Chapter Three
Field Study: Scope, Objectives, and Methodology

3.1 Introduction

This chapter presents scope and objectives of the field study and provides the details of data collection, data base development, statistical analysis, and the features of the database. In the following sections, field study is discussed and the methods and sources for different types of data in the database are explained. This chapter is organized as follows. After this introduction, in section 3.2, objectives and scope of filed study is discussed. Section 3.3 presents the methods and sources for data gathering and section 3.4 reviews the database development. The last section, 3.5, provides a summary.
3.2 Objectives and Scope

A field study was initiated with the survey of 24 bridges in the state of New Jersey and by collecting design and construction data on these bridges for subsequent statistical analysis (Appendix A contains the data collected for all bridges). In the following section the objectives and scope of the field study are discussed.

3.2.1 Objectives

The main objective of these surveys was to identify factors that affect transverse deck cracking in bridges in the state of New Jersey. Another objective of these surveys was the evaluation of the current deck mix design and construction practices in the state of New Jersey based on the survey results and the results reported in the literature. Based on this evaluation, recommendations with regard to material and mix design as well as construction practices were made to improve bridge deck performance. Another important objective of this field study was to help to focus the efforts of the second part of the research study by narrowing down the list of important factors that need to be investigated in more details. These are factors that either have not received proper attention during past research, as discussed, or because these factors are related to particular design and/or construction practice unique to the state of New Jersey. As it will be discussed, the surveys and subsequent evaluation of the data do indeed support the initial thrust of the research endeavor with regard to more emphasis on design factors. These factors will be investigated in details during the next phase of the study using analytical and finite element analyses.

3.2.3 Scope

The field surveys included 24 bridges from central and northern New Jersey. 20 bridges of those surveyed were located in the Mercer County while Bergen, Essex, Hunterdon and Monmouth Counties each had one bridge among the surveyed bridges. Figure 3.1 shows the geographical distribution of the surveyed bridges.

The bridge condition with regard to transverse deck cracking was not know prior to their selection. The only criteria used for selecting these bridges were span length (longer than 85-ft) and age (built after 1994 and considered new). Both prestressed and steel girder bridges were considered. Results showed that the inventory included both cracked and uncracked bridges.
However, majority of the bridges, 18 bridges or 75%, were cracked. Table 3.1 shows the construction year of the bridges included in the survey.

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</tr>
</thead>
<tbody>
<tr>
<td>No. Of Bridges</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>13</td>
<td>2</td>
<td>1</td>
</tr>
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</table>

All bridges considered have composite decks. 8 of them have steel girders while the rest were supported on the prestressed concrete girders. The surveyed bridges have various span lengths with the maximum span length of 175 ft. Most of them consisted of 1, 2 or 3 spans (83 percent), but it also included bridges with up to 12 spans.

There were different support conditions among the bridges surveyed. There were 8 spans with simply supported steel girders and 17 continuous multiple spans with steel girders. Considering prestressed concrete girders, 11 spans were simply supported and the rest of the spans (i.e., 43
spans) were continuous multiple spans. Note that continuous spans are continuous in interior spans only and the exterior supports are simply supported or fixed.

Except for one bridge, all of the bridges were open to traffic at the time of field survey. Field survey included visual walk-by evaluation mostly of the top of the deck. During the field surveys, bridge decks were visually evaluated and the crack information (crack type, spacing, size and approximate location in the deck) were recorded qualitatively for each bridge. The survey logs also included information regarding bridge location, type, span number, span type, wearing surface and type of bearing. Furthermore, structural plans and construction and mix design information for the bridges surveyed were collected from NJDOT and important aspects of design and construction were determined for each bridge. The survey observations and collected data are reported individually for each bridge in appendix A.

3.3 Data Sources

There were three major source of data employed in development of the data base that was consequently used for statistical analysis. These are:

- Field survey logs
- Structural plans
- NJDOT Inspection/Testing datasheets

Field survey form: Figure 3.2 shows the visual bridge evaluation form, which was specifically developed for the field survey. Additional information, such photos of cracks and structural components, were also collected for some of the bridges in conjunction with completing this form, which are included in Appendix A. However, the crack data and general information about the bridge were two main parts of information collected during the field surveys.

