can type in key words (or any string) in this search area. It is not case sensitive. Any MSE wall site with this string, which is inputted by the users, in any column of **Site #**, **County**, or **Location** will show in the search result list. Figure 23 is a search result list when string, “seatonville”, is typed in the search area and **go/Return** button is clicked. If **go/Return** button is clicked without any string as search criterion, all the MSE wall abutments in the current system will be listed.



Figure 22. Handy Function – Search MSE Walls and “go”



Figure 23. Search Result by Using Search MSE Walls with String “seatonville”

## 4.6 MSE Wall Abutment List

This link will list all the MSE wall abutments in current web application. It is the same function as the **go/Return** button is clicked without any string as a search criterion. A special column, **Active**, which is only for administrator, is built on the MSE wall abutment List page (Figure 24). The administrator will find **Check Box** for “Active” at rightmost side on MSE wall abutment List page. If the administrator wishes to close the MSE wall abutment site, uncheck the appropriate box, click on **Update** button, and the unchecked MSE wall abutment site will be closed. The closed MSE wall abutment sites cannot be retrieved by all users except administrator. Besides **Update** button, there are two other buttons, **Retrieve Closed Sites** and **Retrieve All**. **Retrieve Closed Sites** will retrieve closed MSE wall abutment sites only; **Retrieve All** will retrieve all MSE wall abutment sites including both closed and active MSE wall abutment sites. The administrator can take closed items back by checking **Check Boxes** and clicking on the **Update** button. This function will be useful for datum maintenance.

Saturday, July 13, 2013 | Hello, Charlie | [My Account](#) | [User Administration](#) | [Logout](#)



# MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

**MSE Wall Abutment List** ([Click Here To See Them on Map](#))

Site #	Bridge ID #	HW Dist.	County	Route	Mile Post	Location	Height (ft.)	Length (ft.)	Elev. (ft.)	Position	Rating	Active
9236	015B00072N	5	Bullitt	I-65 North Bound	111.80	I-65 and KY 245 Abutment # 2	20.60	162.36	480.00	Above Roadway	Excellent	<input checked="" type="checkbox"/>
9237	015B00072N	5	Bullitt	I-65 South Bound	111.80	I-65 and KY 245 Abutment #1	18.30	162.36	482.70	Above Roadway	Excellent	<input checked="" type="checkbox"/>
9238	015B00078N	5	Bullitt	I-65 South Bound	118.80	I-65 and KY 61	17.00	160.00	456.83	Above Roadway	Excellent	<input checked="" type="checkbox"/>
9239	015B00078N	5	Bullitt	I-65 North Bound	118.80	I-65 and KY 61	17.00	165.00	456.83	Above Roadway	Excellent	<input checked="" type="checkbox"/>
9218	015B00074L	5	Bullitt	I-65 North Bound	112.46	I-65 Over L&N Railroad. Wall #2	28.00	237.86	517.00	Below Roadway	Excellent	<input checked="" type="checkbox"/>
9219	015B00074L	5	Bullitt	I-65 North Bound	112.46	I-65 Over L&N Railroad. Wall # 1	28.00	237.86	469.90	Below Roadway	Excellent	<input checked="" type="checkbox"/>
9220	056B00422N	5	Jefferson	I-65 North Bound	129.70	Abutment Wall # 1 I-65 Over Grade Lane (Grade Lane stations)	20.50	177.92	492.80	Below Roadway	Good	<input checked="" type="checkbox"/>
9221	056B00422N	5	Jefferson	I-65 North Bound	129.75	Abutment Wall # 2 I-65 Over Grade Lane. (Grade Lane stations)	20.50	177.92	492.85	Below Roadway	Good	<input checked="" type="checkbox"/>
9222	056B00390N	5	Jefferson	I-65 South Bound	129.95	Wall # 1 I-65 Over Stanford Lane.(Begin station is Stanford Lane. End station is I-65)	17.20	1028.28	471.00	Below Roadway	Good	<input checked="" type="checkbox"/>
9223	056B00390N	5	Jefferson	I-65 North Bound	130.00	Wall # 2 I-65 Over Stanford Lane. (Stanford Lane stations)	15.00	314.88	515.00	Below Roadway	Excellent	<input checked="" type="checkbox"/>
9299	056B00405N	5	Jefferson	I-264 West Bound	11.80	I-264 Ramp 11 to Airport & Fairgrounds	16.80	358.00	371.30	Above Roadway	Excellent	<input checked="" type="checkbox"/>
9298	056B00405N	5	Jefferson	I-264 West Bound	11.80	I-264 Ramp 11 to Airport & Fairgrounds	17.00	267.00	376.77	Above Roadway	Excellent	<input checked="" type="checkbox"/>
9300	056B00411N	5	Jefferson	I-264 East Bound	9.23	I-264 and Taylor Blvd.	29.00	320.00	345.24	Below Roadway	Excellent	<input checked="" type="checkbox"/>
9301	056B00445N	5	Jefferson	I-264 East Bound	9.24	I-264 and Taylor Blvd.	29.00	235.00	342.15	Below Roadway	Good	<input checked="" type="checkbox"/>
9308	056B00438N	5	Jefferson	I-264 West Bound	17.08	I-264 and KY 155 Abutment Wall C	14.50	377.00	396.45	Below Roadway	Good	<input checked="" type="checkbox"/>
9311	056B00434N	5	Jefferson	I-264 East Bound	18.00	I-264 and Breckinridge Lane (KY 1932) South Bridge abutment	26.20	332.00	546.00	Above Roadway	Excellent	<input checked="" type="checkbox"/>
9312	056B00434N	5	Jefferson	I-264 West Bound	18.00	I-264 and Breckinridge Lane (KY 1932) North Bridge abutment	26.25	761.16	544.00	Above Roadway	Excellent	<input checked="" type="checkbox"/>
9681	056B00436N	5	Jefferson	I-264 East Bound	15.04	I-264 and Bear Grass Creek Span West Abutment, Wall H	24.00	195.00	487.00	Below Roadway	Excellent	<input checked="" type="checkbox"/>
9688	056B00407R	5	Jefferson	I-264 West Bound	10.95	I-264 and Crittenden Drive West Abutment	16.00	280.00	471.00	Below Roadway	Excellent	<input checked="" type="checkbox"/>
9690	056B00407R	5	Jefferson	I-264 East Bound	10.98	I-264 and Crittenden Drive East Abutment	12.00	294.00	506.00	Below Roadway	Good	<input checked="" type="checkbox"/>
9680	056B00436N	5	Jefferson	I-264 East Bound	15.05	I-264 over Bear Grass Creek East Abutment, Wall K	13.00	197.00	470.00	Below Roadway	Excellent	<input checked="" type="checkbox"/>
9310	056B00438N	5	Jefferson	I-264 West Bound	17.09	I-264 and KY 155 Abutment wall D	14.50	390.00	399.99	Below Roadway	Excellent	<input checked="" type="checkbox"/>
9242	056B00448N	5	Jefferson	I-264 West Bound	19.95	Wall #3; Ramp # 1; US 60 West to I-264 Eastbound.	17.00	149.50	454.16	Above Roadway	Good	<input checked="" type="checkbox"/>
9236	056B00445N	5	Jefferson	I-264 East Bound	19.95	North Abutment wall I-264 over US 60	18.00	335.00	426.38	Above Roadway	Excellent	<input checked="" type="checkbox"/>
9238	056B00445N	5	Jefferson	I-264 East	19.91	South Abutment Wall; I-264 over US 60	20.00	329.00	420.29	Above Roadway	Good	<input checked="" type="checkbox"/>
9237	056B00445N	5	Jefferson	I-264 East Bound	19.91	South Abutment wall #4 flyover ramp; I-264 over US 60; US 60 Stations	19.90	96.95	423.81	Above Roadway	Good	<input checked="" type="checkbox"/>
9286	056B00372L	5	Jefferson	I-265 North Bound	15.17	I-265 and Beulah Church Road Abutment Wall No. 2	25.00	250.92	698.33	Below Roadway	Excellent	<input checked="" type="checkbox"/>

