Intelligent Transportation Systems Construction Engineering and Inspection Training, for Road Weather Information System

Module 3 Installation

Welcome

Welcome to the Intelligent Transportation Systems Construction Engineering and Inspection Training, for Road Weather Information System, Module 3 Installation. This training contains audio, so please adjust your speakers accordingly. This CBT contains interactive elements. An alternate version is available on the resources page. The Knowledge Check questions allow you two chances to try and answer the question correctly. To begin, select the start button or press Shift + N on your keyboard.

Physical Inspection

The RWIS is typically located outside the clear zone of the roadway. The clear zone is calculated by the designer using principles set forth in the American Association of State Highway and Transportation Officials Roadside Design Guide. If the clear zone requirement cannot be met, then a protective barrier must be installed. If a protective barrier such as a guard rail is installed, you are to ensure that the equipment is outside the deflection zone.

RWIS Installation Site

RWIS is typically installed at high points in the area or places that are prone to imminent weather.

The unit shown in this picture is located at the apex of the Sunshine Skyway Bridge. The anemometer will measure high wind speeds, and the Regional Transportation Management Center (RTMC) operator can convey the warning to high profile trucks. The bridge wind sensors are also used to aid the Florida Highway Patrol in knowing when to close the bridge for safety reasons.

The unit shown below is located just north of the Caloosahatchee River. The area is known for frequent foggy conditions. Visibility sensors detect heavy fog patterns, and the RTMC operator can post hazardous weather warnings on Dynamic Message Signs in the area.

Tower Installation

The CEI should verify that the installed tower’s orientation is per the project plans. Since the towers are typically made of aluminum, heavy equipment is not required during installation. In the example shown, the RWIS tower folds down to provide easy access to the top without using a ladder or bucket truck. Once the device at the top of the antenna has been installed, the tower is cranked back up to its vertical position. Usually, the wind sensor would be mounted at the top of the tower.

Ensure the tower does not impinge on any overhead utilities or that it does not fold down over the roadway. Also, make sure that when the tower is lowered, the fence that will be surrounding the site does not interfere with the devices on the tower.

Installation – Physical Construction

This picture shows an RWIS located in North Fort Myers. Occasionally, the perimeter of the RWIS is enclosed with a chain link fence for security purposes. Coordinate with the Department representative on the type of padlocks used to secure the gate. The fence typically follows the FDOT Standard Plans Index for Fence Type B.

In addition, the area surrounding the RWIS tower is typically prepared in order to enhance the maintenance of the units. For example, a concrete maintenance pad must be installed near the base of a ground mount cabinet. The pad is similar to the concrete apron shown in the FDOT Pull and Splice Box Index. A typical concrete pad measures three inches thick and is made from non-structural Class NS concrete with a compressive strength of 2,500 pounds per square inch.

In the other areas, such as the North Fort Myers location where a pole mount cabinet is installed, gravel is used in place of the concrete pad.

The North Fort Myers location also utilizes an aluminum tower as the structure to which the sensors are mounted; therefore, proper grounding efforts were implemented. Reference the FDOT Standard Specification Section 620 for grounding and lightning protection.

Service Slab Installation

The FDOT Developmental Specification 688 (Dev688) requires that a concrete service slab is installed for ground mounted cabinets. The diagram shown on the left is from the FDOT Standard Plans Index 676-010 for Cabinet Installation Details.

Although Dev688 does not address service slabs for pole mounted cabinets, typically, the Contract will require that they be installed. This is shown on the diagram on the right.

Concrete Pole Installation

Sometimes, a concrete pole is used instead of an aluminum tower. The RWIS located on I-10 at Mile Marker 160 in District 3 uses a concrete pole. A bucket truck will be needed to access the wind sensor at the top of the pole.

The CEI should verify the pole position, the mounting arrangement of each sensor, and the cabinet orientation, per Contract plans and FDOT specifications.

Pole Cabinet Installation

In this picture, the cabinet is placed into position by a crane. One of the most common installation errors is the height at which the cabinet is mounted. Before the cabinet is strapped to the pole, ensure that the far side of the cabinet is exactly three feet from the ground, not more or less.

This concept is illustrated in FDOT Standard Plans Index 641-020 for a Concrete Pole Mounted CCTV Cabinet. In areas where there is a cross slope, ensure that the far side of the cabinet is three feet from ground level.

Once the cabinet has been properly positioned, it is secured onto the pole using stainless steel bands.

Sensor Installation

The wind sensor is installed at the highest point on the structure. The sensors themselves shall be free from obstructions. The example shown is the Lufft WS600-UMB, which not only measures wind direction and speed, but also precipitation, air temperature, humidity, and air pressure.

The unit should be located away from windbreaks such as sound walls and bridges. These obstacles will disrupt the general speed and direction of the airflow. As a result, the sensors will collect inaccurate airflow data.

Ensure that all cables are installed internal to the pole or inside the externally mounted conduit.

As the magnetic North Pole indicated by the compass differs from the Geographic North Pole, declination (variation) at the site location must be taken into account when aligning the sensor. The magnetic declination is the difference in degrees between the true North and magnetic North. The National Oceanic and Atmospheric Administration has a website calculator, where the magnetic declination can be determined from the latitude and longitude coordinates of the site. A link to this can be found on the resources page.

For example, an RWIS installed in Tallahassee would have a declination of 4 degrees, 47 minutes, on February 18, 2018. The declination value changes over time, thus, is not a static value. A configuration option would allow this to be automatically updated.

When mounting the wind sensor, use a compass. Align the directional arrow on the sensor with the North direction indicated on the compass. Declination will be adjusted in the vendor's software during configuration.

