जल संसाधन विभाग

बिहार सरकार

आदेश सं०– 1/पी०एम०सी०/विविध/181/2024–..655 पटना, दिनांक 23/8/24

आदेश

पुल/पुलिया रख–रखाव/संपोषण/संधारण नीति–2024

1.0– प्रस्तावना

जल संसाधन विभाग द्वारा राज्य की नदियों के जलप्रवाह से संभावित बाढ़ को नियंत्रित करने, सिंचाई योजनाओं का निर्माण एवं संचालन करने का कार्य किया जाता है। जल संसाधन विभाग की नहरों पर विभाग द्वारा एक मानक दूरी के अनुसार पुल/पुलियों का निर्माण किया जाता है, जबकि सड़क निर्माण एवं सड़क सम्पर्कता हेतु निर्माण कार्य करने वाले अन्य विभागों (यथा पथ निर्माण विभाग, ग्रामीण कार्य विभाग, योजना एवं विकास विभाग, पंचायती राज विभाग इत्यादि) द्वारा भी बड़ी संख्या में पुल/पुलियों का निर्माण किया जाता है। सड़क यातायात एवं सामग्रियों की ढुलाई हेतु इन पुल/पुलियों का अत्यधिक महत्व है, इसलिए आवश्यक है कि निर्मित/निर्माणाधीन/भविष्य में निर्माण किए जाने वाले पुल पुलियों के रख–रखाव की एक व्यापक नीति हो।

जल संसाधन विभाग द्वारा संचालित/संधारित/प्रबंधित, नदियों/धारों/नहरों पर अन्य विभागों द्वारा निर्मित/निर्माणाधीन/भविष्य में निर्माण किए जाने वाले पुल/पुलियों के रख–रखाव/संपोषण/संधारण की पूर्ण जिम्मेवारी उन संरचनाओं के निर्माण करने वाले विभागों की है।

जल संसाधन विभाग के नहरों एवं कतिपय नदी धार पुनर्जीवित करने की योजना पर जल संसाधन विभाग द्वारा निर्मित/निर्माणाधीन/भविष्य में निर्माण किए जाने वाले पुल/पुलियों की निर्बाध सेवा हेतु "पुल/पुलिया रख–रखाव/संपोषण/संधारण नीति" का निर्धारण किया गया है।

2.0 पुल/पुलिया (IRC : 5-1998 के अनुसार)

2.1 पुलों को नीचे दिए गए वर्गीकरण के अनुसार छोटे और महत्वपूर्ण पुलों में विभाजित किया गया है :–

क) लघु पुल (Minor Bridge) लघु पुल की कुल लंबाई 60 मीटर तक होती है।

ख) वृहद पुल (Major Bridge) वृहद पुल की कुल लंबाई 60 मीटर से अधिक होती है।

2.2 पुलिया (कलवर्ट)

कलवर्ट एक क्रॉस–जल निकासी (Cross Drainage) संरचना है जिसकी सड़क रेखांकन पर कुल लंबाई 6 मीटर या उससे कम होती है।

2.3 पैदल पुल

पैदल पुल वैसी संरचना है जिसका उपयोग पैदल यात्रियों, साइकिलों, मोटरसाईकिल सवारियों और जानवरों द्वारा आवागमन हेतु किया जाता है।

2.4 उच्च स्तरीय पुल

उच्च स्तरीय पुल वैसी संरचना है जो उच्चतम बाढ़ स्तर (HFL) के उपर निर्मित हो तथा जिसका उपयोग सड़क आवागमन हेतु किया जाता है।

2.5 **सबमर्सिबल पुल (Submersible bridge)/भेन्टेड काजवे (vented causeway)**

सबमर्सिबल पुल/भेन्टेड कॉजवे वैसी संरचना है जिसमें बाढ़ का पानी कुछ समय के लिए संरचना के उपर से पार करता है। बाढ़ का पानी निकल जाने के बाद सामान्य जलश्राव पुल में निर्मित भेन्ट से निकलते रहता है।

3.0 **पुल/पुलिया पंजी**

प्रत्येक प्रमंडल में निम्न प्रपत्र में एक पंजी का संधारण किया जायेगा। जल संसाधन विभाग द्वारा निर्मित पुल के लिए अलग पेज/अन्य विभागों के लिए विभागवार अलग–अलग पेज पर विवरणी संधारित किया जायेगा। उक्त पंजी को प्रत्येक वर्ष मार्च महीना में अद्यतन करना संबंधित प्रमंडल की जिम्मेवारी होगी।

क्र०	पुल निर्माण करने वाले विभाग का नाम	नहर/नदी/धार का नाम	लोकेशन (KM)	पुल/पुलिया का प्रकार	पुल/पुलिया की लम्बाई	निर्माण का वर्ष	अभ्युक्ति
1	2	3	4	5	6	7	8

4.0 जल संसाधन विभाग द्वारा निर्मित पुल/पुलिया का तकनीकी विवरणी

जल संसाधन विभाग द्वारा निर्मित पुल/पुलिया की तकनीकी विवरणी परिशिष्ट–I के अनुसार संधारित किया जायेगा। इसका संधारण पुल/पुलिया संधारण पंजी के साथ होगा।

5.0 पुल/पुलिया के संरचनात्मक अवयव

5.1. **<u>सुपर स्ट्रक्चर (Super Structure IRC: SP: 52-1999 के अनुसार)</u>**

पुल का सुपर स्ट्रक्चर यातायात के सभी वाहन और पैदल यात्रियों के लिए आवागमन की सुविधा प्रदान करता है। यह अवयव पुल का उपयोग करने वाले सभी वाहनों/यात्रियों के भार (Load) और बल (Force) के साथ–साथ हवा का दबाव, भूकंप के प्रभाव को नींव (Foundation) के माध्यम से भूमि में स्थानान्तरित करता हैं।

सुपर स्ट्रक्चर के महत्वपूर्ण अवयव निम्नलिखित हैं :

क) पुल डेक स्लैब, कर्ब, पैदल मार्ग, रेलिंग या क्रैश बैरियर, एप्रोच स्लैब (Approach slab)

ख) लौंगिट्यूडनल मेंबर (Longitudinal Member)– बीम, गर्डर, आर्च (Arch), क्रॉस–गर्डर, बॉक्स–गर्डर आदि।

5.2. **<u>सब स्ट्रक्चर (Sub Structure)</u>**

5.2.1. सब स्ट्रक्चर वैसी वर्टिकल सर्पोटिभ प्रणाली (Vertical Supportive System) है जो पुल के सुपर स्ट्रक्चर के भार और बल को नींव में स्थानान्तरित करता है।

