

# **INDOT PAVEMENT SUBSURFACE CONDITION EVALUATION SOFTWARE MANUAL**

Version 1.0

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## **DISCLAIMER**

The contents of this manual do not necessarily reflect the official views or policies of the Indiana Department of Transportation (INDOT). The details in this manual are intended for reference only, not as specifications or design guidance. In the event that any information presented herein conflicts with the Indiana Design Manual, INDOT Standard Specifications or other INDOT policy, said policy will take precedence.

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## **1 INTRODUCTION**

The evaluation software “INDOT Pavement Subsurface Condition Evaluation (iSub)” was developed as part of the JTRP/SPR-3507: Project Evaluation Methods for Pavement Preservation Treatment to aid the pavement subsurface condition evaluation. The software is entirely based on the “Guidelines of subsurface condition evaluation for pavement preservation.” Thus, iSub provides user-friendly system which helps to follow the hierarchy of evaluation steps. Furthermore, iSub automatically calculates the overall condition of the pavement subsurface as severity rating for each laboratory test result was implemented into the software.

## 2 INSTALLATION GUIDE

### 2.1 BEFORE INSTALLING

iSub was developed using ADOBE Flex technology and requires ADOBE AIR 3.5 to run the application. You can download ADOBE AIR 3.5 or newer version from <http://get.adobe.com/air/>.

In addition, you need to check that your computer has the following minimum requirements to run iSub:

#### Windows

- 2.33GHz or faster x86-compatible processor or Intel® Atom™ 1.6GHz or faster processor for netbooks
- Microsoft® Windows® XP Home, Professional, or Tablet PC Edition with Service Pack 3; Windows Server® 2003; Windows Server® 2008; Windows Vista® Home Premium, Business, Ultimate, or Enterprise (including 64-bit editions) with Service Pack 2; or Windows 7
- 512MB of RAM (1GB recommended)

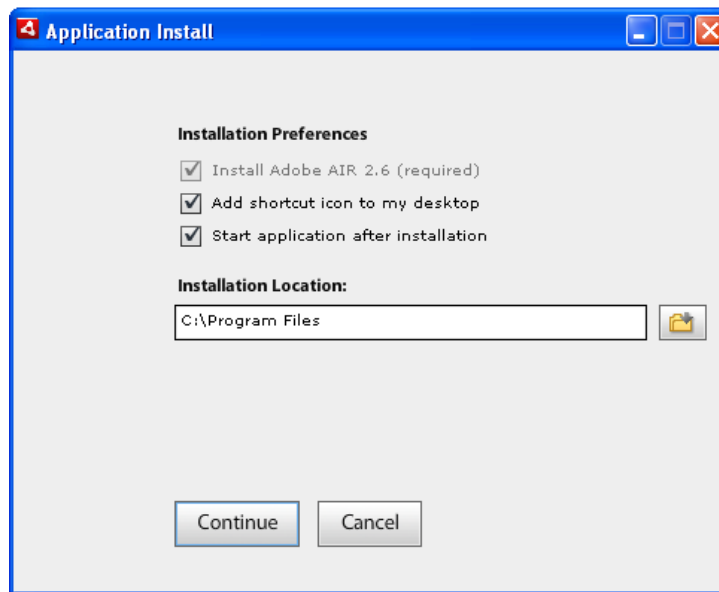
#### Mac OS

- Intel® Core™ Duo 1.83GHz or faster processor
- Mac OS X v10.6, v10.7, or v10.8
- 512MB of RAM (1GB recommended)

## 2.2 INSTALLING ISUB

To install iSub, follow these steps:

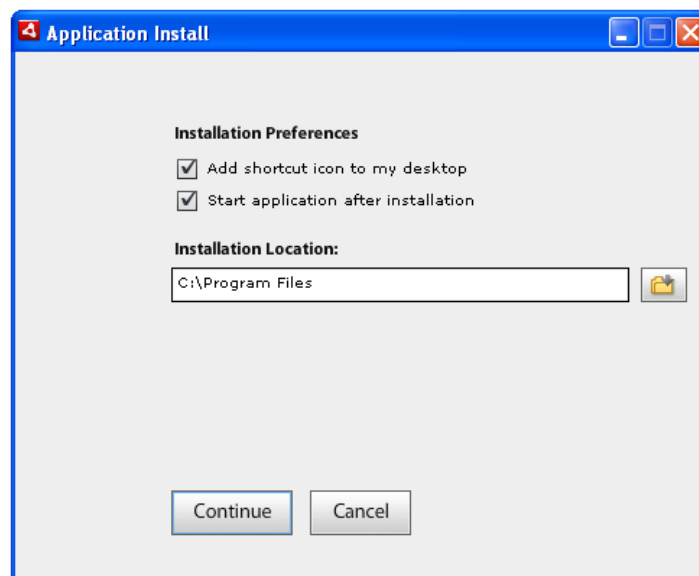
1. Before you can install iSub, you will need to download ADOBE AIR 3.5 or newer version and install it. If you have already done this, you can skip this step.
2. Download iSub installer from from <https://engineering.purdue.edu/people/hyung.j.ahn.1>. The iSub installer icon should appear on your desktop.
3. Run iSub Installer by double-clicking on the iSub\_Install icon on your desktop. An application install status window should appear followed by an application install window. Click the **Continue** button to continue.



