

**New Jersey Department of Transportation**  
**Structural Evaluation**

**How to Review SI&A Data**

The majority of the data in the SI&A sheet was coded many years ago and has been reviewed many times over a number of bridge inspection cycles. So it is necessary for the person reviewing the data to understand which areas are most prone to errors so that the reviewer may budget his available time in the most effective way.

**Federal and State SI&A Edit Checks:**

The SI&A data input program is known as the Edit/Update Program. As it's name implies, this program includes edit functions developed by the FHWA for Federal SI&A Items and State edits developed by NJDOT for both State and Federal Items. These edit functions are run whenever an SI&A sheet is updated. It checks all of the items that are edited, not merely the items being updated.

The Edit Check Program produces an Error Message Sheet whenever an error or potential error is identified by the program. The indication of an error is also shown at the upper right hand corner of the SI&A output sheet as Federal Error-Yes/No and State Error-Yes/No. If the SI&A output sheet indicates that an error exists (showing Federal or State Error = Yes), then an Error Message Sheet is generated which indicates the specific items which need to be reviewed.

The Edit Check Program performs four types of edits, 1) Item Edits Checks, 2) Reasonableness Edit Checks, 3) Cross Check Edits and 4) Reasonableness Cross Check Edits. The nature of these edit checks are as follows:

- 1) **Item Edit Checks**-These checks are made to verify that the coding is consistent with the allowable coding for the SI&A Item being checked. For instance, if only numeric codes are allowable for an item, then coding an alpha code would generate an Item Edit Error.
- 2) **Reasonableness Edit Check**-These checks verify the reasonableness of the coding for the particular SI&A Item being checked. For instance, coding a deck width curb to curb (SI&A Item 51) is greater than 150' or an ADT (SI&A Item 29) greater than 200,000 would be questioned as unreasonable.
- 3) **Cross Check Edit**-These cross checks verify the consistency of the coding for two or more items against each other. For instance, if the type of service (SI&A Item 42) indicates that the bridge is over a waterway, then the code for channel (SI&A Item 61) should not be "N".
- 4) **Reasonableness Cross Check Edit**-These cross checks verify the consistency of the coding for two or more items against each other. For example, if the Year Built (SI&A Item 27) is within the last four (4) years and Items 58 through 62 or Items 67

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through 72 are coded less than “5” and not equal to “N”. It is not reasonable to have low Condition or Appraisal codes for a new bridge.

When the Edit Check Program identifies an error or questionable coding, an Error Message Sheet will be generated. The error message sheet identifies problems using several alpha codes. For Federal errors, the following codes are used:

- 1) **E (indicating error)**-This code indicates that an error is present and should be corrected.
- 2) **R (indicating review)**-This code indicates that a potential for error exists which should be reviewed to assure that it is correct. This code is utilized when either the Reasonableness Edit Check or the Reasonableness Cross Edit Check indicates a possible problem.

For State Edit checks, the following codes are used:

- 1) **C**-This code indicates that an error is present which requires correction.
- 2) **V**-This code indicates that the item has potentially been coded incorrectly and needs to be verified for correctness.

This sheet is not generally seen by consulting engineers performing inspections for the Department as the errors are expected to be corrected/addressed by the Department’s in-house staff.

It should be understood that not all fields in the SI&A sheet are thoroughly checked by the Edit Check Program. The edits performed on Federal Items above Item 90 (Items added in 1988) are much weaker than those for the original SI&A Items. Therefore, the reviewer should be much more careful when reviewing the higher numbered fields than the lower numbered fields.

### Which Items are More Likely to Have Errors:

Although nearly any SI&A Item could be coded incorrectly, there are several Items which are much more likely to have errors. In order for the reviewer to maximize the impact of his limited review time, these items should be carefully reviewed.