5.2.2. सब स्ट्रक्चर पीयर्स (Piers) और एबटमेन्ट (Abutment) से मिलकर बनी होती है।

5.2.3. पुल के प्रत्येक छोर पर जो लम्बवत सहारा (Vertical Support) होता है, उसे एबटमेन्ट कहा जाता है, जबकि बीच के (इंटरमीडिएट) सहारा को पीयर्स कहा जाता है।

5.2.4. पीयर्स और एबटमेंट्स सुपर स्ट्रक्चर के भार और बल के अतिरिक्त हवा के दवाव, भूकंप, जल प्रवाह, बाढ़ में बहते पेड़, नाव और बार्ज के टकराने से भी प्रभावित होता है। दोनो एबटमेन्ट पर एप्रोच सड़क के मिट्टी का भी दवाव रहता है।

5.2.5. पीयर्स और एबटमेंट्स सामान्य रूप से ठोस या खोखले होते हैं और विभिन्न आकार में होते हैं। अगर एबटमेंट के माध्यम से जल संपर्क होता है तो उसके सामने एप्रॉन के साथ पिचिंग कार्य से सुरक्षित किया जाता है।

5.2.6. सामान्य रूप से एबटमेंट्स के प्रत्येक छोर पर विंग वॉल होता हैं जो एप्रोच सड़क के मिट्टी भराव को संभालने के लिए तटबंध से कुछ कोण पर निर्मित होती हैं।

5.3 **नींव (Foundation)**

5.3.1 यह संरचना सुपर स्ट्रक्चर एवं सब स्ट्रक्चर पर पड़ने वाले सभी भार, बल को पुल के नीचे भार सहन करने वाली प्राकृतिक मृदा परत तक सुरक्षित रूप से स्थानान्तरित करता हैं ताकि निर्मित संरचना पूरे जीवन काल के अनुसार सुरक्षित रहे। नींव गहरी (Deep) या छिछली (Shallow) हो सकती हैं।

6.0 निरीक्षण

किसी भी संरचना के अभीष्ट उद्देश्य की प्राप्ति हेतु आवश्यक है कि उसका नियमित निरीक्षण की प्रक्रिया एवं निरीक्षण करने वाले पदाधिकारी की स्पष्ट जिम्मेवारी निर्धारित हो। (निरीक्षण से संबंधित प्रपत्र परिशिष्ट–II पर संलग्न)

6.0.1 पुल के निरीक्षण के क्रम में प्रतिवेदन तैयार करने हेतु अवलोकनीय महत्वपूर्ण बिन्दुओं से संबंधित सामान्य विवरणी परिशिष्ट–III पर संलग्न है, जिसका निरीक्षण के समय सावधानीपूर्वक जाँच किया जाना चाहिए।

6.1 निरीक्षण अवधि (1 से 10 नवम्बर के बीच)

6.1.1 कनीय अभियंता एवं सहायक अभियंता द्वारा नहरों पर अवस्थित सभी पुल पुलियों (जल संसाधन विभाग से संबंधित एवं असंबंधित) का शत प्रतिशत (100%) निरीक्षण किया जायेगा।

6.1.2 कनीय अभियंता एवं सहायक अभियंता द्वारा निरीक्षण प्रतिवेदन में सुरक्षात्मक कार्य, पीयर, एबटमेंट, डेकस्लेब तथा वियरिंग के क्षतिग्रस्त होने से संबंधित प्रतिवेदन दिये जाने पर संबंधित वैसे सभी संरचनाओं पुल/पुलियों का निरीक्षण **कार्यपालक अभियंता** के द्वारा किया जायेगा।

6.1.3 कार्यपालक अभियंता द्वारा निरीक्षण किये गये पुल/पुलियों की संख्या का कम से कम 50 प्रतिशत निरीक्षण **अधीक्षण अभियंता** के द्वारा किया जायेगा।

6.1.4 अधीक्षण अभियंता द्वारा निरीक्षण किये गये पुल/पुलियों की संख्या का कम से कम 50 प्रतिशत निरीक्षण मुख्य अभियंता के द्वारा किया जायेगा।

6.1.5 विभागीय पत्रांक 253 दिनांक 15.03.2024 द्वारा निर्गत नहर संचालन एवं रखरखाव हेतु मानक संचालन प्रकिया की कंडिका 11 (1) के आलोक में नहरों पर अवस्थित जल संसाधन विभाग के स्वामित्व वाले सभी पुल पुलियों का निरीक्षणोपरान्त संपोषण एवं मरम्मति के कार्यो से संबंधित प्रस्ताव मुख्य अभियंता द्वारा 30 नवम्बर तक समेकित कर विभाग को उपलब्ध करा दिया जायेगा।

6.2 निरीक्षण अवधि (15 मई से 20 मई के बीच)

6.2.1 नवम्बर माह में किये गये निरीक्षण के आधार पर कराये गये कार्य को कार्यपालक अभियंता के द्वारा शत प्रतिशत निरीक्षण किया जायेगा। उस समय नहरों पर निर्मित पुल/पुलियों का अधिकांश हिस्सा दृष्टिगोचर होता है। इसलिए पुनः उक्त संरचनाओं का निरीक्षण कर आवश्यक कार्यो का आकलन किया जायेगा।

6.2.2 निरीक्षण में सुरक्षात्मक दृष्टि से यदि किसी अतिरिक्त मरम्मति की आवश्यकता परिलक्षित हो रही हो तो मॉनसून पूर्व कार्य करा लिया जायेगा।

7.0 अन्य विभागों को स्मार

प्रत्येक वर्ष दिसम्बर माह के प्रथम सप्ताह में संबंधित क्षेत्रीय पदाधिकारियों द्वारा नहरों पर अन्य विभागों द्वारा निर्मित पुल/पुलियों की सूची संलग्न कर सभी संबंधित विभागों को इस आशय का पत्र निर्गत किया जायेगा कि संबंधित संरचनाओं के स्थायित्व/सुरक्षित रहने के स्थिति से संतुष्ट हो ले। इन संरचनाओं के क्षतिग्रस्त होने की स्थिति में संबंधित विभाग जिम्मेवार होंगे।

8.0 पुल/पुलिया की संख्या

जल संसाधन विभाग की नहरों पर सर्वेक्षणोपरान्त वर्तमान में कुल 14604 पुल/पुलिया निर्मित है, जिसकी विवरणी निम्न प्रकार है :–