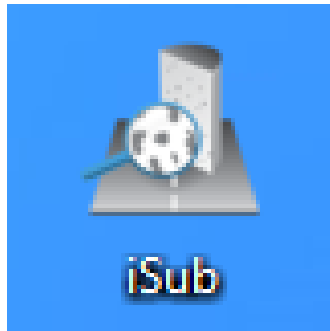
4. You will be asked whether ADOBE AIR to be installed or not if you have not already installed ADOBE AIR in your computer. Click the **I Agree** button to continue.



5. You will then have to specify the installation location and click the **Continue** button.



6. You have finished installing iSub and an icon shown below should now appear on your Windows desktop.



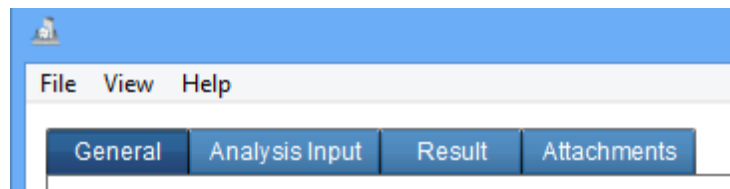


## 3 OVERVIEW

iSub consists of five tabs, namely **General**, **Analysis Input**, **Result** and **Attachments**.

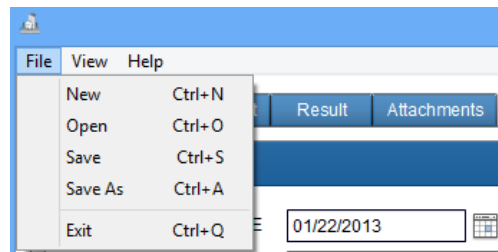
### 3.1 APPLICATION MENU

Application menus are located in the upper left corner of the window and consist of **File**, **View** and **Help**.



#### 3.1.1 FILE

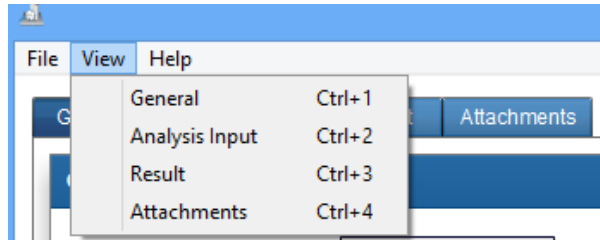
The figure below illustrates the **File** menu.



- **New:** Opens a new sheet. (Keyboard shortcut CTRL + N).
- **Open:** Opens the selected file (Keyboard shortcut CTRL + O).
- **Save:** Saves the current work or any changes to a folder on your hard disk. The name of the file is automatically generated as Date\_Time.indot and the default file save location is set to your computer's desktop. (Keyboard shortcut CTRL + S).
- **Save As:** Saves the current work or any changes to a folder on your hard disk. Although the name of the file is automatically generated as Date\_Time.indot, the save as dialog appears. (Keyboard shortcut CTRL + A).
- **Exit:** Closes the entire program. If there are multiple sheets, it closes them all at the same time (Keyboard shortcut CTRL + Q).

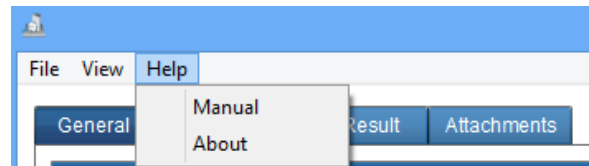
### 3.1.2 VIEW

The figure below illustrates the **View** menu. This allows a user to switch between different tabs and displays the keyboard shortcuts designated for each tab.



### 3.1.3 HELP

The figure below illustrates the **Help** menu. This provides the manual and software version information.



## 3.2 TAB

### 3.2.1 GENERAL

The **General** tab is the default screen when the software is launched. This allows a user to input general information regarding the test site location along with analysis level to be applied.

The screenshot shows the 'General' tab of the software interface. The window title is 'Indiana Seal Coat Design Software' and the menu bar includes 'File', 'View', and 'Help'. The 'General' tab is selected, with other tabs being 'Analysis Input', 'Result', and 'Attachments'. The 'General' section contains the following fields:

- EVALUATION DATE: 01/22/2013 (with a calendar icon)
- ENGINEER: [Empty text box]
- DISTRICT: [Dropdown menu]
- SUBDISTRICT: [Dropdown menu]
- ROAD NAME: [Empty text box]
- FROM LOCATION: [Empty text box] R. P. [Empty text box] + [Empty text box]
- TO LOCATION: [Empty text box] R. P. [Empty text box] + [Empty text box]
- LANE DIRECTION: [Dropdown menu]
- LANE LOCATION: [Dropdown menu]

The 'Analysis' section contains:

- ANALYSIS LEVEL: [Dropdown menu]
- TOTAL COVERAGE: 0 (with up/down arrows)

The 'Comment' section is a large empty text area. On the right side of the window, there is a circular logo for the Indiana Department of Transportation (INDOT) with the text 'INDOT' and 'DEPARTMENT OF TRANSPORTATION' around the perimeter.