Figure 24. Functions for Administrator Only

#### 4.7 Click Here To See Them on Map

On the project list, yellow text link, *Click Here To See Them on Map* (Figure 25) will lead to a map showing searched MSE wall abutment sites with Lat/Long coordinates (Figure 26). Clicking on an interested point, the user will see a small window with a brief information for this MSE wall abutment site. The user will see detail information on the next web page if s/he clicks on this MSE wall abutment location.



Figure 25. *Click Here To See Them on Map* Shows Searched MSE Wall Abutment Sites, Which Have Lat/Long Coordinates, on a Map





Figure 26. A Map Showing Searched Sites Is Presented after the Link, *Click Here To See Them on Map*, Is Clicked

## 4.8 All On Map

Contrast to *Click Here To See Them on Map*, the link, **ALL ON MAP**, will show all the MSE wall abutment sites with Lat/Long coordinates on a map (Figure 27). Similar to the previous map function, clicking on an interested point, the user will see a small window with brief information for this site. User will see detail information on next web page if s/he clicks on this site location.



Figure 27. **ALL ON MAP** Shows All the Sites, Which Have Lat/Long Coordinates, on a Map

## 4.9 FAQ

**FAQ** provides simple questions and answers for MSE Wall Abutment Inspection/Rating In KY web application (Figure 28). There are two links, **Register** and **Login**, embedded on this page for the user's convenience.



Figure 28. FAQ Page with Two Convenient Links



## 4.10 Contact Us

The screen, **Contact Us**, provides an avenue to have convenient communication with the system administrator (Figure 29). The user either uses regular e-mail tool by clicking on administrator's name; or, fill out all the information required and click on the **Send** button.

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# MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

## Contact Us

Please contact [UK Transportation Center](#) via e-mail, phone or the form below if you have any comments, questions, suggestions, or concerns about MSE Wall Abutment Inspection/Rating web site.

You can send regular mail to:

**Charlie Sun**  
University of Kentucky  
277 Raymond Building  
Lexington, KY 40506  
Phone: 859-257-7330

Or, you can send e-mail by filling following information:

Your Name \*

Email Address \*

Organization

Phone Number

Fax Number

Subject \*

Comments \*

\* Required fields

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Figure 29. **Contact Us** Screen

## 4.11 Input New MSE Wall

Inputting new MSE wall abutment sites can be entered by the Principal Investigator or Administrator from **Input New MSE Wall** screen (Figure 30). When submitter successfully submits new MSE wall data, the system will save MSE wall site information and will send the administrator an email automatically, and notify her/him a new MSE wall site has been submitted.

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# MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

## MSE Wall Information

### Input MSE Wall Abutment Information

The purpose of this form is to provide UK Transportation Cabinet with information about the MSE Wall abutment site being submitted for monitoring and Rating. Please fill ALL fields as completely as possible. When a field is not applicable enter "N/A."

1. Bridge ID Number:
2. Description of MSE Wall Abutment:
18. Last Evaluated By:
19. Last Evaluation Date:
20. Status: ☒ Active ☐ Closed

\* Required Fields

This Information Input By: Charlie Sun  
Today's Date: July 13, 2013  
Address: 277 Raymond Building  
City: Lexington  
State: KY Zip Code: 40506  
Phone No: 859-257-7330  
Email Address: charlie.sun@uky.edu

Submit information for new site

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Figure 30. Screen for Inputting New Site

## 4.12 Upload Files

After a user successfully submits a new project detail information, the following screen (Figure 31) will show up for uploading files. Users need to select “For Visit Number” first, then, find files on her/his local computer by clicking on the **Browse** button, and upload these files to the server by clicking on the **Upload** button.

The screenshot displays the 'MSE Wall Abutment Inspection/Rating In KY' web application. At the top, there is a navigation bar with links: HOME | MSE Wall Abutment LIST | ALL ON MAP | INPUT NEW MSE WALL | FAQ | CONTACT US | MANUAL. Below this is a search bar labeled 'Search MSE Walls:'. The main content area is titled 'MSE Wall Detail Information' and shows 'MSE Wall Abutment Site Number: 9256'. A tabbed interface includes 'MSE Wall Info', 'Inspection/Rating', 'Pictures/Attachments', 'Comments', and 'My Comment'. The 'Pictures/Attachments' tab is active, showing an 'Upload File/Files (Pictures, .pdf, .doc, or .zip; File Size < 16MB)' section. This section contains a dropdown menu for 'For Visit Number: 1', four 'Browse...' buttons for selecting files, and an 'Upload' button. Red annotations are present: 'Select visit number first' points to the dropdown, 'Find files for uploading' points to the 'Browse...' buttons, and 'Click here to upload selected files' points to the 'Upload' button. The footer contains copyright information for the University of Kentucky Transportation Center.

Figure 31. Screen for Uploading Files When Submitting New Site

Besides uploading files here, when the registered user re-visits her/his own MSE wall abutment site, (s)he can also add/upload files (Figure 32).

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# MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)



**MSE Wall Detail Information**

MSE Wall Abutment Site Number: **9256**

[MSEWall Info](#) | [Inspection/Rating](#) | [Pictures/Attachments](#) | [Comments](#) | [My Comment](#)

Select the attachment you wish to open and double click on it. If a window appears asking **DO YOU WANT TO SAVE THIS FILE?** that means you must save the file to your hard drive and then open it from your hard drive. We apologize for the inconvenience.

**Attached Files for This MSE Wall Site**

Visit #	File Name	Type	Size	Uploaded By	Organization	Date	Accept	Delete
1	2005Plans.pdf	application/pdf	1225280	Charlie Sun	University of Kentucky	Dec 20, 2012	Yes	<input type="checkbox"/>
1		image/jpeg	67962	Charlie Sun	University of Kentucky	Jul 11, 2012	Yes	<input type="checkbox"/>
2		image/jpeg	1921117	Charlie Sun	University of Kentucky	Jul 11, 2012	Yes	<input type="checkbox"/>

**Upload File/Files (Pictures, .pdf, .doc, or .zip; File Size < 16MB)**

Pick up a visit number

Select a file  No file selected.

Select a file  No file selected.

Select a file  No file selected.

Select a file  No file selected.

**Click here to upload selected files**

**Find files for uploading**

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Figure 32. Screen for Uploading Files When Registered User Re-visits Her/His Own Site

### 4.13 MSE Wall Detail Information

By clicking on a single Site # or site Location on MSE wall abutment list, a page with MSE wall detail information appears (Figure 33). There are five tabs: **MSE Wall Info**, **Inspection/Rating**, **Pictures/Attachments**, **Comments**, and **My Comment**, on this page for the registered users.