वर्तमान में नहरों पर निर्मित पुल/पुलिया की कुल संख्या	वर्तमान में संबंधित विभाग अन्तर्गत निर्मित पुल/पुलिया की संख्या		
	जल संसाधन विभाग	वाह्य विभाग	पुल/पुलिया की संख्या जिसके स्वामित्व के विषय में सूचना प्राप्त नहीं है।
14604	11244	2325	1035

9.0 रख–रखाव/मरम्मति का प्रकार

9.1 सामान्य मरम्मति :– प्लास्टर का क्षरण, reinforcement exposed, railing, पुल के उपर निर्मित सड़क पर जल–जमाव, दरार (crack), अवांछित रूप से उग आये पेड़ पौधों की सफाई, approach slab से संबंधित कार्य, अन्य समरूप कार्य।

9.2 विशेष मरम्मति :– क्षतिग्रस्त सुरक्षात्मक कार्य एवं नींव संबंधित कार्य, किसी भी संरचना में परिलक्षित बदलाव/विकृति इत्यादि, अन्य समरूप कार्य। ।

9.3 आकस्मिक मरम्मति :– आपदा यथा भूकम्प, बाढ़, आंधी, वाहनों का टकराव आदि से उत्पन्न क्षति की मरम्मति से संबंधित कार्य, अन्य समरूप कार्य।

10.0 संपोषण कार्य का कार्यान्वयन

10.1 नहरों पर अवस्थित पुल/पुलिया

सामान्य रख–रखाव/मरम्मति–नहर संचालन एवं रखरखाव हेतु मानक संचालन प्रकिया के अनुसार नहरों के सामान्य संपोषण के समरूप प्रक्रिया अपनाते हुए पुलों/पुलियों का सामान्य संपोषण एवं मरम्मति कार्य कराया जायेगा। वार्षिक कार्यक्रम की स्वीकृति के समय पुल/पुलियों के सामान्य संपोषण कार्य को प्राथमिकता दी जायेगी।

विशेष मरम्मति–नहर संचालन एवं रखरखाव हेतु विभागीय पत्रांक–253 दिनांक 15.03.2024 द्वारा निर्गत मानक संचालन प्रकिया की कंडिका 11 (प्रमंडल द्वारा तैयार वार्षिक प्रस्ताव में पुल/पुलिया से संबंधित कार्यों को चिन्हित करते हुए मुख्य अभियंता के माध्यम से मुख्यालय में समर्पित किया जायेगा) के आलोक में नहरों पर अवस्थित पुल/पुलिया के मरम्मति एवं संपोषण के कार्य हेतु आवश्यक कारवाई की जायेगी एवं TAC/SRC में पुल/पुलिया के रख–रखाव/मरम्मति कार्य को प्राथमिकता दी जायेगी।

आकस्मिक मरम्मति :– ऐसे कार्यो को कराने हेतु विभागीय पत्रांक 155 दिनांक 26.02.2019 द्वारा अंगीकृत पथ निर्माण विभाग की अधिसूचना सं०–1725/S दिनांक 18.02.2019 द्वारा विभागीय कार्य कराने से संबंधित दिशा निर्देश के आलोक में मुख्य अभियंता स्तर से अंचल के नाम से जल संसाधन विभाग के अन्तर्गत निबंधित संवेदकों तथा श्रेणी–4 के जिला स्तर पर निबंधित संवेदकों को वित्तीय वर्ष के प्रारंभ में सूचिबद्ध कर लिया जायेगा। संरचना के क्षतिग्रस्त भाग की स्थिति के अनुसार विभागीय रूप से ऐसे कार्यो को कराया जा सकता है।

10.2 नदी/धार पर अवस्थित पुल/पुलिया

सामान्य संपोषण :– नदी/धार पर अवस्थित पुल/पुलिया के सामान्य रख–रखाव/संपोषण कार्य मुख्य अभियंता द्वारा वार्षिक कार्यक्रम की स्वीकृति के अनुसार कराया जायेगा। वार्षिक कार्यक्रम में पुल/पुलियों से संबंधित मरम्मति कार्य को प्राथमिकता दी जायेगी।

विशेष संपोषण नदी/धार पर अवस्थित पुल/पुलिया के विशेष संपोषण एवं मरम्मति कार्य बाढ़ प्रबंधन हेतु निर्गत मानक संचालन प्रक्रिया/मानक बाढ़ कैलेन्डर के अनुसार TAC/SRC के माध्यम से कराया जायेगा। जिसमें पुल/पुलियों के विशेष संपोषण के कार्य को प्राथमिकता दी जायेंगी।

आकस्मिक मरम्मति :– बाढ़ अवधि मे नदी/धार पर अवस्थित पुल/पुलिया का आकस्मिक मरम्मति का कार्य बाढ़ संघर्षात्मक कार्य के माध्यम से कराया जायेगा। अन्य अवधि में विभागीय पत्रांक 155 दिनांक 26.02.2019 द्वारा अंगीकृत पथ निर्माण विभाग की अधिसूचना सं०–1725/S दिनांक 18.02.2019 द्वारा विभागीय कार्य कराने से संबंधित दिशा निर्देश के आलोक में आकस्मिक मरम्मति का कार्य कराया जायेगा।

11.0 संरचना को प्रतिबंधित/अनुपयोगो घोषित करना

विभाग अंतर्गत सभी प्रमंडल अपनी परिसम्पत्तियों/कार्यक्षेत्र में निर्मित समस्त पुल/पुलियों की स्थिति का व्यापक सर्वेक्षण कर रिपोर्ट तैयार करेंगे।

11.1 रिपोर्ट की समीक्षा के पश्चात् यदि किसी पुल/पुलिया की स्थिति भारी वाहन के आवागमन योग्य नहीं पायी जाये तो मुख्य अभियंता की सहमति प्राप्त कर भारी वाहनों के लिए प्रतिबंधित घोषित किया जायेगा। इस आशय की सूचना पुल/पुलिया स्थल पर सूचना–पट्ट लगाकर, पुल के दोनो छोर पर बैरियर लगाकर अनुपालित कराया जायेगा। साथ ही इसकी सूचना संबंधित जिला पदाधिकारी को भी दी जायेगी।