### 3.2.2 ANALYSIS INPUT

The **Analysis Input** tab presents a user to input values required to calculate the subsurface condition, including Layer Depth, Layer Thickness, R. P., Tensile Strength, Water Stripping Severity, Bulk Specific Gravity (Gmb), Maximum Specific Gravity (Gmm), and Air Voids. The procedures for each test available from “GUIDELINES OF SUBSURFACE CONDITION EVALUATION FOR PAVEMENT PRESERVATION TREATMENTS.”

The screenshot shows the 'Analysis Input' tab of the software. It features two sections for 'Layer 1' and 'Layer 2'. Each section includes input fields for 'Mid-Layer Depth' and 'Thickness', both currently set to 0 inches. Below each layer section is a table for data entry. The tables for Layer 1 and Layer 2 are identical in structure, with columns for Name, R. P., Tensile Strength, Water Stripping, Gmb, Gmm, and Air Voids, and rows for Replicate 1, Replicate 2, and Replicate 3.

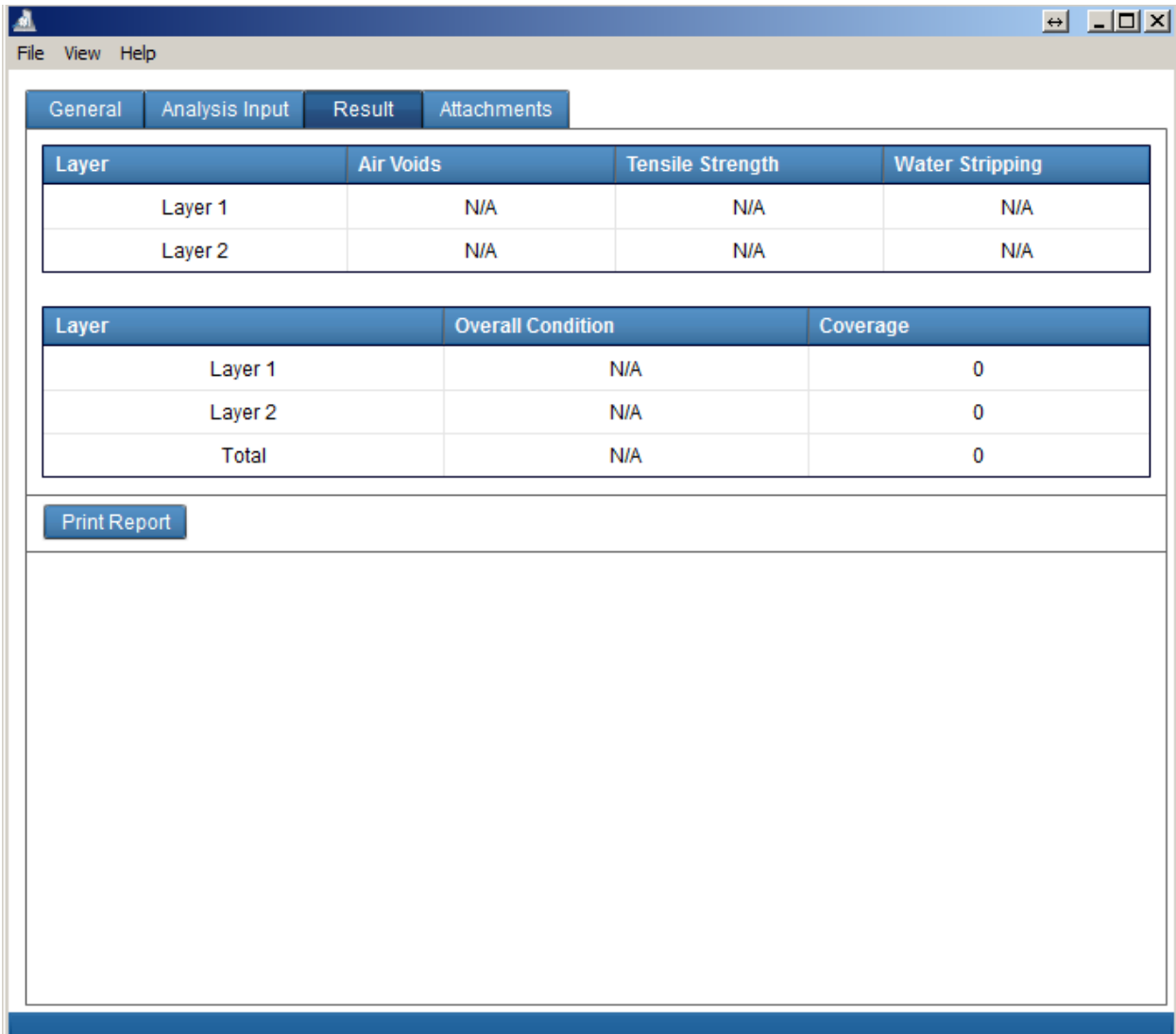
Layer 1						
Mid-Layer Depth	0	in.	Thickness	0	in.	
Name	R. P.	Tensile Strength	Water Stripping	Gmb	Gmm	Air Voids
Replicate 1						
Replicate 2						
Replicate 3						

Layer 2						
Mid-Layer Depth	0	in.	Thickness	0	in.	
Name	R. P.	Tensile Strength	Water Stripping	Gmb	Gmm	Air Voids
Replicate 1						
Replicate 2						
Replicate 3						