- 1) **Functional Classification (Item 26)**-This Item must be coded utilizing either the Straight Line Diagram or the Functional Classification Maps. The coding of this field is very important because many of the Appraisal Ratings are affected by the Functional Classification and this in turn affects the Sufficiency Rating and Federal funding apportionment to the State. The coding of this field may be incorrect because Functional Classification maps were not available during the initial bridge inspection

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cycles. This resulted in the estimation of the Functional Classification of the various roads which invariably was an inaccurate proposition. Therefore, with the exception of the Interstate highways, the accuracy of the coding for this Item is dependent upon whether or not someone in the past looked up this information.

- 2) **Highway System Inventory Route (Item 104)**-This Item is coded from the listing of the National Highway System (NHS) as defined in New Jersey. This listing is available in the NJDOT Procedures Manual. However, before the NHS was defined in New Jersey, the NHS was estimated based on the Functional Classification of the highway. This means that the existing coding may be incorrect if it has not been checked against the defined NHS. A general rule of thumb when evaluating this coding is that highways with a Functional Classification of Minor Arterial or lower classifications are not part of the NHS. All Interstate Highways and Freeways are included in the NHS. The problem area is Principal Arterial highways where some are NHS and some are not NHS. For checking County roads, it is suggested that the reviewer verify the NHS status using the Straight Line Diagram CD which lists all NHS roads.
- 3) **Year Reconstructed (Item 106)**-There has always been some confusion regarding the definition of reconstruction. Clearly, if a bridge is widened, lengthened or raised, it has been reconstructed. If the deck or damaged stringers/girders have been replaced, this is also clearly reconstruction. If a deck has been rehabilitated and a protective system installed, this is also reconstruction. However, if the deck has been patched without the installation of a protective system, even as part of a Deck Patching Contract, this is **not reconstruction**. If other maintenance type repairs have been made, this is also **not reconstruction**. It is of extreme importance that this Item be coded correctly because a bridge is not eligible for Federal funding for a ten year period from the date of reconstruction.
- 4) **Average Daily Traffic—ADT (Item 29)**-The coding for this Item requires constant updating. The updated information can sometimes be obtained from the Straight Line Diagram CD. It can also be obtained from the ADT Maps or the bridge owner. However, the intent is to have current ADT's coded for this Item. That means that ADT's which are five or six years old are not acceptable. If the only available ADT data is older than four years, then the current ADT should be estimated based on the observed field conditions. As a rule of thumb, a 1% per year increase in ADT can be used for estimation.
- 5) **Designated National Network (Item 110)**-The Designated National Network includes all mainline Interstate highways plus several other highways which are identified on page 5-6 of the "Recording and Coding Guide for the Structure Inventory and Appraisal of New Jersey Bridges" (April 1990) [page SA-5 of the new SI&A Manual]. The confusion usually occurs when ramp roadways are involved. Ramps are defined as being part of the Designated National Network when they

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connect other parts of the Designated National Network. If they do not connect parts of the Network, they are not part of the Network. There may also be some errors whereby highways which are clearly part of the Network, such as mainline Interstate highways, are not coded as part of the Network.

- 6) **Critical Feature Inspection (Item 92)**-This Item is essentially three Items in one field. Therein lies the problem. Errors are embedded in this field when someone revises the Fracture Critical Detail inspection without re-inputting the Underwater and Special (Interim) inspection data. This action will result in the blanking-out of the Underwater and Interim inspection data. These errors are very common and result in much confusion when the data is used to run queries or to plan future inspection work. Remember, if you update one part of the Item, you need to input the entire three parts of the Item. Also, if you want to blank the field out for Item 93, you need to code twelve (12) x's.
  
- 7) **Deck Width Out To Out (Item 52)**-This Item requires careful scrutiny when the structure is a "through type" superstructure, such as through girders and through trusses. For through type superstructures, the code for this Item represents the lateral clearance between the superstructure members rather than the deck width out-to-out. For these type structures, the "Structure Width" specified in the Summary of the Bridge Survey Report would not be consistent with the coding of Item 52.
  