**4.13.1 MSE Wall Info** - The screen shown in Figure 33 is under the first tab, **MSE Wall Info**. It shows detail information for the MSE wall chosen by user.

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## MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

### MSE Wall Detail Information

MSE Wall Abutment Site Number: **9256**

**MSEWall Info** | [Inspection/Rating](#) | [Pictures/Attachments](#) | [Comments](#) | [My Comment](#)

**Bridge Number:** 01500072N  
**Description of MSE Wall:** Bridge abutment  
**MSE Wall Abutment Location:** I-65 and KY-245 Abutment # 2  
**County:** Bullitt Highway District: 5  
**Route:** I- 65 , Mile Post: 111.800 , Direction: Northbound Centerline: Right  
**Begin Station:** 0- , **End Station:** 0-  
**2nd Route:** KY- 245 (for intersection or interchange)  
**Latitude:** 37.925147365 **Longitude:** -85.687355001  
**Link to Geotech Report:** http://  
**Dimension:** Height: 20.600 ft., Length: 162.359 ft., Elevation: 480.000 ft.  
**Designer:**  
**Position:** Above Roadway  
**Topography:** Rolling  
**Backfill Material:** Soil and Aggregate  
**KYTC Drawing #:** 20074  
**Manufacturer's Drawing #:** 1770  
**Manufacturer:** RECO  
**Type of Reinforcement:** Galvanized Steel  
**Year Constructed:**  
**General Comments:**  
**Abutment Wall # 2**  
**Last Evaluated By:** TJ and CS  
**Last Evaluation Date:** 2012-01-25  
**Status:** Active

**Infor. Last Modified By:**  
**Charlie Sun**  
**University of Kentucky**  
**277 Raymond Building**  
**Lexington, KY 40506**  
**Phone:** 859-257-7330  
**Email:** charlie.sun@uky.edu

This information is last modified on: Jan 24, 2006

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Figure 33. MSE Wall Detail Information

**4.13.2 Inspection/Rating** - By clicking on the second tab, **Inspection/Rating**, the existing visits for current MSE wall will appear (Figure 34). Under this tab, the user can see brief information for each visit. If the user clicks on visit number, s/he will see detail information about this visit (this will be discussed later). If the user is the principal investigator for a current MSE wall, the **Add New Visit/Evaluation Information** screen will show up. The principal investigator can add a new visit by filling detail information about this visit.

Saturday, July 13, 2013 | Hello, Charlie | [My Account](#) | [User Administration](#) | [Logout](#)

# MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ADD NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

## MSE Wall Detail Information

MSE Wall Abutment Site Number: **9256**

[MSE Wall Info](#) | [Inspection/Rating](#) | [Pictures/Attachments](#) | [Comments](#) | [My Comment](#)

Visit #	Visual Evaluation	Comments	Soil Condition	Soil Ph	Acid/Alk	Rating	Evaluator	Evaluate Date
1	Bridge Abutment, Surface of Face, Vegetation Protruding from Face	Abutment Wall # 2	Silt,	6.3	Acidic	Excellent	Butcher	2002-05-16
2	Bridge Abutment, Surface of Face, Vegetation Protruding from Face					Excellent	TJ and JC	2012-03-16

**Clicking on a site # or Description to see a site detail information**

### Add New Visit/Evaluation Information:

1. Visit Number:

2. Visual Evaluation:  Comments:

3. General Soil Condition:

4. Soil pH:

5. Acidic or Alkaline?

6. Rating:

7. Evaluator:

8. Evaluate Date:

9. Comments:

Evaluation Information Input By: Charlie Sun  
 Today's Date: July 13, 2013  
 Address: 277 Raymond Building  
 City: Lexington  
 State: KY Zip Code: 40506  
 Telephone No: 859-257-7330  
 Email Address: charlie.sun@uky.edu

**Add a new site**

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Figure 34. Inspection/Rating Tab Shows All the Ratings for Current Site



**4.13.3 Pictures/Attachments** - By clicking on the third tab, **Pictures/Attachments**, all the uploaded pictures or attachments will be listed, see Figure 35, which is the same as Figure 32. If this MSE wall belongs to the current user, the upload files portion will show up for uploading extra attachments for the current MSE wall. The user chooses correct visit number in “For Visit Number” dropdown list to upload attachments to database for corresponding visit. This portion will not show up if the user is not a principal investigator for this MSE wall, or the user does not log on.

Saturday, July 13, 2013 | Hello, Charlie | [My Account](#) | [User Administration](#) | [Logout](#)

## MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)



### MSE Wall Detail Information

MSE Wall Abutment Site Number: **9256**

[MSEWall Info](#) | [Inspection/Rating](#) | [Pictures/Attachments](#) | [Comments](#) | [My Comment](#)

Select the attachment you wish to open and double click on it. If a window appears asking **DO YOU WANT TO SAVE THIS FILE?** that means you must save the file to your hard drive and then open it from your hard drive. We apologize for the inconvenience.

#### Attached Files for This MSE Wall Site

Visit #	File Name	Type	Size	Uploaded By	Organization	Date	Accept	Delete
1	20054Plans.pdf	application/pdf	1225280	Charlie Sun	University of Kentucky	Dec 20, 2012	Yes	<input type="checkbox"/>
1		image/jpeg	67962	Charlie Sun	University of Kentucky	Jul 11, 2012	Yes	<input type="checkbox"/>
2		image/jpeg	1921117	Charlie Sun	University of Kentucky	Jul 11, 2012	Yes	<input type="checkbox"/>

#### Upload File/Files (Pictures, .pdf, .doc, or .zip; File Size < 16MB)

**Pick up a visit number** For Visit Number: 1

Select a file Browse... No file selected

Select a file Browse... No file selected

Select a file Browse... No file selected

Select a file Browse... No file selected

**Click here to upload selected files** Upload

Find files for uploading

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Figure 35. **Pictures/Attachments** Lists All the Uploaded Attachments for this MSE Wall Abutment; New Attachments Will Be Uploaded from Here as Well

**4.13.4 Comments** - By clicking on the fourth tab, **Comments**, the existing comments by registered users will appear (Figure 36). Under this tab, the user can see all the comments from registered users, all the responses corresponding to comments by the principal investigator. If the current user is a principal investigator for the current MSE wall, s/he can respond to any comment by clicking on corresponding comment; also, s/he can modify the response by clicking on existing response. The user will see detail information about the commenter by clicking on the commenter's name.

SE Wall Abutment Inspection/Rating In KY

Search MSE Walls:  go

HOME | MSE Wall Abutment LIST | ALL ON MAP | INPUT NEW MSE WALL | FAQ | CONTACT US | MANUAL

MSE Wall Detail Information

MSE Wall Abutment Site Number: 9256

MSE Wall Info | Inspection/Rating | Pictures/Attachments | **Comments** | Add Comment

Notes:  
Abutment Wall # 2

Comments

Visit #	Organization	Commenter	Comment	Response	Date
1	University of Kentucky	Charlie Sun	Something here.		Jul 13, 2013
2	University of Kentucky	Charlie Sun	Something there.		Jul 13, 2013

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**Existing Comments**

**PI responses comments by clicking single comment**

**Clicking on a user's name to see her/his detail information**

Figure 36. Comments by Other Registered Users and Responses by Principal Investigator for Current MSE Wall Abutment Site



**4.13.5 My Comment** - Under the fifth tab, **My Comment**, the users can submit her/his comments for different visits on the current MSE wall abutment site (Figure 37). S/he can pick up existing visit numbers from a dropdown list. By clicking on the **Submit** button, the user can submit and save her/his opinions to the database.