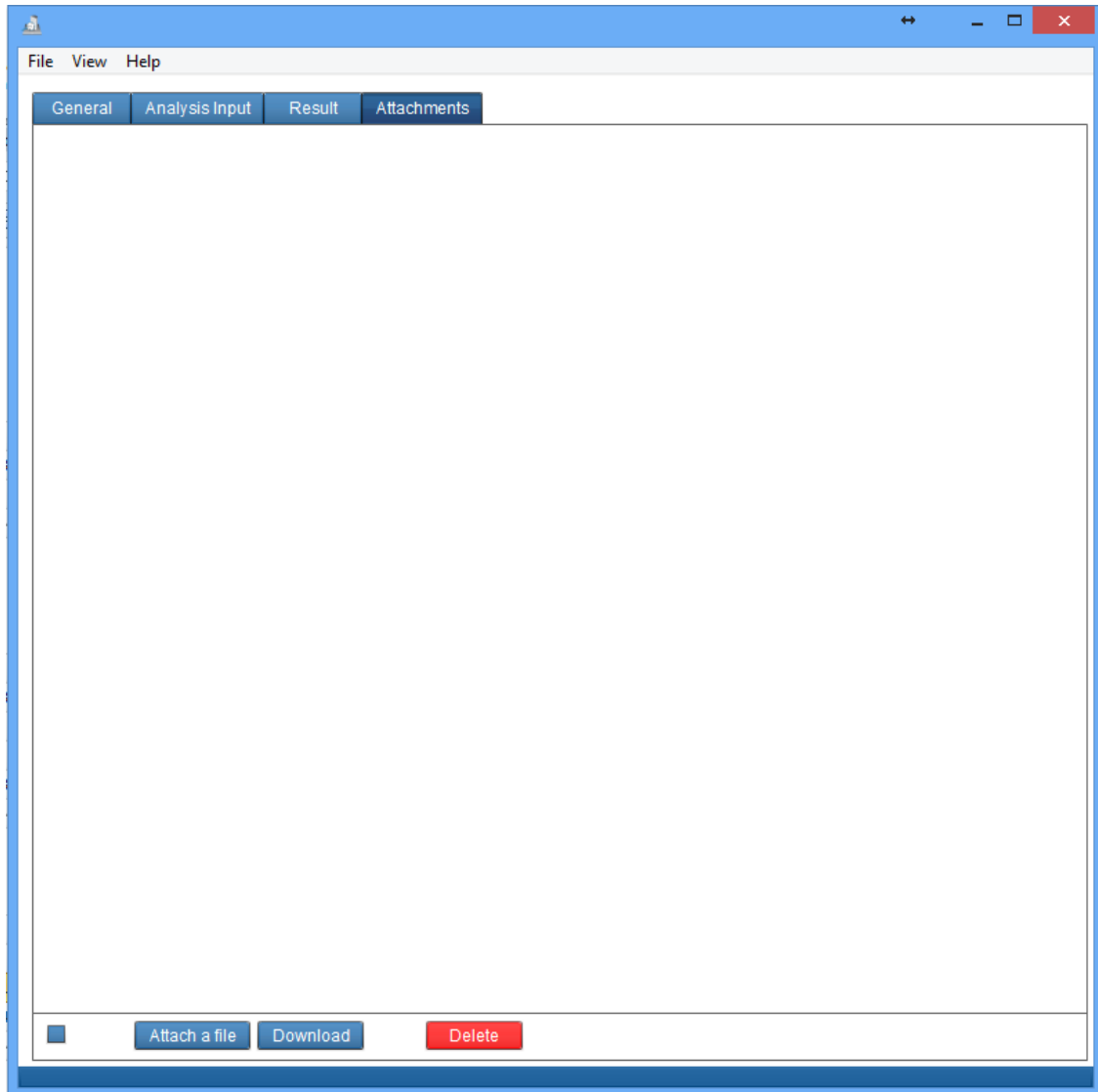
### 3.2.3 RESULT

The **RESULT** tab presents analysis results as a summary and instantly updates as any changes occurs in selected values. Overall condition is automatically calculated and displayed once the required data are defined in the software and update once any change in the value in the **Analysis Input** tab detected. The **RESULT** tab also features a **Print Report** option button in the left lower corner of the window, which allows a user to print detailed report. A detailed report shows every value input by a user and analysis result in PDF format. The figures below illustrate **RESULT** tab.



### 3.2.4 ATTACHMENTS

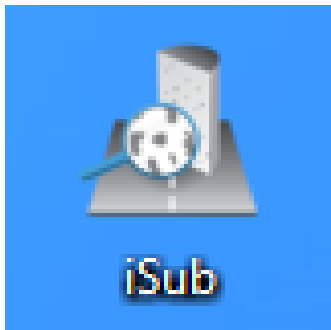
The **Attachments** tab displays a list of attached files. This feature essentially works the same way as attaching a file to an email. Furthermore, it provides a drag and drop function, which allows a user to simply drag any file to a software window and automatically the file in that location. This feature also provides options to manage multiple files at once by selecting the check box located in the lower left corner of the window.



## 4 GETTING STARTED

### 4.1 LAUNCHING iSub

Run iSub by double-clicking on the iSub icon on your desktop or



in your Windows **Start** menu.

## 4.2 DESIGN EXAMPLE

The following example illustrates how to evaluate subsurface condition using iSub step by step. Procedures presented in this example are designed to help the first-time user to become more familiar with iSub, but hereafter a user may enter and edit values for each required input in any order.