11.2 रिपोर्ट की समीक्षा के पश्चात् यदि किसी पुल/पुलिया की स्थिति अपेक्षित मरम्मति के वगैर किसी भी प्रकार के वाहन के आवागमन योग्य नहीं हो तो मुख्य अभियंता की सहमति प्राप्त कर पुल/पुलिया को सभी वाहनों के लिए प्रतिबंधित घोषित किया जायेगा। इसकी सूचना संबंधित जिला पदाधिकारी को भी दी जायेगी। साथ ही इस आशय की सूचना पुल/पुलिया स्थल पर सूचना–पट्ट लगाकर, आम जनता को अवगत कराया जायेगा। मरम्मति के बाद संबंधित मुख्य अभियंता के निरीक्षण के उपरान्त पुनः वाहनों का परिचालन प्रारंभ किया जायेगा।

11.3 रिपोर्ट की समीक्षा के पश्चात् यदि किसी पुल/पुलिया की स्थिति ऐसी पायी जाये जो किसी भी प्रकार के आवागमन के योग्य नहीं हो, तो ऐसे पुल/पुलिया को मुख्य अभियंता की स्वीकृति से अनुपयोगी घोषित कर दिया जायेगा। इस आशय की सूचना संबंधित जिला पदाधिकारी को देते हुए पुल/पुलिया स्थल पर सूचना–पट्ट पर अंकित कर दिया जायेगा। ऐसे पुल/पुलिया पर दोनो ओर दीवार चिनाई कर आवागमन पूरी तरह से बन्द कर दिया जायेगा।

12.0 अनुपयोगी संरचना के बदले नवनिर्माण

जिन पुल/पुलियों को ध्वस्त किया जाना आवश्यक होगा, उन्हें मुख्य अभियंता के निरीक्षणोपरान्त जिला पदाधिकारी को सूचित करते हुए आवागमन हेतु प्रतिबन्धित घोषित कर आम जनता को सूचित किया जाएगा तथा उन्हें ध्वस्त करने के साथ–साथ नए निर्माण की कार्रवाई की जाएगी। इस परिस्थिति में वैकल्पिक मार्ग की सूचना भी आम जनता को दी जाएगी।

13.0 अन्य विभागों के स्वामित्व का पुल/पुलिया

13.1 अन्य विभागों द्वारा राज्य के नदियों/धारों/नहरों पर सेतु/संरचना निर्माण कराने के पूर्व जल संसाधन विभाग से विधिवत अद्यतन प्रकिया के तहत अनापत्ति प्रमाण–पत्र प्राप्त करना आवश्यक होगा।

13.2 बिना विभागीय पूर्वानुमति/अनापत्ति प्रमाण पत्र के किसी अन्य विभाग को नदियों/धारों/नहरों आदि पर किसी भी तरह की संरचना/अन्य कार्य नही करने दिया जायेगा।

13.3 पथ निर्माण विभाग, पंचायती राज विभाग, ग्रामीण कार्य विभाग, ग्रामीण विकास विभाग, योजना एवं विकास विभाग अथवा अन्य किसी भी विभाग द्वारा नहरों/नदियों/धारों पर निर्मित सभी पुल पुलियों का नियमित निरीक्षण/जांच, रख–रखाव एवं आवश्यक मरम्मति संरचना के स्वामित्व वाले विभाग द्वारा किया जाएगा।

13.4 प्रत्येक वर्ष दिसम्बर माह में नियमित रूप से अन्य विभागों को उनके विभाग द्वारा निर्मित पुल/पुलियों की सूची संलग्न करते हुए पत्र द्वारा सूचित किया जाएगा कि सूची में अंकित पुलों/पुलियों की स्थिति से वे संतुष्ट हो ले कि ये संरचनाएं आवागमन के लिए सुरक्षित है। इन संरचनाओं की सुरक्षा यदि किसी तरह प्रभावित होती है तो इसकी पूर्ण जवाबदेही उनके विभाग की होगी।

13.5 जल संसाधन विभाग द्वारा नवम्बर माह में तथा मई माह में निरीक्षण के क्रम में यदि अन्य विभागों द्वारा निर्मित किसी पुल/पुलिया में प्रथम दृष्टया कोई ऐसी कमी परिलक्षित हो जो आवागमन हेतु सुरक्षित नहीं मानी जाए, तो वैसी स्थिति में पुल/पुलिया के निर्माण करने वाले विभाग के कार्यपालक अभियंता को तुरंत सूचित किया जायेगा।

13.6 नहरों पर निर्मित पुलों/पुलियों जिनके स्वामित्व के विषय में सूचना प्राप्त नहीं हो पा रही हो, ऐसे सभी पुल/पुलिया की सूची से पुल/पुलिया निर्माण करने वाले सभी विभागों (पथ निर्माण विभाग, ग्रामीण कार्य विभाग, योजना एवं विकास विभाग, पंचायती राज विभाग इत्यादि) के साथ–साथ जिला पदाधिकारी को इस आशय के साथ पत्र दिया जायेगा कि इन संरचनाओं का स्वामित्व किसी अन्य विभाग द्वारा स्वीकार नहीं किया जा रहा है। अब इसे जल संसाधन विभाग द्वारा इसका स्वतः स्वामित्व लेते हुए इसके संरचनात्मक स्थायित्व की जाँच कर अग्रेत्तर कार्रवाई की जायेगी। तदोपरांत रख–रखाव/संपोषण/संधारण की कार्रवाई की जायेगी। तदोपरांत ऐसी समस्त संरचनाओं के रख–रखाव/संरक्षण का उत्तरदायित्व जल संसाधन विभाग का होगा।

उक्त पर माननीय मंत्री, जल संसाधन विभाग का अनुमोदन प्राप्त है।

अनुलग्नक :– परिशिष्ट–I, II एवं III

23/08/24

(आलोक कुमार)
संयुक्त सचिव (अभियंत्रण)
पटना, दिनांक 23/8/24

ज्ञापांकः–1/पी०एम०सी०/विविध/181/2024–655
प्रतिलिपि – महालेखाकार (ले० एवं ह०)/महालेखाकार (लेखा परीक्षा), बिहार, वीरचन्द्र पटेल मार्ग, पटना को सूचनार्थ एवं आवश्यक कार्रवाई हेतु प्रेषित ।

23/08/24

(आलोक कुमार)
संयुक्त सचिव (अभियंत्रण)
पटना, दिनांक 23/8/24

ज्ञापांक– 1/पी०एम०सी०/विविध/181/2024–655
प्रतिलिपि –सचिव (संसाधन), वित्त विभाग, बिहार, पटना को सूचनार्थ एवं आवश्यक कार्रवाई हेतु प्रेषित ।