The screenshot shows the 'MSE Wall Abutment Inspection/Rating In KY' web application. The page title is 'MSE Wall Abutment Inspection/Rating In KY'. The navigation bar includes links: HOME | MSE Wall Abutment LIST | ALL ON MAP | INPUT NEW MSE WALL | FAQ | CONTACT US | MANUAL. The main content area is titled 'MSE Wall Detail Information' and shows 'MSE Wall Abutment Site Number: 9256'. The 'My Comment' tab is selected. The form includes a dropdown menu for 'My Comments on Visit Number:' with a 'Please Select' option. Below the dropdown is a text area for 'Something here.' and a 'Today's Date: July 13, 2013' field. The 'Submit' button is highlighted with a red circle. Red text annotations read: 'My comment', 'Pick up a visit number from dropdown list', and 'Click here for submitting'.

Figure 37. Register User Enters Comments Here for Current MSE Wall Abutment Site and Selected Visit Number

#### 4.14 Inspection/Rating Detail Information

As described in section 4.13.2, clicking on the visit number will lead to the Inspection/Rating detail information page (Figure 38). There are four tabs, **Inspection/Rating**, **Pictures/Attachments**, **Comments**, and **My Comment**, on this page for the registered user.

**4.14.1 Inspection/Rating** - The screen shown in Figure 38 is under the first tab, **Inspection/Rating**. It shows detail information for the inspection chosen by the user. If the current user is the principal investigator for this MSE wall, s/he can modify the information on the screen. After s/he makes modification, s/he can save changes to the database by clicking on the **Save Changes** button. Or, s/he can delete this site by clicking on the **Delete** button.

Saturday, July 13, 2013 | Hello, Charlie | [My Account](#) | [User Administration](#) | [Logout](#)

## MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

### Inspection/Rating Detail Information

MSE Wall Abutment Site Number: **9256**  
Visit Number: **1**

**Inspection/Rating Info**

**Inspection/Rating** | Pictures/Attachments | Comments | My Comment

1. Visual Evaluation: \*  
 Bridge Abutment:   
 Support of Roadway Traffic:   
 Possible Exposure to Roadway Salts:   
 Vegetation Protruding from Face:

2. General Soil Condition: Silts  Please Select ...  
 3. Soil pH: 6.3  
 4. Acidic or Alkaline? Acidic

5. Rating: Excellent   
 6. Evaluator: Butcher  
 7. Evaluation Date: 2002-05-16

8. Comments:  
 Abutment Wall # 2

\* Required Fields

**Info:** Last Modified By: Charlie Sun  
 Modified Date: Dec 31, 1969  
 Address: 277 Raymond Building  
 City: Lexington  
 State: KY 40506  
 Telephone No: 859-277-7330  
 Email Address: charlie.sun@uky.edu

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Figure 38. **Inspection/Rating** Tab Shows Detail Information for Selected Visit

**4.14.2 Pictures/Attachments** - By clicking on the second tab, **Pictures/Attachments**, all the uploaded pictures and attachments for this visit will be listed, see Figure 39. If this MSE wall abutment is inputted by the current user, the uploaded files portion will show up for uploading extra attachments for the current visit in the current MSE wall abutment site. This portion will not show up if the user is not a principal investigator for this MSE wall abutment site, or the user does not log on.

Saturday, July 13, 2013 | Hello, Charlie | [My Account](#) | [User Administration](#) | [Logout](#)

## MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)


### Inspection/Rating Detail Information

MSE Wall Abutment Site Number: **9256**  
Visit Number: **1**

[Inspection/Rating](#) | [Pictures/Attachments](#) | [Comments](#) | [My Comment](#)

Select the attachment you wish to open and double click on it. If a window appears asking **DO YOU WANT TO SAVE THIS FILE?** that means you must save the file to your hard drive and then open it from your hard drive. We apologize for the inconvenience.

#### Attached Files for This Visit

File Name	Type	Size	Uploaded By	Organization	Date	Accept	Delete
	image/jpeg	67962	Charlie Sun	University of Kentucky	Jul 11, 2012	Yes	<input type="checkbox"/>
	image/jpeg	53306	Charlie Sun	University of Kentucky	Jul 11, 2012	Yes	<input type="checkbox"/>
20074Plans.pdf	application/pdf	1225280	Charlie Sun	University of Kentucky	Dec 20, 2012	Yes	<input type="checkbox"/>

#### Upload File/Files (Pictures, .pdf, doc or .zip; File Size < 16MB)

Select a file  CLAYTONS BRID.pdf

Select a file  No file selected.

Select a file  No file selected.

Select a file  No file selected.

**Find files for uploading**

**Click here to upload selected files**

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Figure 39. Uploaded Pictures/Attachments for Selected Visit are Listed under **Pictures/Attachments** Tab; New Attachments for This Selected Visit Will Be Uploaded from Here as Well

**4.14.3 Comments** - By clicking on the third tab, **Comments**, the existing comments by registered users will appear (Figure 40). Under this tab, the user can see all the comments from registered users and all the responses corresponding to comments by the principal investigator for the selected visit. If current user is a principal investigator for the current MSE wall abutment site, s/he can respond to the comment by clicking on corresponding comment; also, s/he can modify responses by clicking on an existing response. The user will see detail information about the commenter by double clicking on commenter's name.

Existing Comments

Comments

Division	Commenter	Comment	Response	Date
University of Kentucky	Charlie Sun	Something here.	Response here.	Jul 13, 2013

Clicking on a user's name to see her/his detail information

PI responses comments by clicking single comment

Figure 40. Comments by Other Registered Users and Responses by the Principal Investigator for Current Site

**4.14.4 My Comment** - Under the fourth tab, **My Comment**, the user can submit her/his comments for selected visits of the current MSE wall abutment site (Figure 41). By clicking on the **Submit** button, the user can submit and save her/his opinion to the database.

The screenshot displays the 'MSE Wall Abutment Inspection/Rating In KY' web application. At the top, there is a navigation bar with links: HOME | MSE Wall Abutment LIST | ALL ON MAP | INPUT NEW MSE WALL | FAQ | CONTACT US | MANUAL. Below this, the 'Inspection/Rating Detail Information' section shows 'MSE Wall Abutment Site Number: 9256' and 'Visit Number: 1'. The 'My Comment' tab is selected and circled in red. A large red text overlay 'My comment' is positioned over the comment input area. The input area contains the placeholder text 'Something here.' and a 'Submit' button, which is also circled in red. A large red text overlay 'Click here for submitting' points to the 'Submit' button. The footer includes copyright information for the University of Kentucky Transportation Center.

Saturday, July 13, 2013 | Hello, Charlie | [My Account](#) | [User Administration](#) | [Logout](#)

# MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

Inspection/Rating Detail Information

MSE Wall Abutment Site Number: **9256**  
Visit Number: **1**

Inspection/Rating | Pictures/Attachments | **Comment** | **My Comment**

**My Comments:**

Something here.