### 4.2.1 STEP 1

Enter evaluation date along with engineer name.

The screenshot shows the iSub software interface with the following details:

- General Section:**
  - EVALUATION DATE:** 01/22/2013 (highlighted with a red dashed box)
  - ENGINEER:** Jusang Lee (highlighted with a red dashed box)
  - DISTRICT:** [Dropdown menu]
  - SUBDISTRICT:** [Dropdown menu]
  - ROAD NAME:** [Text input field]
  - FROM LOCATION:** [Text input field] R. P. [Text input field] + [Text input field]
  - TO LOCATION:** [Text input field] R. P. [Text input field] + [Text input field]
  - LANE DIRECTION:** [Dropdown menu]
  - LANE LOCATION:** [Dropdown menu]
- Analysis Section:**
  - ANALYSIS LEVEL:** Level 2 (Surface Distress B...)
  - NUMBER OF LAYERS:** 2
  - TYPES OF DISTRESS:**
    - Fatigue Crack: 0
    - Pumping: 0
    - Potholes: 0
    - Patch: 0
  - TOTAL COVERAGE:** 0
- Comment Section:** [Text input field]

The software window includes a menu bar (File, View, Help) and a navigation bar (General, Analysis Input, Result, Attachments). A logo for the Indiana Department of Transportation is visible on the right side of the interface.



### 4.2.2 STEP 2

Enter location information. For district selection, the user can choose from one of six districts of Indiana. Once a district is selected, a list of subdistricts corresponding to the selected district becomes available. Beginning and end point of test section can be represented either road name or R. P. In case of 2-way road, driving lane can be selected for lane location.

The screenshot displays the 'General' tab of the software interface. The 'General' section includes the following fields:

- EVALUATION DATE: 01/22/2013
- ENGINEER: Jusang Lee
- DISTRICT: Vincennes
- SUBDISTRICT: Tell City
- ROAD NAME: SR-70
- FROM LOCATION: R. P. 3 + 00
- TO LOCATION: R. P. 5 + 00
- LANE DIRECTION: East
- LANE LOCATION: Driving Lane

The 'Analysis' section includes the following fields:

- ANALYSIS LEVEL: Level 2 (Surface Distress B...)
- NUMBER OF LAYERS: 2
- TYPES OF DISTRESS:
  - Fatigue Crack:  0
  - Pumping:  0
  - Potholes:  0
  - Patch:  0
- TOTAL COVERAGE: 0

A red dashed box highlights the DISTRICT, SUBDISTRICT, ROAD NAME, FROM LOCATION, TO LOCATION, LANE DIRECTION, and LANE LOCATION fields. On the right side of the interface, the Indiana Department of Transportation logo is visible, featuring a map of Indiana with icons for an airplane, a train, a car, and a truck.

### 4.2.3 STEP 3

Enter analysis information and additional comments in the blank space provided.

There are three analysis levels, such as Level 1, Level 2, and Level 3. For the selection of proper analysis level, refer to Guideline. Total coverage is the combined coverage of all layers considering the overlapped locations. The overlapped locations are a certain sections which were determined to be problematic in more than one layer or covered with more than one type surface distress. Consequently, overlapped locations should only be counted once in the calculation of total coverage.

The screenshot displays the 'Analysis Input' tab of the software. The 'General' section includes the following fields:

- EVALUATION DATE: 01/22/2013
- ENGINEER: Jusang Lee
- DISTRICT: Vincennes
- SUBDISTRICT: Tell City
- ROAD NAME: SR-70
- FROM LOCATION: R. P. 3 + 00
- TO LOCATION: R. P. 5 + 00
- LANE DIRECTION: East
- LANE LOCATION: Driving Lane

The 'Analysis' section, highlighted with a red dashed border, includes:

- ANALYSIS LEVEL: Level 2 (Surface Distress B...)
- NUMBER OF LAYERS: 2
- TYPES OF DISTRESS:
  - Fatigue Crack: 0
  - Pumping: 0
  - Potholes: 0
  - Patch: 0
- TOTAL COVERAGE: 0

The 'Comment' section is currently empty.

#### 4.2.4 STEP 4

The tables in **Analysis Input** tab are generated based on the information given in analysis level in **General** tab. Enter laboratory test results for each replicate and layer. A user can input air voids by directly typing values in the box or iSub automatically calculated once Gmb and Gmm values are given.

The screenshot shows the 'Analysis Input' tab of the software. It contains two sections for data entry:

**Layer 1**

Mid-Layer Depth: 1 in. Thickness: 2 in.

Name	R. P.	Tensile Strength	Water Stripping	Gmb	Gmm	Air Voids
Replicate 1	2.5	120 psi	20 %			15 %
Replicate 2						
Replicate 3						

**Layer 2**

Mid-Layer Depth: 0 in. Thickness: 0 in.

Name	R. P.	Tensile Strength	Water Stripping	Gmb	Gmm	Air Voids
Replicate 1						
Replicate 2						
Replicate 3						

### 4.2.5 STEP 5

Review the results. iSub determines condition of each layer based on the analysis input and overall condition along with coverage once the necessary input values are presented.

The screenshot shows the 'Result' tab of the iSub software. It contains two data tables and a 'Print Report' button.