Some manufacturers provide a bird kit. The kit consists of a metallic band with spikes pointing upward. The kit is installed on top of the sonic anemometer's transmitter. The shape and location of the spikes has been designed so that the interference with wind and rain measurement is minimal. The spikes do not hurt the birds; they are simply a barrier that makes it difficult for birds to land on top of the sensor. The bird spike kit does not provide complete protection against birds, but it does deter birds from roosting and building nests.

This picture shows a visibility sensor mounted at the mid-height of the pole. A suggested guideline for mounting the visibility sensor is that the height should be a minimum of five feet from the ground.

Here are other things to look out for when installing the visibility sensor:

The visibility sensor uses the forward scatter method to measure visibility. It measures the intensity of the light scattered by the dust particles illuminated by an incident beam of infrared light. When the air is clear, very little light is scattered since there are few particles in the sample volume resulting in a small signal received by the sensor. As the number of particles in the sample volume increases, the amount of light detected by the receiver also increases.

When mounting the visibility sensor, avoid locations where the transmitter is pointing at a light scattering or reflecting surface since this will contaminate the sample of air that is being measured. Examples of contamination include heavy exhaust from vehicles, water spray caused by moisture on the road, exhaust from a generator.

If possible, the receiver should point north for all RWIS sites in Florida.

The unit should be located away from possible physical obstructions that could affect the fall of precipitation.

The unit should also be positioned away from sources of heat, electrical interference, and in such a position as to not have direct light on the sensor lenses.

Ensure that all cables and conductors are installed inside the pole or within an externally mounted conduit.

Installation – Surge Mitigation

Lightning protection, grounding, and surge protection are key to long-term, trouble-free performance of the ITS field devices. This is a critical step. Small surges from a nearby lightning strike could be enough to cause damage to the RWIS sensors.

Air terminals, if required, should be anchored (mechanically connected) with screws and not straps. Class II rated air terminals must be installed. Based on the FDOT Standard Plans Index 641-020, the half inch ETP Alloy 110 Copper Air Terminal must extend a minimum of 24 inches above the top of the pole. Electrolytic Tough Pitch Copper, also referenced as Copper Alloy 110 is the most common copper item on the market. It has the highest electrical conductivity of any metal except silver.

Grounding electrodes should be tested per FDOT Standard Specification. Exothermic welds should be inspected for proper bonding.

The CEI personnel should also be very familiar with the NESC, the NEC and UL 96A regarding these items. The CEI is responsible for bringing any potential problems in the design or construction to the Department's attention that do not meet the Department's standards and/or best practices.

The CEI personnel should verify that the Surge Protective Devices (or SPDs) are firmly mounted onto the DIN rail. Both the upper and lower jaws of the SPD bracket should be clamped around the DIN rail.

In addition, the CEI should verify that the wiring is installed correctly. For example, some AC voltage SPDs will have an "in" terminal and an "out" terminal. The "in" would face the power service and the "out" would face the cabinet. Some surge protection devices have a "protected" side and an "unprotected" side. The sensor should be connected to the "protected" side. If extreme care is not taken during installation, it could accidentally be installed backwards. Good cable management should also be employed.

The manufacturer will require that their sensors are grounded. This is critical to achieve maximum performance of the sensors. They will have special connections for the equipment to be grounded. This example shows the grounding details for a sensor.

Functional Inspection

After the equipment has been installed and connected correctly, the sensors are providing measurement data to the RWIS unit. The Contractor will supply the laptop and any specialized cables for configuration and test purposes. The vendor's software will be downloaded onto the laptop.

- For temperature, the units will be configured to Fahrenheit.
- For humidity, the units will be stated in percentages.
- Air pressure units are in inches of Mercury.
- Wind speed is stated in miles per hour.
- The local declination value of the earth magnetic field will be entered here.
- Precipitation settings are in inches per hour, and its resolution set to 0.02 inches per hour.
- Visibility will be measured in miles.

All sensors will require a polling interval. Confirm with the Department on the minimum, maximum, and average intervals.

Once the sensors are configured, they can be tested locally. During the test, no access to equipment is allowed since its performance could be disrupted from any tampering.

Conclusion

This concludes the Intelligent Transportation Systems Construction Engineering and Inspection Training, for Road Weather Information System, Module 3 Installation. Please continue to the next lesson, Module 4 Testing.

Knowledge Check

1. Determine whether the following statement is TRUE or FALSE. "A perimeter chain link fence and a concrete maintenance pad may be included in RWIS installation to enhance security and maintenance characteristics of the RWIS site location."

   a. true b. false

2. For unobstructed operations and ease of maintenance access, a typical RWIS installation will make use of:

   a. existing heavy infrastructure such as concrete bridges, abutments, and sound barriers to attach to.

   b. static and dynamic message signs to attach to.

   c. portable solar and gasoline powered portable signs to attach to.

   d. aluminum towers and concrete poles, clear of obstructions, to attach to.

3. Determine whether the following statement is TRUE or FALSE. "RWIS cabinets and cabinet components are never co-located with other ITS cabinet components."

   a. true **b. false**

4. Determine whether the following statement is TRUE or FALSE. "The RWIS wind sensor is installed at the highest point on the installation tower or pole and the visibility sensor is installed below that, at a midrange height."

   a. true b. false

5. RWIS visibility sensors should be installed in a manner so that all of the following are avoided EXCEPT:

   a. the installed unit avoids direct effects of heat, electrical, and light sources.

   b. the installed unit avoids obstructions that affect the natural fall of precipitation.

   c. the installed unit has its receiver pointed in the direction of north.

   d. the install unit is located to be unobstructed from of airflow.

6. Which of the following items is NOT a design component of RWIS surge mitigation?

   a. grounding electrodes

   b. surge protection devices

   c. lightning air terminal devices

   d. embedded pavement temperature sensors