- 8) **Minimum Lateral Underclearance-Right & Left (Items 55 & 56)**-There are three typical problems which occur with the coding of these items.
  - A) The lateral clearances are to be measured from the edge of the through lane to the substructure unit or slope protection. Often, the measurements are made from the edge of a ramp lane adjacent to the through lanes. This is incorrect. The lateral underclearance is always measured from the edge of the through lane excepting the situation when all of the lanes under the structure are ramps. Then, and only then, the lateral clearance is measured from the edge of the ramp lane.
  
  - B) The right edge of the through lane not delineated with a traffic stripe. Often, the measurements are made from the curblin or edge of pavement in such cases. This is incorrect. The inspector should assume that the through lane is striped consistently with the classification of road under the bridge, for State highways this would be twelve (12) feet, and measure the lateral clearance from this point.
  
  - C) The highway under the structure is divided with a non-mountable median barrier but there is no substructure unit in the median. The inspector should measure a lateral left underclearance in such cases. If there is no substructure unit in the median area, the lateral left underclearance is still applicable. In such cases where the non-mountable median barrier forms a crash barrier directly adjacent to a

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substructure unit, the lateral left underclearance should still be measured to the barrier.

The lateral underclearance measurements directly affect the coding of Underclearance -Vertical and Lateral (Item 69). Since Item 69 directly affects the structure's Sufficiency Rating, it also affects the bridge's eligibility for Federal funding.

- 9) **Latitude & Longitude (Items 16 & 17)**-When the majority of the SI&A sheets were originally coded, the only means for obtaining the latitude and longitude was for the data to be scaled from maps. Since the scales of these maps and skill used to scale the data from the maps varied greatly, a large variance in the accuracy of the information resulted. These problems were further compounded by the fact that there was no simple way of checking the data without actually repeating the functions of the inspector originally coding the data. There are now several much more accurate ways of obtaining this information, such as GIS maps and GPS, which allow the inspector to easily check/update the data without utilizing a large amount of time.
- 10) **Bypass Detour Length (Item 19)**-The Federal Coding Guide originally specified that this Item was required to be coded for all roads. Unfortunately, many of the SI&A sheets for local roads were incorrectly coded "00" miles. Coding the Bypass Detour Length is mandatory for all bridges.
- 11) **STRAHNET Highway Designation (Item 100)**-This Item was previously specified as Defense Highway Designation. The old Defense Highway Network is completely different from the STRAHNET (Strategic Highway Network). Therefore, the coding for this Item must be carefully checked to assure that the data is correct and represents the STRAHNET. Refer to Page SB-1 of the SI&A Coding Manual for a listing and maps of the STRAHNET.
- 12) **Minimum Vertical Underclearance (Item 54)**-The coding for this Item represents the minimum vertical underclearance above the normal traveled portions of the highway (including through lanes, merge lanes and ramps). It should not represent the clearance measured above shoulders. The minimum vertical underclearance above shoulders is represented by Item DJ (Minimum Vertical Underclearance Including Shoulders). It should be noted that Item 54 can never be less than Item DJ. It is important that this Item be coded correctly as it affects Item 69 (Underclearances-Vertical and Lateral) and ultimately can affect the status of the bridge for funding under Federal HBRRP.
- 13) **Inventory Route (Item 5)**-The coding for this Item is generally correct where it represents State highways. However, due to the assignment of 600 and 700 series county highway designations to many county roads, the coding of this Item requires verification in such cases where the designation occurred subsequent to the initial inventory of the structure.

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14) **Milepoint (Item 11)**-With the exception of minor alterations of alignment, this information is generally accurate for State highways. However, on non-State highways, this information is generally not coded consistently with the current Straight Line Diagrams. All Federal Aid highways are included in the Straight Line Diagrams and have milepoints assigned. However, for many structures, the existing code for this Item is "000.000". This is due to the fact that when the structure was initially inventoried, there were no assigned milepoints for many Federal Aid highways.

15) **Scour Critical (Item 113)**-The coding of this Item represents the structure's vulnerability to damage from scour. Great care must be taken when revising the coding for this Item as it is easy to make mistakes while doing so. If the inspector is unsure as to the proper code, advice from other staff within Structural Evaluation should be obtained prior to making any revisions.