Layer	Air Voids	Tensile Strength	Water Stripping
Layer 1	Poor (15)	Good (120)	Poor (20)
Layer 2	N/A	N/A	N/A

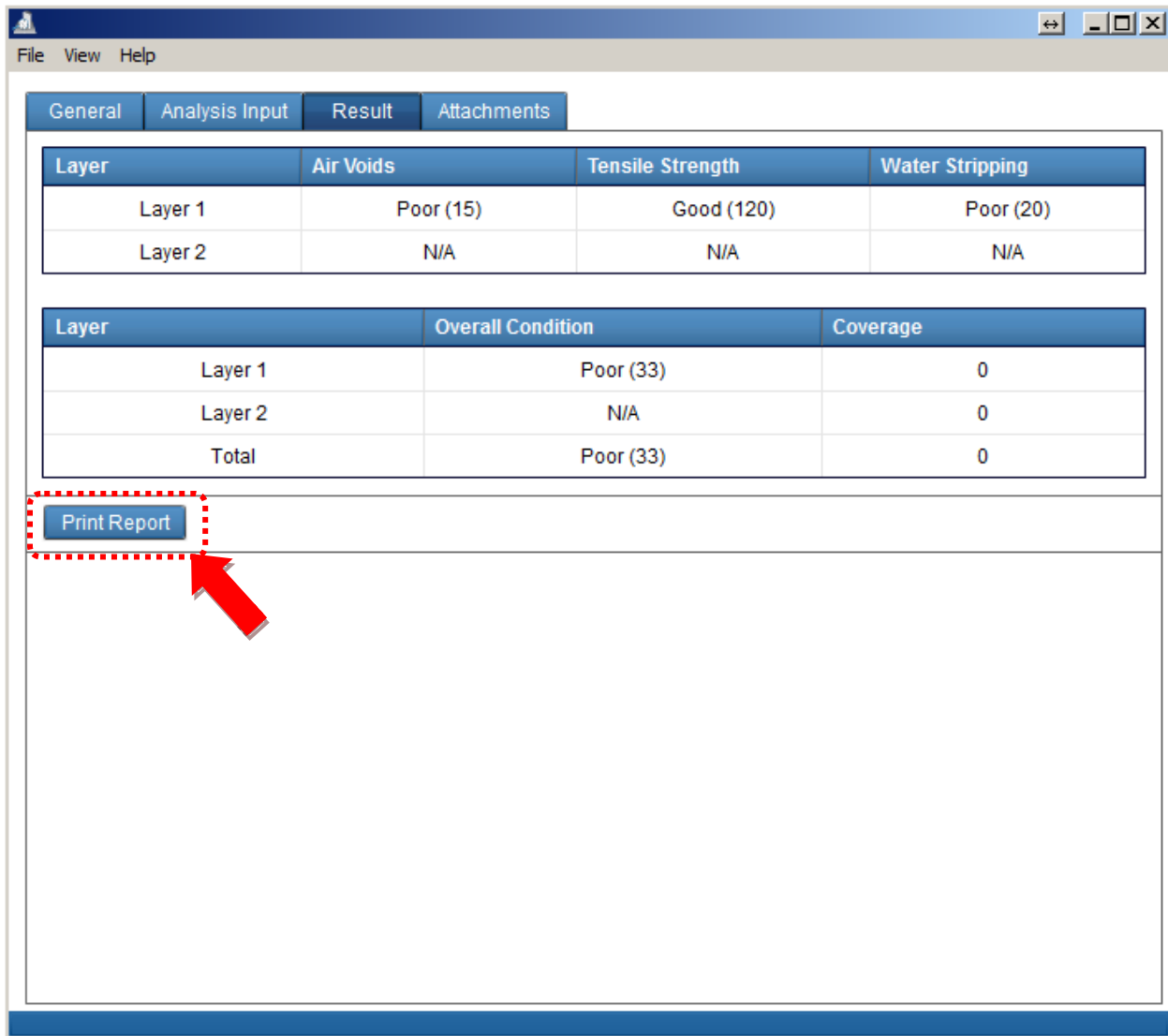
  

Layer	Overall Condition	Coverage
Layer 1	Poor (33)	0
Layer 2	N/A	0
Total	Poor (33)	0

Print Report

### 4.2.6 STEP 6

If you would like to print a detailed report that contains general information as well as analysis input, click the **Print Report** button located at the bottom of the window. iSub will generate a report in PDF format.