Today's Date: July 13, 2013

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Figure 41. Register User Enters Comments Here for Selected Visit

## 4.15 My Account

When the link, **My Account** in the top right line of each screen, is clicked, the screen in Figure 42 appears. All users may go to this screen and change their profile. They can change their passwords or any of their contact information using this screen.

Saturday, July 13, 2013 | Hello, Charlie | [My Account](#) | [User Administration](#) | [Logout](#)

# MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

## My Account

Please provide the following information to update your account

User Email: [charlie.sun@uky.edu](#)

Password:  **Specially change password**

First Name: Charlie

Last Name: Sun

Phone Number: 300-XXX-XXXX: 859-257-7330

Fax Number [optional]: 859-257-1815

Address1 Street Number Street Name: 277 Raymond Building

Address2 [optional]:

City: Lexington

State: KY

Zip Code: 40506

Country: USA

Organization/Company: University of Kentucky

Description: Any description

\* Required

**Save changes by clicking this**

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Figure 42. Update User's Account from **My Account** Link



## 4.16 User Administrator

An Administrator will have a specific access in the top line links called **User Administration** in addition to the PI access and the agency access previously. This option only appears when an Administrator logs in and is hidden from all the other users. When clicking this link, the Administrator reaches the **User Administration** web page (Figure 43). On this page, there are four tabs:

- Pending Agency/PI
- All Existing Users
- Corresponding Administrator
- Add New User

**4.16.1 Pending Agency/PI** - This screen shown in Figure 43 is under the first tab, **Pending Agency/PI**. These two areas depend on if there are agency and PI requests pending. These situations happen only when the user has registered to the system, but they have not activated their accounts. If they exist, the boxes with dropdown lists appear (see Figure 43).



Figure 43. User Administration Page with Agency and PI in Pending

As an example, when the box under **Agency Requests** is clicked, a dropdown list with a pending agency appears (Figure 44). The Administrator can see this potential agency's detail information by clicking on the **Agency Request Information** button, approve the agency's request by clicking on **Approve Agency** button, and reject/delete agency's request by clicking on **Delete Agency** button.



Figure 44. The Box under **Agency Requests** Is Clicked, a Dropdown List with a Pending Agency Appears

A dropdown list with a pending PI appears (Figure 45) when the box under **Principal Investigator Requests Unverified** is clicked. The Administrator can see this potential PI's detail information by clicking on **PI Information** button, approve PI's request by clicking on **Approve PI** button, send a notification to the PI by clicking on **Send PI Notification** button; and reject/delete the PI's request by clicking on **Delete PI** button.



Figure 45. When the Box Under **Principal Investigator Requests Unverified** Is Clicked, a Dropdown List with a Pending Vendor Appears



If there is no request pending, only text “No Approval pending” appears under **Agency Requests** and **PI Requests Unverified** (Figure 46).

The screenshot shows the web application interface for "MSE Wall Abutment Inspection/Rating In KY". At the top, there is a header with the date "Saturday, July 13, 2013" and user links: "Hello, Charlie", "My Account", "User Administration", and "Logout". Below the header is a navigation bar with a search box labeled "Search MSE Walls:" and a "GO" button. The main navigation menu includes links for "HOME", "MSE Wall Abutment LIST", "ALL ON MAP", "INPUT NEW MSE WALL", "FAQ", "CONTACT US", and "MANUAL". The user is logged in as "User Administrator".

Under the "User Administrator" section, there are tabs for "Pending Agency/PI", "All Existing Users", "Corresponding Administrator", and "Add New User". The "Pending Agency/PI" tab is selected, showing two sections:

- Agency Requests**: A text box containing "No Approval pending".
- Principal Investigator Requests Unverified**: A text box containing "No Approval pending".

At the bottom, there is a copyright notice: "Copyright© 2013 University of Kentucky Transportation Center. All rights reserved." and links to "University of Kentucky", "Kentucky Transportation Center", "Kentucky Transportation Cabinet", and "Contact Us".

Figure 46. There Is No Approval Pending

**4.16.2 All Existing Users** - The screen shown in Figure 47 is under the second tab, **All Existing Users**. A dropdown list with all the existing users appears (Figure 47) when the box under **All Existing Users** is clicked. The administrator can see one selected user's detail information by clicking on **User Information** button; approve the user's agency request by clicking on **Approve Agency** button; reset a selected the user's password by clicking on **Reset Password** button; and delete a selected user by clicking on **Delete User** button.

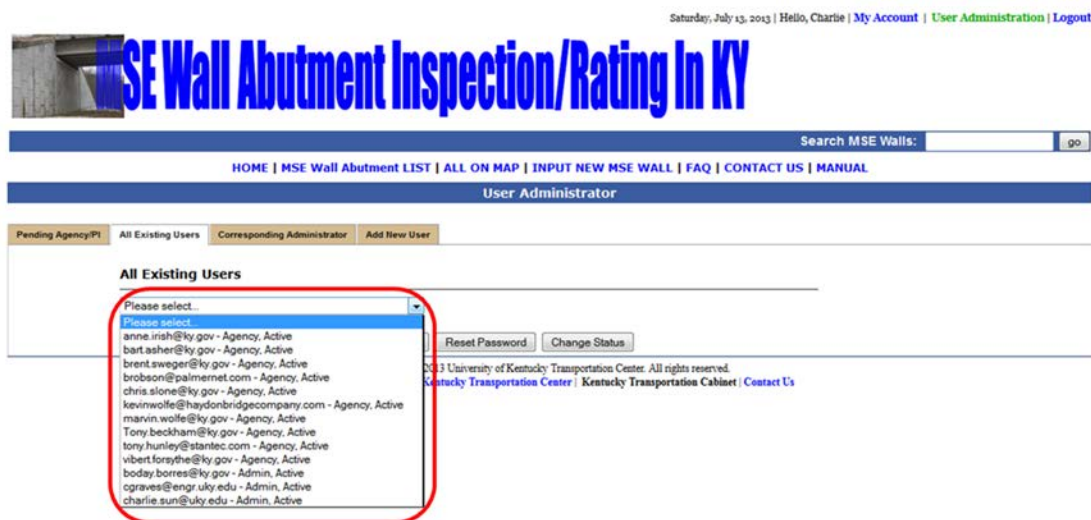


Figure 47. All the Existing Users Are Listed When the Box under **All Existing Users** Is Clicked

As an example, when [charlie.sun@uky.edu](mailto:charlie.sun@uky.edu) is selected, and **User Information** button is clicked, Charlie's detail information is shown in Figure 48.

Saturday, July 13, 2013 | Hello, Charlie | [My Account](#) | [User Administration](#) | [Logout](#)

# MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

**User Administrator**

[Pending Agency/PI](#) | [All Existing Users](#) | [Corresponding Administrator](#) | [Add New User](#)

**All Existing Users**

charlie.sun@uky.edu - Admin, Active

[User Information](#) | [Approve Agency](#) | [Upgrade Admin](#) | [Reset Password](#) | [Change Status](#)

**Creation Date:** Mon, 15 Mar 2010 14:11:44 -0400

**User Email:** charlie.sun@uky.edu

**User Type:** Admin

**First Name:** Charlie

**Last Name:** Sun

**Phone:** 859-257-7330

**Address1:** 277 Raymond Building

**Address2:**

**City:** Lexington

**State:** KY

**Zip Code:** 40506

**Country:** USA

**Organization:** University of Kentucky

**Description:** Any description

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Figure 48. User's Detail Information Appears When a User Is Selected, and Button **User Information** Is Clicked

**4.16.3 Corresponding Administrator** - The screen shown in Figure 49 is under the third tab, **Corresponding Administrator**. A dropdown list with all the users with administrator privileges appears when the box under **Set Up Corresponding Administrator** is clicked. The Administrator can set up one selected administrator as corresponding administrator by clicking on **Set Up** button.