23/08/24

(आलोक कुमार)
संयुक्त सचिव (अभियंत्रण)
पटना, दिनांक 23/8/24

ज्ञापांक– 1/पी०एम०सी०/विविध/181/2024–655
प्रतिलिपि – सभी कोषागार पदाधिकारी, बिहार को सूचनार्थ एवं आवश्यक कार्रवाई हेतु प्रेषित

23/08/24

(आलोक कुमार)
संयुक्त सचिव (अभियंत्रण)

ज्ञापांक– 1/पी०एम०सी०/विविध/181/2024–655 पटना, दिनांक - 23/8/24

प्रतिलिपि – माननीय मंत्री के आप्त सचिव, जल संसाधन विभाग/अपर मुख्य सचिव के आप्त सचिव, जल संसाधन विभाग, पटना को सूचनार्थ एवं आवश्यक कार्रवाई हेतु प्रेषित।

23/08/24
(आलोक कुमार)
संयुक्त सचिव (अभियंत्रण)

ज्ञापांक– 1/पी०एम०सी०/विविध/181/2024–655 पटना, दिनांक 23/8/24

प्रतिलिपि सभी अभियंता प्रमुख/सभी मुख्य अभियंता/सभी संयुक्त सचिव/सभी अधीक्षण अभियंता/सभी निदेशक/सभी संयुक्त निदेशक/सभी कार्यपालक अभियंता/सभी उप सचिव/सभी अवर सचिव जल संसाधन विभाग/स्थानिक अभियंता, सम्पर्क कार्यालय, जल संसाधन विभाग, बिहार सरकार, काठमाण्डू (नेपाल) को सूचनार्थ एवं आवश्यक कार्रवाई हेतु प्रेषित ।

23/08/24
(आलोक कुमार)
संयुक्त सचिव (अभियंत्रण)

ज्ञापांक– 1/पी०एम०सी०/विविध/181/2024–655 पटना, दिनांक 23/8/24

प्रतिलिपिः– कार्यपालक अभियंता, आई०टी०, सूचना प्रावैधिकी केन्द्र, जल संसाधन विभाग, बिहार, पटना को वेब साईट पर अपलोड करने तथा सभी संबंधित पदाधिकारियों को ई–मेल के माध्यम से पत्र भेजने हेतु प्रेषित ।

23/08/24
(आलोक कुमार)
संयुक्त सचिव (अभियंत्रण)

परिशिष्ट–I

PROFORMA FOR ORIGINAL BRIDGE REPORTS

(To be filled in Bridge register)

(REFER IRC : SP-18)

1.0 General
1.1 Name of the Bridge/No. of the bridge, name of the river
1.2. Name, No. of Highway, Bridge Location
1.3. Location (Latitude/Longitude)
2. Details of span (giving reference to spans for clarity)
2.1. No. of spans (length centre to centre of piers)
2.2. Length of bridge
2.3. Angle of crossing
3. Hydraulic particulars
3.1. Drainage area
3.2. Design discharge
3.3. Design HFL
3.4. Vertical clearance
*3.5. LWL
*3.6. Maximum depth of flow
*3.7. Maximum velocity of flow
*3.8. Ordinary flood level
3.9. Safe scour depths for
(a) piers
(b) abutments
4. Loadings
4.1. Design live load (if data is not available then rated capacity)
4.2. Special forces considered in design
5. Soil particulars
5.1. Founding strata
*5.2. If available a cross-section of the bed showing the different strata based on bore hole data (necessary for major bridges only).
6. Foundations
6.1. Type and brief details (Well or Open or piles, RCC or PCC)
6.2. Depth of foundations (measured from bottom of sub-structure)
6.3. Report settlements, excessive scour, etc.
7. Sub-structure
7.1. Type (PSC, RCC, CC or masonry)
7.2. Dimensions of pier
7.3. Dimensions of abutment
7.4. Details of returns (type and dimensions)
8. Bearings
8.1. Type

8.2. Brief details
9. Superstructure
9.1. Type
9.2 Brief details
9.3. Carriageway and footpath widths
*9.4. Details of prestressing
9.5. Details of wearing coat
9.6. Details of Expansion Joints
9.7. Details of Articulation.
Protective works
Type of protective works (guidebund, abutment, protection spurs, etc.)
*10.2. Details of protective works (show by sketch, height, slope, thickness of slope pitching and apron, and for layout refer to the detailed plans)
10.3. Details of bed protection
11. Position of surface utilities (telephone cables, electric line, water vent, sewage, etc.)
*12 Design details & drawings (give reference to the designs and drawings with their comments and the source where available)
*13 Diagrammatic sketch (give LS of bridge showing span arrangement, bed level of the river with the RLs for major bridges, soil profile based on bore data)
*14 Special features (give constructional or design problems, etc. encountered which may be of special guidance for future)
15 Date when completed and opened to traffic
16 Cost of the project
17 Name of the constructing agency
18 Date of the report
19 Dated signature of the reporting officer
Designation of the reporting officer

Note.—Items marked * need not be filled up for Minor Bridges.

परिशिष्ट–II

PROFORMA FOR INSPECTION REPORT
(REFER IRC : SP-18)

1. General
1.1. Name of bridge/No. of the bridge, name of the river
1.2. Name, No. of Highway, Bridge Location
2. Type of bridge
3. Date of last Inspection
4. Approaches
4.1. Condition of pavement surface (Report unevenness settlement, cracking, pot-holes, etc.)
4.2. Side slopes (report pitched or unpitched, condition of pitching/turfing any signs of slope failure, etc.)
4.3. Erosion of embankment by rain cuts or any other damage to embankment
4.4. Approach slab (report settlement, cracks, movement, etc.)
4.5. Approach geometries (report whether it satisfies the standards as in force)
5. Protective Works
5.1. Type (mention whether guide bund or protection around abutments or spurs)
5.2. Report damage of the layout, cross-section profile (check whether the layout and the cross-sections are in order)
5.3. Report condition of slope pitching, apron and toe walls indicating the nature of damage if any (check for proper slope, thickness of pitching in the slopes, width and thickness of apron, erosion of toe walls, etc.) Proforma for Inspection Report
5.4. Report condition of floor protection works indicate nature of damage if any, (condition of impervious floor, flexible apron, curtain walls, etc.)
5.5. Extent of scour (report any abnormal scour)
*5.6. Reserve stone material (check against specified quantity)
6. Waterway
6.1. Report presence of obstruction, under growth^ etc.
'6.2. Report maximum observed scour and location and compare with the design values
6.3. Report any abnormal change in flow pattern
6.4. Report maximum flood level observed during the year and mark the same on the pier/abutment both on the U/S and D/S
6.5. Report abnormal afflux if any
6.6. Report adequacy of waterway
7.0. Foundations
7.1. Report settlement if any
7.2. Report cracking, disintegration, decay, erosion, cavitation, etc
7.3. Report damage due to impact of floating bodies, boulders, etc
7.4. For sub-ways report seepage if any, damage to the foundations, etc.