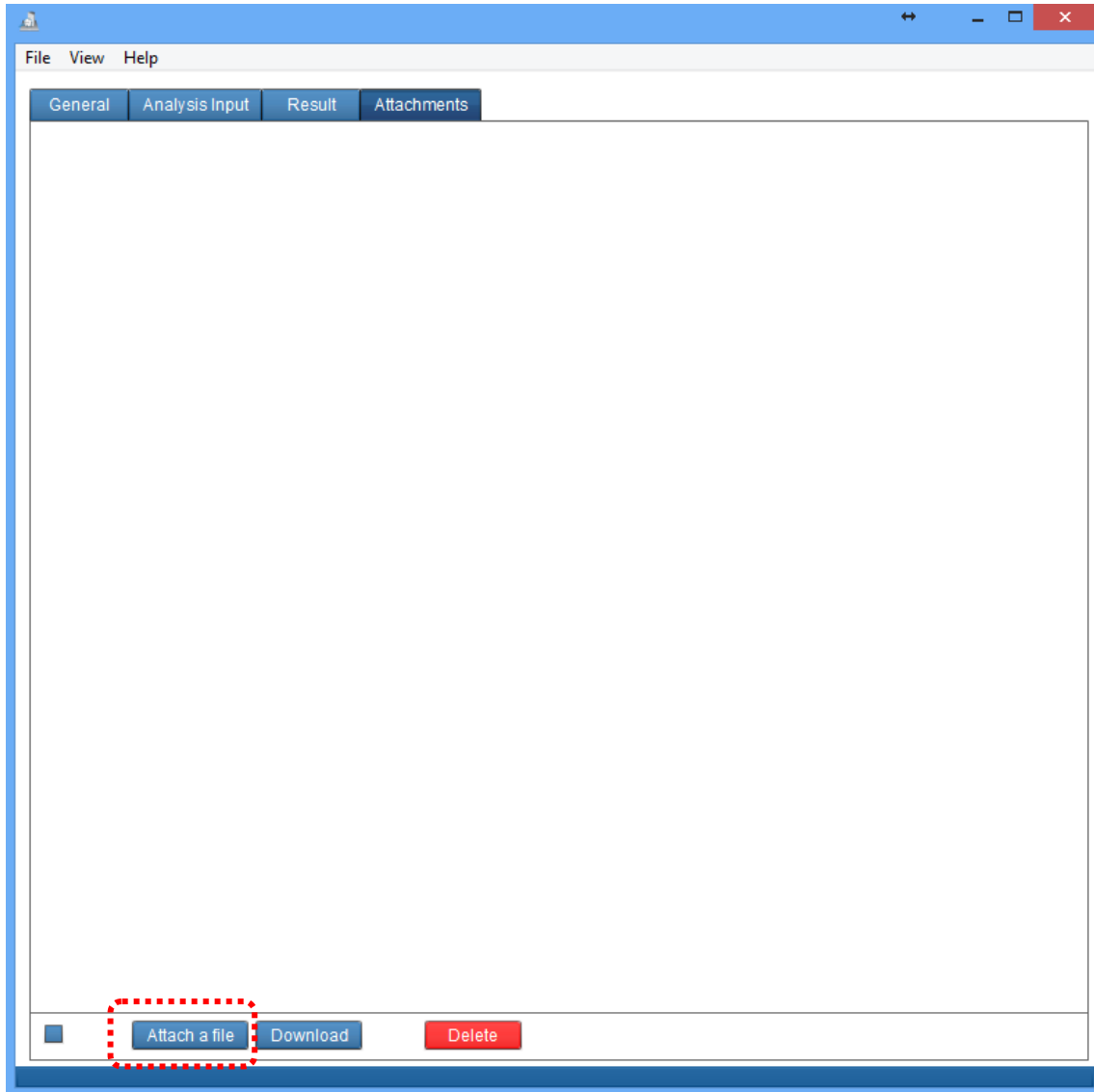


#### 4.2.7 STEP 7

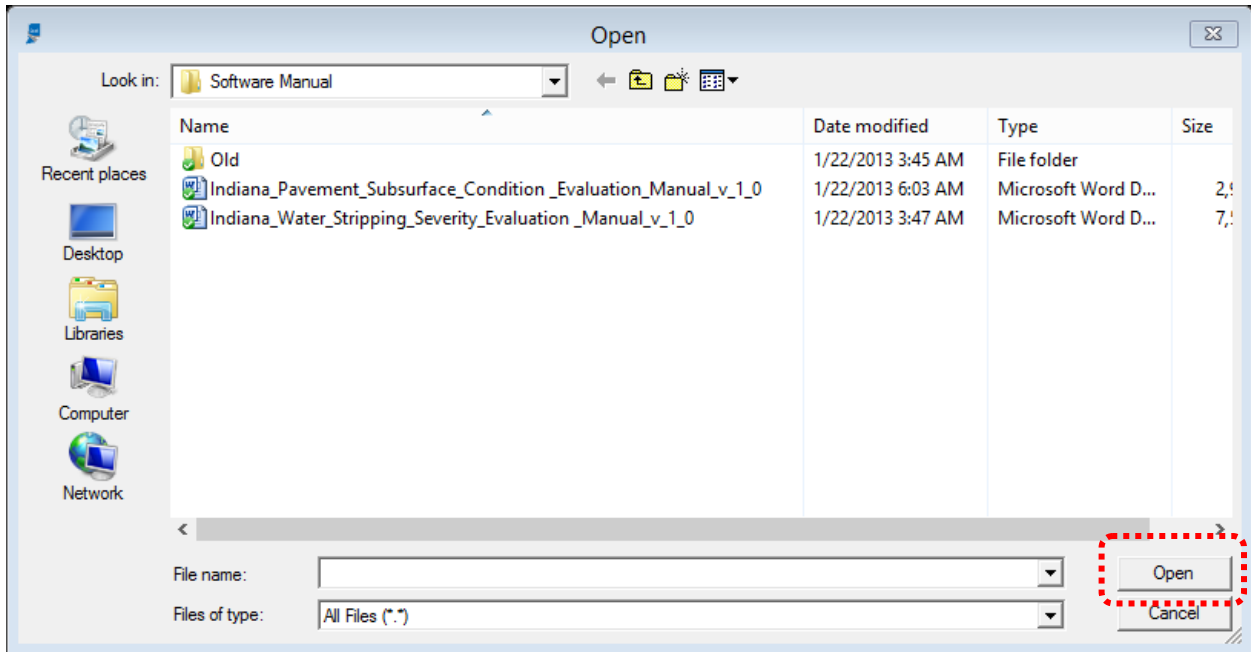
The user can attach any type of file with no size limit. The figure below illustrates how to add or delete attached files.