As an example, when [cgraves@engr.uky.edu](mailto:cgraves@engr.uky.edu) is selected, after clicking on Set Up button, Clark will be set up as a corresponding administrator. Note: The corresponding administrator's information will be shown on **Contact Us** web page. S/he will receive information that the user sent from **Contact Us** web page and respond users' questions.



Figure 49. Set up **Corresponding Administrator**

**4.16.4 Add New User** - The screen shown in Figure 50 is under the fourth tab, **Add New User**. This tab provides a field for the Administrator to fill a target user's information. After the Administrator clicks on the **Register** button, a new user's account will be created, an invitation email will be sent to this invited user. Her/his password, web link, and instruction will be included in that email.

Saturday, July 13, 2013 | Hello, Charlie | [My Account](#) | [User Administration](#) | [Logout](#)

# MSE Wall Abutment Inspection/Rating In KY

Search MSE Walls:

[HOME](#) | [MSE Wall Abutment LIST](#) | [ALL ON MAP](#) | [INPUT NEW MSE WALL](#) | [FAQ](#) | [CONTACT US](#) | [MANUAL](#)

**User Administrator**

[Pending Agency/PI](#) | [All Existing Users](#) | [Corresponding Administrator](#) | [Add New User](#)

**Please provide following information to create a new account**

First Name \*

Last Name \*

Email \*

This will be new user's Log In ID  
An Invitation Email will be sent to this address  
Also, in case s/he forget her/his password, this address will be used for reset

Password \*  Minimum 6 characters

Retype Password \*

Phone Number \* xxx-xxx-xxxx

Fax Number [optional]

Address1 Street Number Street Name \*

Address2 [optional]

City \*

State \*

Zip Code \*

Country \*

Organization/Manufacturer \*

Designation ☒ PI  
☐ Agency  
☐ Administrator

Description

\* Required Fields

**Fill all required information and click on Register to create new user's account**

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Figure 50. Create a New User's Account

## 4.17 Logout

The **Logout** link is shown at the top rightmost corner on every web page for MSE Wall Abutment Inspection/Rating In KY web application. It is also shown at the left lower corner on the **Welcome** page (Figure 51). When a user clicks a logout link/button, the system deletes all session variables, then, a fresh session is started while a logout condition is set. It will redirect her/him to the **Login** page and prompts her/him to login again using their **Names** and **Passwords**.



Figure 51. **Logout** Link Is Shown at the Top Rightmost Corner on Every Web Page for Convenience

If you have any question or need help with the MSE Wall Abutment Inspection/Rating In KY, please contact:

Charlie Sun, Email: [charlie.sun@uky.edu](mailto:charlie.sun@uky.edu); Phone: 859-257-7330



## 5. VISITED MSE WALL ABUTMENTS IN KENTUCKY

### 5.1 General Information

The oldest MSE wall at the end of a bridge was built in 1976 on I-75 in Kenton County. Based on the data from the Geotechnical Database, which was developed by the Geotechnical Branch, in the Division of Structural Design of the Kentucky Transportation Cabinet in 2004, combined with new findings on MSE wall abutments in Kentucky, fifty-six (56) MSE wall abutment sites were visited (Figure 52). Twenty-seven (27) MSE wall abutments are located in Jefferson County (Figure 53). Location distributions are shown in Figures 54 and 55. Most of the heights for MSE wall abutments (52/56) are less than 30 ft.; only four (4) MSE wall abutments' heights are larger than 30 ft.; the maximum height of MSE wall is thirty-seven (37) feet (Figure 56).