8. Substructure (piers, abutments and wingwalls)

8.1 Report efficiency of drainage of the backfill behind abutments (check functioning of weep holes, evidence of moisture on abutment faces, etc.)

8.2, Report cracking, disintegration, decay, etc. For sub-ways

8.3. Report condition of side retaining walls like cracking, disintegration, etc., and seepage, if any

9. Bearings

9.1. Metallic bearings

9.1.1. Report general condition (check rusting, cleanliness, ceasing of plates)

*9.1.2.Functioning (report excessive movement, tilting, jumping off guides)

9.1.3. Greasing/oil bath (report date of last greasing/oil bath and whether to be redone or not)

9.1.4. Report cracks in supporting member (abutment cap, pier cap, pedestal)

9.1.5. Report effectiveness of anchor bolts (check whether they are in position and tight)

9.2. Elastomeric bearings

9.2.1. Report condition of pads (oxidation, creep, flattening, bulging, splitting)

9.2.2. Report general cleanliness

9.3. Concrete bearings

9.3.1. Report any signs of distress (cracking, spalling, disintegrating)

9.3.2. Report any excessive tilting

10. Superstructure

10.1. Reinforced concrete and prestressed concrete members

10.1.1. Report spalling, disintegration or honey combing, etc

10.1.2. Report cracking (pattern, location, explain preferably by plotting on sketch)

10.1.3. Report corrosion of reinforcements if any

10.1.4. Report damages if any due to moving vehicle

10.1.5. Report condition of articulation (cracks if any)

10.1.6 Report perceptible vibrations if any

*10.1.7. Report excessive deflections or loss of camber if any (measure at same point each time)

*10.1.8. Report cracks in end anchorage zone (for prestressed concrete members)

*10.1.9. Report deflection at central hinge, tip of cantilever for cantilever bridges

10.2. Steel members

10.2.1. Report condition of paint

10.2.2. Report corrosion if any

*10.2.3. Report perceptible vibrations, if any

10.2.4. Report on alignment of members

10.2.5. Report condition of connection (adequacy, Looseness of rivets, bolts or wornout welds report specially on connection of stringers to cross girders, cross girders to main girders, gussets or splices, etc.)

10.2.6. Report camber and deflection

10.2.7 Report buckling, if any

10.2.8. Report on the cleanliness of members and joints (check choking of drainage holes provided in the bottom booms)

10.3. Masonry arches *

10.3.1. Report condition of joints mortar, pointing, masonry, etc.

10.3.2. Profile report flattening by observing rise of the arch at centre and quarter points.

10.3.3. Report cracks if any (indicate location, pattern, extent, depth, explain by sketches)

10.3.4. Check drainage of spandrel fillings (report bulging of spandrel walls if any

10.3.5. Check growth of vegetation

10.4. Timber members

10.4.1. Report condition of paint

10.4.2.Check decay, wear and tear, structural defects needing immediate replacement if any

10.4.3. Report condition of joints, splices, spikes, etc.

10.4.4. Report excessive sag, if any

*10.5. Suspension bridges

10.5.1. Report condition of cables

*10.5.2. Report condition of suspenders and their connectors

*10.5.3. Report condition of structural steel

10.5.4. Report condition of painting

*10.5.5. Report excessive oscillations if any requiring need of guy ropes

10.5.6. Report looseness of joints, bolts, rivets, welds

*10.5.7. Report condition of anchors (evidence of movement)

*10.5.8. Report condition of towers and saddles (verticality, lateral support)

11. Expansion joints

11.1. Functioning (Report cracks in deck in the existing gap and approximate temperatures)

11.2. Report condition of sealing material (for neoprenesealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumenfiller, check for hardening, cracking, etc.)

11.3. Report secureness of the joints

*11.4. Top sliding plate (report corrosion, damage to welds, etc.)

11.5. Locking of joints (report locking of joints especially for finger type expansion joints

11.6. Check for debris in open joints

11.7. Report rattling, if any

12. Wearing Coat (concrete/bitumen)

12.1. Report surface condition (cracks, spalling, disintegration, pot-holes

12.2. Report evidence of wear (tell-tale rings, check for thickness as against actual thickness, report date of last inspection)

13. Drainage spouts

13.1. Check clogging, deterioration and damage, if any
13.2. Check the projection of the spout on the underside (see whether structural members are being affected)
13.3. Report adequacy, thereof
13.4. For sub-ways report about adequacy of pumping arrangements, etc
14. Handrails
14.1. Report general condition (check expansion gaps, missing parts, if any, etc.)
14.2. Report damage due to collision
14.3. Check alignment (report any abruptness in profile)
15. Footpaths
15.1. Report general condition (damage due to mounting of vehicles)
15.2. Report missing footpath slabs
16. Utilities
16. 1. Report leakage of water and sewage pipes
16.2. Report any damage by telephone and electric cables
16.3. Report condition of lighting facilities
16.4. Report damages due to any other utilities
17. Bridge Number
17. 1 Report condition of painting.
18. Aesthetics
18.1. Report any visual intrusion (Bill-boards, paints on structural members, etc.)
19. Report whether maintenance recommended during last inspection has been done or not (give details).
20. Maintenance and improvement recommendations SI. No. Item needing Action Time when Remarks attention recommended to be completed
21. Certificate to be accorded by the inspecting official.

Certified that I have personally inspected this bridge.
Signature-
Designation of the inspecting officer.

Note: Items marked • need not be filled upfor Minor Bridges.

परिशिष्ट–III

(REFER IRC : SP : 52-1999)

Observations During Inspection

During Inspection a number of points have to be remembered. The inspection report form covers most of these points. The points to be checked while inspecting and the nature and significance of the problems, in brief, have been indicated in this chapter.

1.0 Road approaches and protection

1.1 Slopes of approach embanlunents become unstable if the base of the embankments is being attacked and washed away by the river flow. It is, therefore, necessary to check for scour at the base of embankment slopes. Where scour takes place, the embankment fill slips down. It is necessary to check for slip of embankment fill.

1.2 If rain water or in case of submersible bridges, river water, on the approaches to bridges is not drained properly water runs down the face of the embankment. This after some time, may wash the fill away. It can also cause damage to parts of abutment and wing walls. Hence, it is necessary to check for erosion of the fill near the abutments.