- For bridges that have not been fully assessed for scour, the appropriate codes are U (Unknown Foundation), T (Tidal Waterway) or 6 (All Other Bridges). **"U", "T" and "6" are not to be used for bridges that have been assessed as being not scour critical by the bridge owner, nor should they be used for bridges where Stage 2 (In-Depth Scour Evaluations) have been performed.** A code of "U", "T" or "6" is appropriate for bridges that could not be categorized as not being scour critical based on a Stage 1 Screening and Prioritization (pending a Stage 2 In-Depth Scour Evaluation) or where the bridge is included in the Capital Program for replacement or rehabilitation and completion of a Stage 2 In-Depth Scour Evaluation is not warranted.
- Where a bridge has been determined to be scour critical based on a Stage 2 In-Depth Scour Evaluation, the coding must be "3" or less. A code of "2" may only be used where a Priority recommendation to install scour countermeasures has been made. Also, codes of "1" or "0" may only be used for closed bridges.
- Where a bridge has been determined to not be scour critical based on a Stage 1 Screening and Prioritization, Stage 2 In-Depth Scour Evaluation or engineering assessment by the owner, the codes of "9", "8", "7", "5" or "4" must be used. **In order to use the code of "7", scour countermeasures must be present.** A code of "7" should not be used to "shade" between a code of "8" and "5". If any part of the foundation is exposed on a bridge determined not to be scour critical, the codes of "5" or "4" must be used. **In order to use the code "4", a recommendation to correct scour damage must be made by the inspector.**

### Deck Patching versus Deck Repairs and the Effect on Item 58 (Deck Condition):

There has always been some confusion about the coding of SI&A Item 58 for concrete decks that have been repaired or patched. When a deck has been repaired, the condition has been improved and the code for Item 58 should reflect the change. If the deck has

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merely been patched, the repairs are cosmetic or temporary and no real improvement has occurred. The code for Item 58 should not reflect any improvement in such cases. In addition, the coding of the Pontis deck/slab elements are similarly affected by the presence of repairs or patches.

It is usually easy to differentiate between repairs and patches on concrete decks. When a deck is repaired, the spalled/scaled area is typically squared-off, the reinforcing steel cleaned or replaced as needed and the deck surface is then restored. If a deck is repaired and an asphalt overlay is added, the underlying concrete deck must have been repaired prior to the placement of the overlay. Deck repairs including asphalt overlays usually include the placement of waterproof membranes, cathodic protection or other deck protective systems. Deck repairs are usually completed through bridge rehabilitation or “Deck Patching” contracts. However, deck repairs can also be made by in-house maintenance forces, so the inspector should be careful. If you are unsure about the work done on the deck, contact your Project Manager to determine if any additional information exists.

Deck patching can be done with either concrete or asphalt. Deck patching is done exclusively by in-house maintenance forces with the intention of improving the rideability of the roadway surface. Patches normally do not exhibit squared-off edges and the edge of the repair usually is crumbled due to the tapering of the patch as it meets the existing concrete surface. All asphalt patches on concrete decks is considered to be patching.

### **Asphalt Overlays Placed on Concrete Decks to Temporarily Improve the Riding Surface:**

Asphalt overlays are occasionally placed on concrete decks that are in poor condition as a means to temporarily improve the riding surface. When this occurs, there is often confusion as to how this affects the SI&A and Pontis coding for the bridge. Since the condition of the bridge deck is not improved by the placement of an asphalt overlay without first making repairs to the underlying concrete, the coding for Item 58 (Deck Condition) should remain as it was. Alternatively, the coding for the Pontis Deck/Slab Element should be changed to reflect the presence of an asphalt overlay. For instance, Element #012—Concrete Deck—Unprotected and Bare would be revised to Element #013—Concrete Deck—Unprotected w/AC Overlay. In addition, the Pontis Condition State coding would be revised (usually upwards) to indicate the present condition of the asphalt overlay that would typically be very good immediately after placement. This creates an acceptable situation where the SI&A Condition and Pontis Condition State coding can be inconsistent for the deck.