Structural plans: Structural plans were another source of information. In coordination with NJDOT staff at the Bureau of Bridge Design, structural plans for all bridges were obtained and important design information such as bridge dimensions, deck details, and girder details were extracted.
**Date of Evaluation:**
**Region:**
**Date Constructed:**

**Number of Spans:**
- Single
- Multiple Span
  - Simply Supported
  - Continuous

**Degree of Skewness (quantify if possible):**
- None (straight)
- Mild
- Severe

**Type of Beam:**
- Prestressed
- Steel
- Others

**Deck Surface:**
- Concrete
- Latex
- Unknown

**Deck Surface Texture:**
- Sawcut
- Turf Drug
- None – New Construction

**Type of Bearings:**
- Steel Bearings
- Elastomeric Pads
- Others:

**Pictures/Video Available:**
- Yes
- No

**Additional Note:**

<table>
<thead>
<tr>
<th>Date Constructed</th>
<th>Region</th>
<th>Number of Spans</th>
<th>Degree of Skewness</th>
<th>Type of Beam</th>
<th>Deck Surface</th>
<th>Deck Surface Texture</th>
<th>Type of Bearings</th>
<th>Pictures/Video Available</th>
<th>Additional Note</th>
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</table>

<table>
<thead>
<tr>
<th>Structure Location</th>
<th>Type of Cracks (use additional forms for &gt; 3 span):</th>
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<tbody>
<tr>
<td></td>
<td>Span</td>
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<tr>
<td></td>
<td>1</td>
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<table>
<thead>
<tr>
<th>Location of Cracks within the Deck</th>
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<tbody>
<tr>
<td>Span</td>
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<tr>
<td>1</td>
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<table>
<thead>
<tr>
<th>Spacing of Cracks</th>
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<tr>
<td>Span</td>
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<table>
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<tr>
<th>Size of Cracks (quantify if possible):</th>
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<tbody>
<tr>
<td>Span</td>
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<tr>
<td>1</td>
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</tbody>
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**Figure 3.2 – Visual bridge evaluation form**
**NJDOT Inspection/Testing datasheets:** These datasheets, which are completed during the construction, contain different data regarding construction and the mix design for each bridge. The results of the strength and slump tests are also reported on these forms. These forms are part of the documents that NJDOT holds for each bridge. Figure 3.3 shows a typical datasheet. One part of these forms is completed on the day of casting and the other parts are completed after conducting strength tests. Mix design, strength test results and temperature measurements are three important parts of these datasheets that were used in this study.

![Figure 3.3 – Typical NJDOT Inspection/Testing datasheet](image-url)
3.4 Database

The information in database (see Appendix A) is divided into five major categories for each bridge. These are: general information, structural design information, material properties and mix design information, construction information, and crack information.

**General information:** This part of the database contains information regarding bridge location and construction year. This information is derived from the survey forms.

**Structural design information:** Using the structural plans, detailed information about the bridge design is extracted. These data include:
- Bridge dimensions
- Number of spans
- Traffic direction
- Girder type
- Span type (e.g., if continuous at interior spans or simply supported)
- Span length and width
- Framing information (e.g., spacing of girders in each span)
- Deck design information (i.e. rebar details, thickness, cover depth and wearing surface)
- Girder properties (e.g., area, depth, and moment of inertial)
- Shear studs spacing

**Material properties and mix design information:** This information is derived from NJDOT Inspection/Testing datasheets. Important mix design information like water content, cement content, cement type, admixtures and slump are reflected in the database. Note that since during the construction slump in measured several times, the average value of these tests are taken as the representative value of the slump for the deck concrete during casting. Similarly, average compressive strength of all concrete deck specimens are reported as the compressive strength of the deck.

**Construction Information:** In this part, based on the NJDOT Inspection/Testing forms the average air temperature during the casting period and the average value of concrete temperature at the time of casting for all the measurement is reported as the representative values.
Crack information: Crack information, which was recorded during the field surveys, is reported in this part. This information includes: crack type, approximate crack location on the deck, crack spacing and its size.

The database program Microsoft Access [16] was used to store and organize the data. Microsoft Excel [17] program was mostly used for presentation and analysis of the data. These two software packages are also employed for statistical analyses. Charts are extensively used in presenting the result of analyses.

3.5 Summary

24 bridges were surveyed in the state of the New Jersey and the data collected was used to develop a database, which was employed in a statistical analysis. The following is a list of the most important features of the field study and the database:

- Walk-by survey of 24 newly built bridges in the state of New Jersey with different
  - Deck conditions (cracked and uncracked)
  - Girder types, and
  - End conditions
- Review of the material properties and mix design information
- Review of the structural plans

The results of the field survey are presented in the next chapter.