1.3 Cracking of the road or the edge of embankments behind abutments indicates that the wall has moved. Any cracking of the road or edge of embankment has, therefore, to be checked. Failure of embankments may be by formation of slip circles or by 'piping'. In both modes, there is loss of materials from around the abutinent.

1.4 Toe walls are usually provided at the end of embankment slopes to prevent scouring away. Sometimes concrete, steel or timber piles may be provided below toe walls. It is necessary to look for any 'away' movement of the toe wall or piles. Though small movements are common these are not serious. Movement of large sections of the wall are serious.

2.0 Stone pitching for slope protection:

One of the ways of protecting the slope surface from being washed away by rain or by water running off the road, is by providing stone pitching. It is necessary to look for cracks in the stone pitching. Cracks wider than 5 mm are serious. The stone pitching breaks up if the mortarpointing is poor. Pitching may crack due to settlements in embankment. It is necessary to observe for any scouror erosion at the edges of stone-pitching. Pieces broken off from stone pitching indicate bad undermining.

2.1 **Stone filled crates/boxes for slope protection:**

Wire or wooden crates or boxes filled with stonesare sometimes used to protect slopes from getting washed off in floods or due to water run-off from road. These crates can move considerably, and movement has to be checked. The wires and ties should also be checked to verify that these are in place. When the boxes move excessively the top of the slope gets exposed and the road cracks. There may be scour at the bottom of the slope, resulting in settlement of the boxes.

2.2 Boulder pitching for slope protection: For boulder pitching to be effective, the size and weight of the boulders should be such as to prevent the river or tide from moving these. As the embankment gets scoured at base, the boulder pitching sinks into the river bed. Any sinking or washing away should be carefully noted.

3.0 River bed protection

Rivers can damage the river bed under bridges. It is important to prevent this as it usually leadsto major damage to bridges. It is necessary to make a note of large holes in the river bed near or directly undera bridge. If the river flow is fast and if the river bed is soft, protection may have to be provided by:

1. Stone pitching
2. Concrete cover slab or concrete block pitching
3. Stone-filled crates or boxes
4. Boulder pitching.

(All these come under bed protection or aprons).

3.1 Scour in the river bed usually occurs at the edge of the bed protection or apron. Small scour holes are usually not important. If any scour holes go below the bed protection the same must be noted and reported. It is preferable to illustrate the note by means of a sketch. Cracks in the surface of the bed protection occur usually due to settlement. It is necessary to report all cracks in reinforced concrete aprons but for mass concrete or stone aprons, only large cracks usually need be reported. To find cracks, a spade should be used to scrape off any soil, sand and debris. If cracks are noticed, a sketch should be prepared. It is necessary to check for any sign of spalling of concrete or missing stones from pitching. It is important to remember that stones carried by fire river usually cause erosion of the surface o1' the concrete aprons. For reinforced concrete aprons, corrosion of reinforcement should be looked for.

3.2 Stone filled crate› or.boxes can be advantageously used for river bed protection. These are flexible and when scour takes place, they function as a "launching apron". The protection, therefore, is more effective. It is important to look for signs that the stone filled boxes garlanded around piers or abutments, have broken away. If this occurs, the river can very quickly destroy the bed protection. Damage or corrosion of wires and ties could also result in the destruction of protection work.

3.3 Boulder aprons: Boulder pitching or garlanding is used to prevent scour around piers. It is usually necessary to replenish the boulders lost during floods in filling up the scour holes. It is necessary to look for loss of stones of apron or garlanding during inspection.

4.0 **River behaviour and training works**

During inspection any changes in the river characteristics should be looked for carefully. Most of the changes and problems can be seen when looking from the bridge deck or when looking from the abutments while standing under the bridge. It may sometimes be necessary to walk along the banks for some distance onboth sides to check what is happening to the river.

5.0 **Obstructions in the waterway:**

The waterway under a bridge should be clear. Any obstruction can:

a. Cause scour in the bed or banks.

b. Cause successively larger obstruction due to further deposition and entanglement of debris.

It is, therefore, necessary to look for any debris piled up against piers and abutments or in the bed on theu/s of the bridge. Sometimes, the old bridge is not fully dismantled after a new bridge is built nearby. Parts of the old bridge can arrest debris and lead to scour. Under many bridges, some of the waterway is usually dry, except in floods. Farmers tcnd to put fences or bunds and may be huts on fire dry areas and start cultivation. Largc plants or trees and shrubs grown in bed can block waterway. Obstructions like these must be removed, especially when on the u/s of a bridge.

6.0 **Change of river course:**

If a river changes its course, it can destroy a bridge, especially when the change rakes place on its upstream. To judge whether a river is changing its course, bends in the river upstream of a bridge and condition of banks on bends should be examined, duly considering information obtained from local people. If the bank is steep with trees at the edge, but with nothing else growing on the bank, then it can be inferred that the river is shifting towards that bank. When a lot of water is seen flowing but the bank is not steep and small plants are seen growing with some mud or pebbles on the bank, then it can be inferred that the river is shifting away from that bank. If new islands are forming on the u/s, it means that the river is likely to change its course.

7.0 **Training works:**

7.1 The river affects the training works in four ways:

a. The river can atrack the end of the training work by moving beyond the u/s end of the works.

b. The river can wash off or disturb/damage the materials of the river training works.

c. Piles or walls may be moved forward due to scour.

d. The river training works may be damaged by floating logs or trees.

7.2 Sometimes, trees grown on terraces are used to train rivers. The trees are protected by stone filledcrates or boxes till they grow. Damage to trees used in river training works should be noted and dead and damaged trees should be replaced.

8.0 Sub-structure and retaining walls

8.1 It is usually found that for a bridge, the sub-structure and retaining wings or returns are made from the same material. However, to enable the inspector to fill in the report form properly, all types of materials are covered in each category. Substructure comprises abutments, returns, wing walls and piers.

8.2 Concrete **abutments,** wing walls and return walls

In concrete structures, the inspector should look for any cracking of concrete and indicate the important cracks on a sketch. In concrete, cracks are termed important if 1 mm or wider and/or if water seeps through them. Near the bearings, even fine cracks are important and these should be shown on the sketch.

8.3 Spalling of concrete should be noted and the area indicated on the sketch.

8.4 The inspector should indicate areas where the quality of concrete is poor, as apparent from honey combing and/or chemical attack.