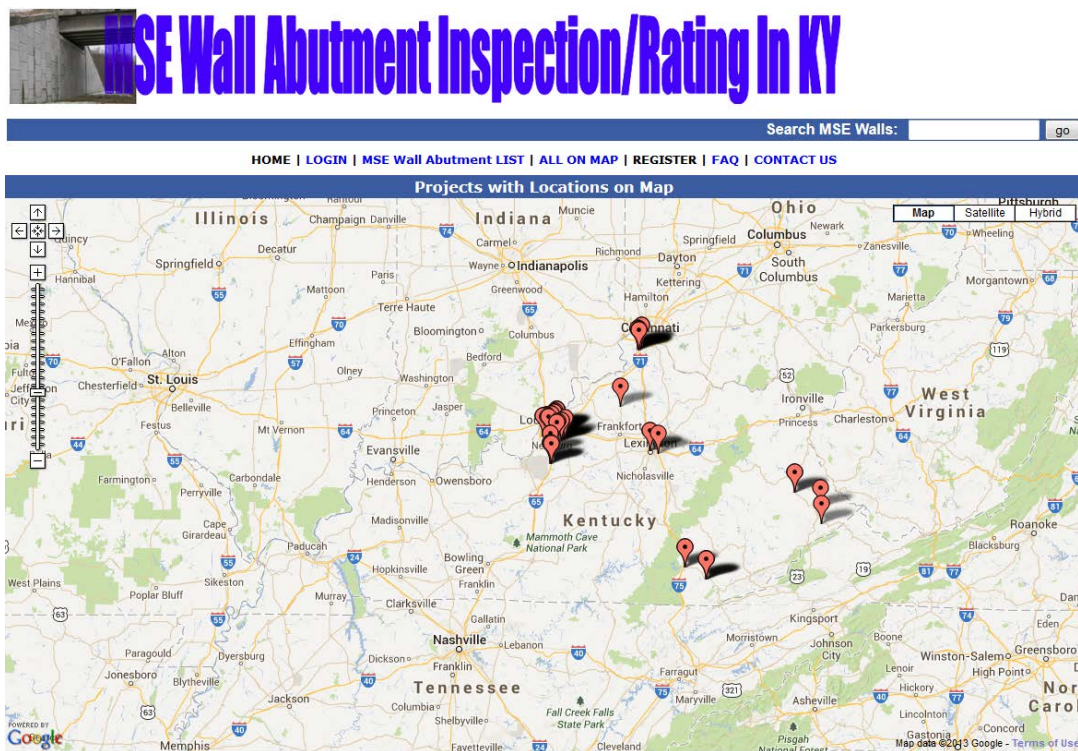


Figure 52. Visited MSE Wall Abutment in Kentucky

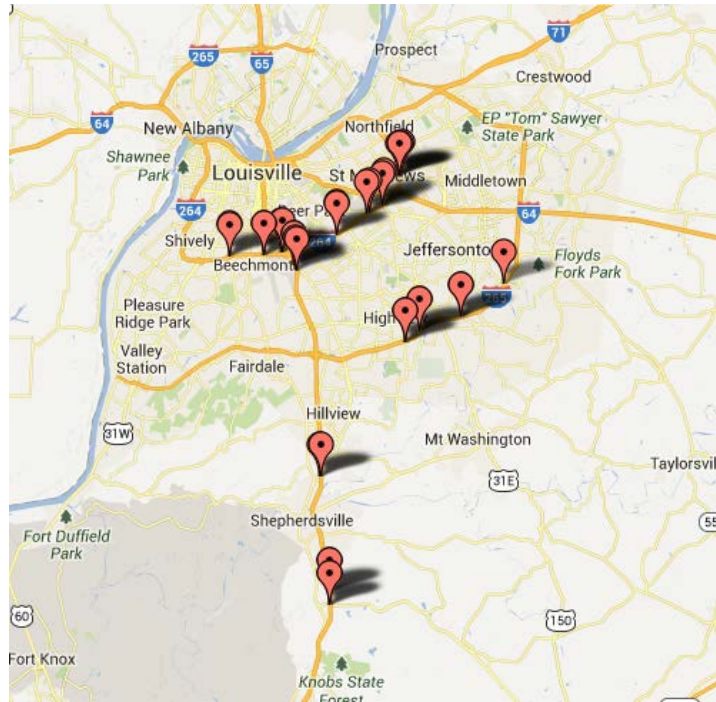


Figure 53. Twenty-seven (27) MSE Wall Abutments in Jefferson County

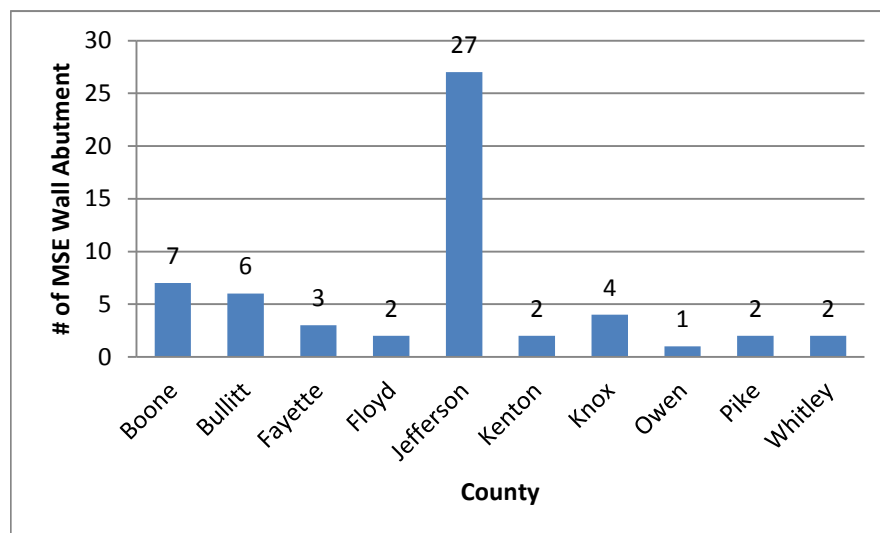


Figure 54. MSE Wall Abutment Distribution by County



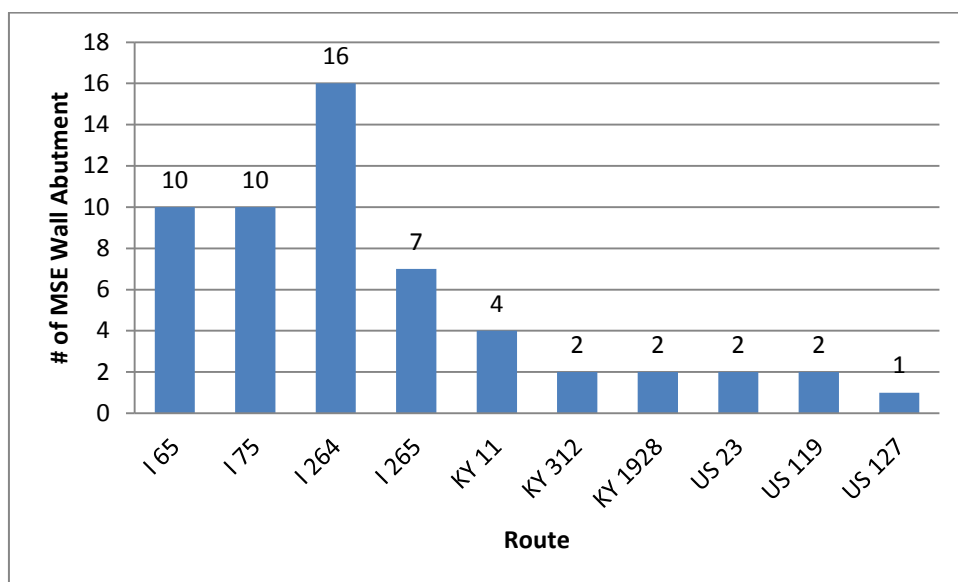


Figure 55. Twenty-seven MSE Wall Abutment Distribution by Route

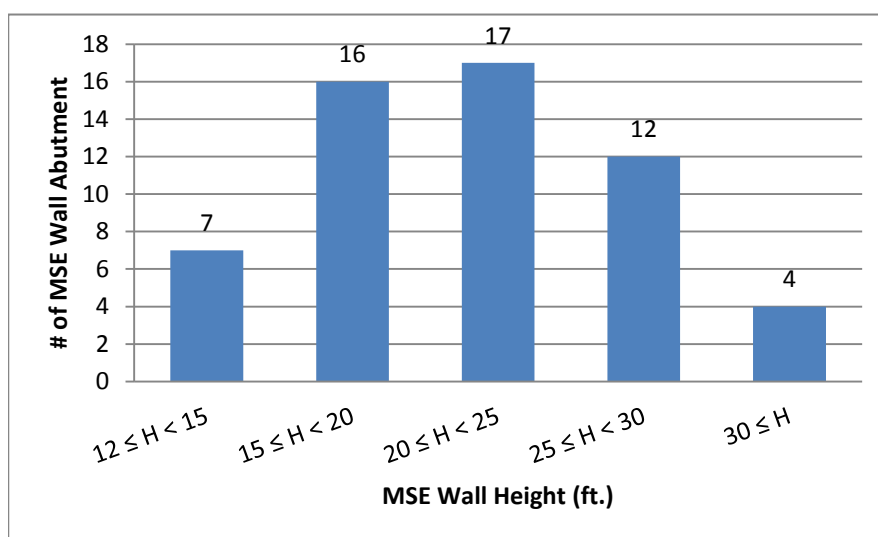


Figure 56. MSE Wall Abutment Distribution by Height

## 5.2 Backfill Material

The majority of the MSE wall abutments (42/56) consisted of backfill with Soil + Aggregate. Only one (1) MSE wall abutment had backfill with soil and two (2) with Soil + Sand. Eight (8) MSE wall abutments were backfilled with aggregate material only (see Figure 57).