### **Revisions to Condition/Appraisal Ratings Affecting the Status of the Bridge:**

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The conditions of the Deck (Item 58), Superstructure (Item 59), Substructure (Item 60) and Culvert (Item 62) are in a continual state of change. The changes are mostly due to continuing or increased deterioration. These changes affect the SI&A condition codes assigned to these Items in addition to any differences in the inspector's perception of the significance of pre-existing conditions.

Understanding that these Items will change, the inspector must be aware of when the change in condition codes has the greatest effect. This occurs when a condition code changes from a "5" to a "4". A condition code of "4" makes the bridge Structurally Deficient and has a significant influence on the Sufficiency Rating. Alternatively, a condition code of "5" does not make the bridge Structurally Deficient and has only a slight influence on the Sufficiency Rating.

In order for a bridge to be eligible for Federal funding, it must be Structurally Deficient or Functionally Obsolete and, in addition, have a Sufficiency Rating of 80 or less (less than 50 for bridge replacement funding). Obviously, from the State's perspective, this is very important. Therefore, the inspector should take great care when contemplating the lowering of a condition code from a "5" to a "4" or alternatively from raising a condition code from a "4" to a "5". These changes are often referred to as "changing the status" (i.e., changing the eligibility of the bridge for Federal HBRRP funding) of the bridge. It is generally a more serious matter to raise the condition codes from "4" to "5" than to lower the codes.

In addition to changes in condition codes, changes in Appraisal Codes (SI&A Item 67, 68, 69, 71 or 72) can also change the status of the bridge for Federal HBRRP funding eligibility. An appraisal code of "3" or less will make a bridge Functionally Obsolete. Functionally Obsolete bridges that have a Sufficiency Rating of 80 or less are eligible for rehabilitation funding (less than 50 Sufficiency Rating for replacement funding). If an Appraisal Code is raised from a "3" to "4", the bridge would no longer be Functionally Obsolete. Therefore, changes where this occurs are critically important. Primarily, changes in the coding of Items 68 (Deck Geometry) and 69 (Underclearances—Vertical and Lateral) result in changes in the status of the bridge. Since these Items are not directly coded, it is changes in the other SI&A Items that cause the coding to change. Care should be taken when changes in the SI&A Items affecting the Appraisal Code Items are made.

It is recommended that the inspector consider these implications very carefully before contemplating changes that affect the status of the bridge. In addition, it is strongly suggested that the NJDOT Project Manager be consulted before making any changes of this nature to assure that there are no existing design projects that would be affected. This consultation would also provide the opportunity for the Project Manager to assure that the inspector has all of the available information to make the determination of the most appropriate code.

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### Design Exceptions and Their Effect on SI&A Coding:

Whenever the inspector determines that a bridge has been rebuilt (Item 27 updated) or reconstructed (Item 106 updated), the possibility exists that the field conditions at the bridge site did not permit the designer to meet current standards. The designer may not be able to meet current standards for Deck Geometry (Item 68) or Underclearances (Item 69) without an extreme expenditure of funds which would not provide an adequate benefit of increased service. In such cases, the designer would weigh the cost versus the benefit of the service improvements. If the service improvements are determined to be too costly, the designer may choose to provide an acceptable level of service below current design standards. Under such circumstances, the designer would implement a Design Exception.

As you know, the coding for Item 68 (Deck Geometry) and Item 69 (Underclearances) is automatically calculated by the Edit/Update Program. Also, you know that you must recommend remedial action when the coding for Items 68 or 69 is "3" or less. However, the existence of a Design Exception changes the rules. For example, if a Design Exception for Deck Geometry has been taken, the inspector should not recommend to widen what is essentially a brand new bridge.

The problem with Design Exceptions involves the determination of when one exists. The design project files, where the record of the Design Exception exists, are not generally available to the bridge inspector. Therefore, the inspector should be aware that they probably exist when substandard design features exist on a new bridge. The alternative to this is that the designer made a **very big mistake** (not likely). It is suggested that consultants contact their NJDOT Project Manager and ask for any available information on potential Design Exception situations which may be encountered.