To add files, follow these steps:

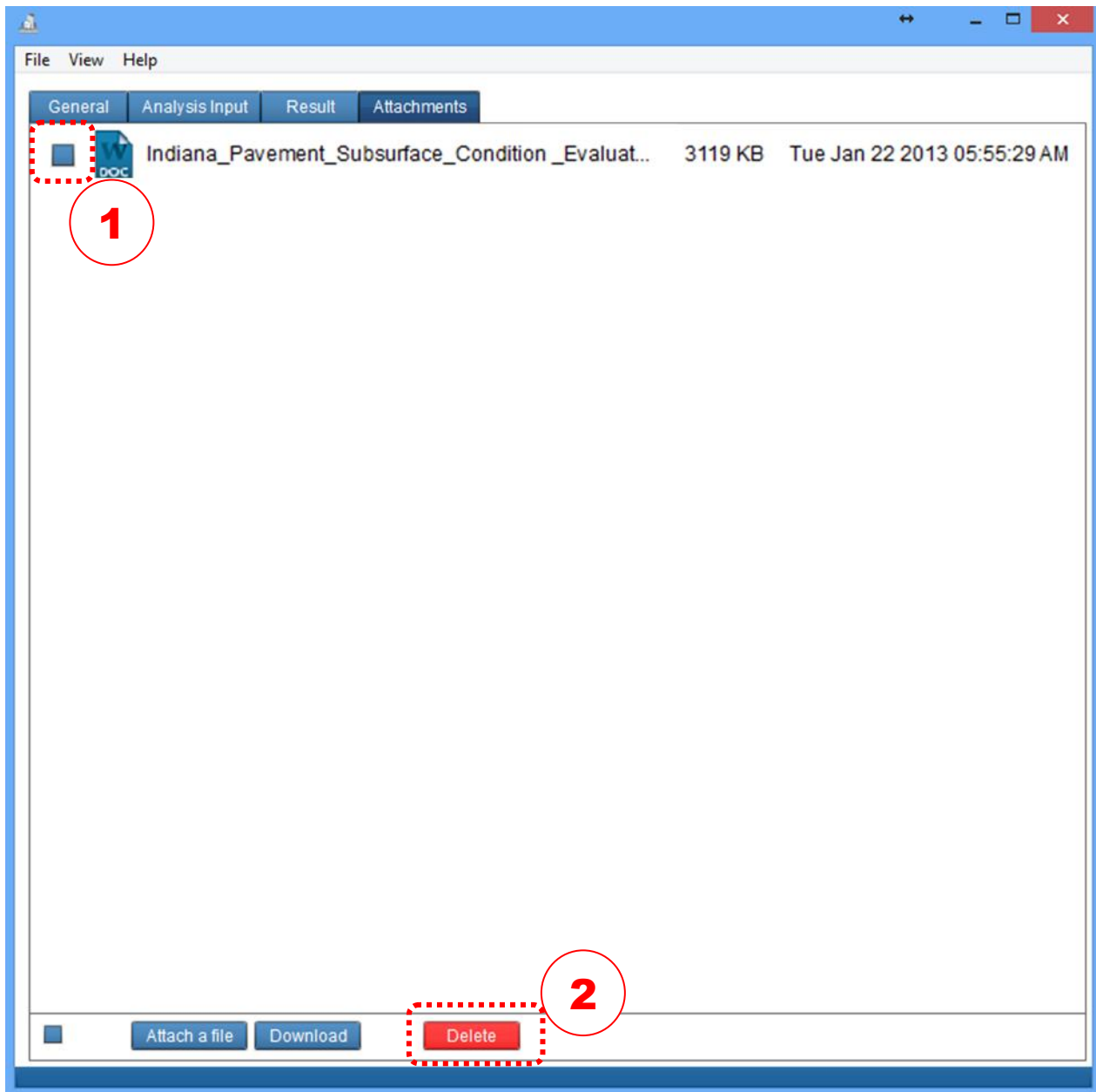
1. Click the **Attach a File** button.



2. Select a file and then click **Open**.



To delete files, select files by clicking the box, then click the **Delete** button



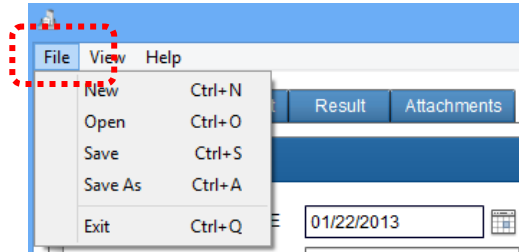


#### 4.2.8 STEP 8

The last step is to save your work. You can save your work at any time by typing the keyboard shortcut CTRL + S.

To save your work, follow these steps:

1. Click the **File** button.



2. Click either the **Save** or the **Save As**.