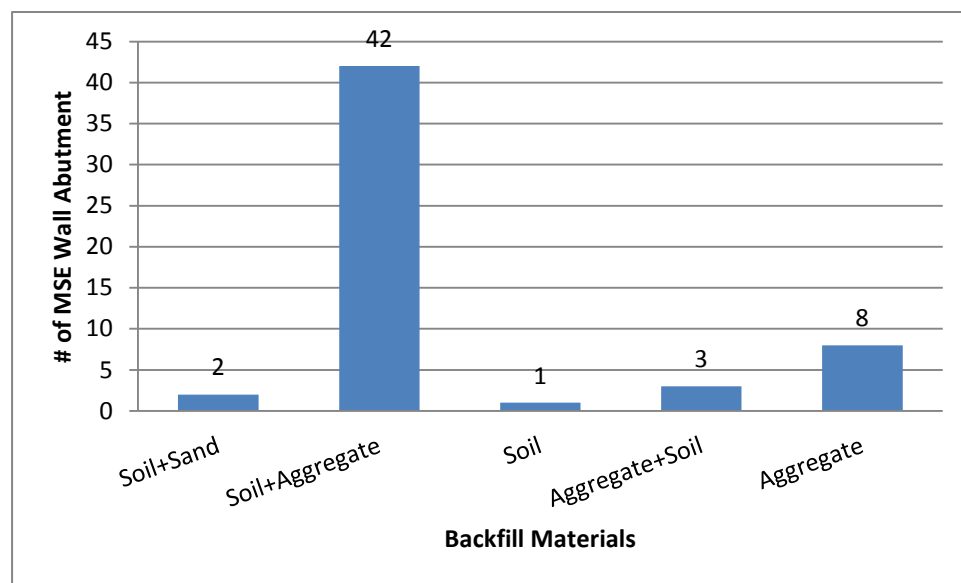


Figure 57. Backfill Materials for MSE Wall Abutments

## 5.3 Reinforcement for Wall

Among all fifty-six (56) MSE wall abutment sites, only twenty-one (21) sites showed galvanized steel reinforcement. There was no reinforcement information for the rest of the thirty-five (35) sites.

## 5.4 Visual Rating after Inspection

Based on preliminary visual inspections, there were visible damage, deterioration, or deformation on nine (9) MSE wall abutment sites; vegetation protruding from face on nineteen (19) MSE wall abutment sites. Majority of the MSE wall abutments (45/56) were rated as “Excellent” condition; the rest of Abutments were rated as “Good” condition; none were rated as “Fair” or “Poor” condition.

All the inspection/rating results and pictures taken from the inspections were inputted in the MSE Wall Abutment Inspection/Rating In KY web Application. The data are available for both registered and non-registered users.

## **6. DESIGN GUIDANCE, CONSTRUCTION AND MAINTENANCE INSPECTOR'S HANDBOOK**

### **6.1 Design Guidance**

The design guidance was prepared to assist Kentucky design engineers, specification writers, and estimators with the selection and design of Mechanically Stabilized Earth (MSE) Wall Abutments. Its principal function is to serve as a reference source to the materials presented. It serves as a primary technical guideline on the use of these technologies on transportation facilities.

The majority of the information in the design guidance was reproduced from Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Design and Construction Guidelines, Publication Number Vol. I - FHWA-NHI-10-024, and Vol. II - FHWA-NHI-10-025 2009, LRFD Bridge Design Specifications. 4th Edition, with 2008 and 2009 Interims published by American Association of State Highway and Transportation Officials, Washington, D.C. 2007, and Earth Retaining Structures, FHWA-NHI-07-071 by Tanyu, B.F., Sabatini, P.J. and Berg, R.R., U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., 2008. The guidance is a separated document which will not be included in this report.

### **6.2 Construction and Maintenance Inspector's Handbook**

The construction and maintenance inspector's handbook is primarily intended for use by inspectors who are charged with overseeing the construction of mechanically stabilized earth (MSE) walls. The material presented in this handbook is not intended to address design issues, but to highlight sound construction methods that will enable the MSE wall to function successfully. The handbook is also provided for post-construction inspection.

The majority of information in the construction and maintenance inspector's handbook was taken from Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Design and Construction Guidelines, Publication Number Vol. I - FHWA-NHI-10-024, and Vol. II - FHWA-NHI-10-025 2009, Mechanically Stabilized Earth Wall Inspector's Handbook published by Florida Department of Transportation, Geotechnical Engineer Paul D. Passe, P.E., CPM, 2000, and was reproduced from Inspection Guidelines for Construction and Post-Construction of Mechanically Stabilized Earth Wall by David P. Vankavelarr, Delaware Department of Transportation, Dov Leshchinsky, Department of Civil and Environmental Engineering, College of Engineering, University of Delaware, November 2002. The handbook is distributed separately and is not shown in this report.

## 7. CONCLUSIONS AND RECOMMENDATIONS

Due to the advantages of more rapid construction and lower cost of MSE wall abutments as compared to conventional concrete abutments, 80% of states/provinces (33/41), who participated in a nationwide MSE wall status survey, used MSE walls as abutments in their highway construction. The majority of states/provinces (30/33) used galvanized steel as reinforcement in the MSE wall as an abutment. An interesting survey result is that fourteen (14) states/provinces used geogrid and five (5) states/provinces used geotextile as reinforcement in the MSE wall abutment construction. A more interesting survey result is that one state is implementing GRS-IBS system. Most of the states/provinces (26/33) used aggregate as backfill materials for MSE wall abutment. Majority of states/provinces (27/33) limited the maximum height for the MSE wall abutment equal to or less than 40 feet; only one (1) state allowed the maximum height of 50 feet. All the states/provinces (33/33), who used MSE wall as an abutment, allowed MSE wall footing to be built on soil. Only seven (7) states/provinces allowed bridge beams/girders bearing on MSE wall itself directly. There were MSE wall abutment failures in 36% (12/33) states/provinces. Failure reaches 10 times in one (1) state. Seven (7) states/provinces had failure type "Settlement/washout of backfill material". Three (3) states/provinces had a formalized maintenance rating system for MSE wall abutments. Twenty-four (24), which is 73% out of 33, states/provinces had guidelines for building MSE wall abutments. Only two (2) states/provinces had maintenance inspector's handbook for MSE wall abutments.

To aid in the rating process for maintenance, a preliminary web application for the MSE Wall Abutment Inspection/Rating In KY has been developed. In efforts to assist the users of the MSE Wall Abutment Inspection/Rating In KY web application, many handy features in web application are highlighted, and various graphical user interfaces of the web application were illustrated and described. This web application is ready for inspectors to explore when they inspect and rate the MSE wall abutments in Kentucky.

Fifty-six (56) MSE wall abutment sites in Kentucky were inspected and rated. Most of the heights for MSE wall abutments (52/56) were less than 30 ft.; only four (4) MSE wall abutments had heights larger than 30 ft.; the maximum height of MSE wall was 37 feet. Based on preliminary visual inspection, there were visible damage, deterioration, or deformation on nine (9) MSE wall abutment sites; vegetation protruding from face on nineteen (19) MSE wall abutment sites. Majority of MSE wall abutments (45/56) were rated as "Excellent" condition; rest of the abutments were rated as "Good" condition; none were rated as "Fair" or "Poor" condition. All the inspection/rating results and pictures taken from the inspections were inputted in the MSE Wall Abutment Inspection/Rating In KY web application. All data are available for both registered and non-registered users. More MSE wall abutments are expected to be inspected and rated, while MSE Wall Abutment Inspection/Rating In KY web application will be used to manage and share the data statewide.

The design guidance and construction & maintenance inspector's handbook were developed mainly based on Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Design and Construction Guidelines, Publication Number Vol. I - FHWA-NHI-10-024, and Vol. II - FHWA-NHI-10-025 2009, LRFD Bridge Design Specifications. 4th Edition, with 2008 and 2009 Interims published by American Association of State Highway and Transportation Officials (AASHTO), Washington, D.C. 2007. It is expected to assist Kentucky design engineers, specification writers, and estimators with the selection and design of Mechanically Stabilized Earth (MSE) wall abutments by using the guidance and handbook compiled from this study.

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