8.5 It is necessary to observe leach marks, rust marks discolouration, leakage, cracks and spalling to infer corrosion of reinforcement. At the location of spalling, the cover to reinforcement and the reduction in diameter of the exposed bar or its stage/state of corrosion should be noted carefully.

9.0 Masonary abutments and returns

9.1 In masonry, it is necessary to map all cracks wider than 3 mm at the widest location and also when there is a step across a crack.

9.2 Any cracks near bearings especially if these go all around the bearings, and cracks which run underneath the bearings are important and should be noted very carefully.

9.3 It must be remembered that bulges noticed in abutments are more serious than those noticed in returns. Specially, when a bulge has horizonal cracks in it, careful noting is needed as this is a serious problem. A sketch showing the location and the extent of bulges should be prepared.

9.4 It is important to observe and note poor quality or loss of pointing.

9.5 Any deterioration of the bricks, stones or concrete blocks should be observed and noted.

10.0 Stacked abutments and returns

Stone filled crates or boxes or wire baskets are at times stacked together to form abutments and returns of simple and often temporary bridges. They could be used as abutments for timber bridges, Bailey bridges and steel beam bridges with timber decks. When these abutments settle or bulge, the deck may be damaged and the road may also be damaged. Any change in shape, cracks or hollows or settlement should be noted. The wires and ties can be cut by debris in the river or corrosion or excessive deformation of the crates or baskets. It is, therefore, necessary to inspect and note the condition *ot* the wires and ties.

11.0 Timber abutments and returns

Abutments and renims are sometimes made of logs tied or spiked together. Usually, these are provided for log bridges. Timber piles topped with timber cross-beam are used as abutments for timber bridges. Timber in contact with ground and water is prone to decay and insect attack. The ties and spikes can corrode and decay. It is necessary to check for the following during an inspection

1. Decay-near beams of spans, near ground and at water level.
2. Insect attack-at the seat of beams on abutments.

12. Piers

12.1 The different types of piers are shown in Sketches 8 tc 12. Boat inspection may be needed to inspect bridges on perennial rivers or on creeks. Ladders or soirie other arrangement may have to be provided for inspecting piers. In general, piers need to be inspected for the following:

i. Scour near the base of the piers.
ii. Damage near the base or damage to wells or piles including corrosion.
iii. Movement of the piers.
iv. Damage due to impact from boats, vessels, floating logs or trees or vehicles passing under the bridge.
v. Debris resting against piers.
vi. Vegetation growth on the piers.
vii. Leakage of water from expansion joints damaging the piers.

12.2 Concrete Piers: For piers built in concrete, it is necessary to inspect for the following:

i. Cracking of concrete, especially around bearings, in pile caps, wells and pier caps. Important cracks should be shown on a sketch.
ii. Spalling of concrete: Spalled areas should be shown on a sketch.
iii. Corrosion of reinforcement with special attention given to rust-stains from cracks and areas of spalledconcrete. If exposed, the loss in bar diameters should be measured.
iv. Areas of poor concrete especially showing honey combing and chemical attack.

12.3 Masonry piers: For piers built in masonry, it is necessary to remember that cracks can be caused by failure of foundations. These cracks are usually long and go deep into the body of the piers. Overloading may cause cracks around bearings. These may also be caused by free bearings prevented from moving. For piers in masonry, the following points need to be inspected:

i. Cracking of Masonry, especially long and wide cracks and any cracks near bearings.
ii. Poor pointing can lead to problems. Brick or stone masonry piers can be seriously weakened by lossof mortar pointing by erosion due to river flow. The flow of water past a pier and alternate wetting and drying can damage the pier material.
iii. Detcrioration of bricks or stones should be tested by hitting the surface with a hammer. If pieces falloff, the indication is that the bricks or stones are in poor condition.

12.4 Steel piers: Steel piers are usually trestle piers and each trestle consists of a number of membersjointed together. For steel piers, it is necessary to inspect for:

i. Debris in the joints of the steelwork, leading to corrosion.
ii. Deterioration of paint or galvanizing/metallizing.
iii. Corrosion, especially near water level and in creeks, in the portion between HTL and LTL.
iv. Bends in steel members and joints, usually caused by barges or logs/trees impacting.
v. Loose bolts or rivets and lost welds or cracks near welds and bolt holes.
vi. Cracking especially near bearings.

12.5Timber piers: Wet timber decays. For timber piers, it is necessary to inspect for:

i. Debris in the joints.
ii. Decay at joints and near water levels.
iii. Insect attack especially below water level in salt water. Attack by marine borers is very common here.

iv. Splits in timber, especially near bolt holes and at or below water-level.

v. Loose bolts or pins at joints.

vi. Bends in timber, which may be caused by impact or overloads.

vii. Corrosion of steel parts especially at water level.

13 Superstructure

13.1 General: Each span of a bridge will have to be inspected and each superstructure will have to be recorded in a separate part of the form. The general inspection should be carried out both from the top of the deck and from under the deck. The points to be checked during general inspection include:

i. Impact damage to beams trusses or bracings caused by vehicles, boats or logs.

ii. Debris and vegetation on beams, misses, bracings or in joints.

iii. Water coming through the bridge deck, signs of wetness on steel work, on timber and on concrete, respectively in the form of rust marks, water run marks and dark areas with build up of white material on surface, should be noted.

iv. Water from the deck-drainage flowing on the girders, trusses, beams or bracings.

v. Adequate headroom for overbridges exists and is not encroached upon. The actual head room should be noted.

vi. Excessive deflections in superstructure.

vii. Cracking and spalling in superstructure.

13.2 Concrete girders: If cracks are noticed, these should be measured for length and maximum width. A sketch should be included in the report. Date and ends of cracks should be marked and preferably glass tell- tales should be attached. The progress of the cracks akeady identified in the previous inspections should be observed and noted. For concrete girders, it is important to look for the following:

i. Cracks at ends of beams which spread up from the bearing seat (Sketch βS). It is a serious problem.

ii. Cracks parallel to the beams on the faces of bottom bulbs of beams. These cracks are normally due to corrosion anfi occur when the concrete in bulb-comers is about to spall. It is necessary, therefore, to tap the concrete here firmly with a hammer.

iii. Spalling of concrete which may be due to external impact or corrosion of reinforcement.

iv. Signs of corrosion of reinforcement. If any reinforcement is visible, a note of fire concrete cover andloss in diameter of the bar should be taken in the report.

v. Signs of poor quality of concrete, especially at the comers of bottom bulbs.

13.3 Steel girders and bracings: The parts of a steel girder are shown in Sketch 32.
For steel girders, it is necessary to inspect the following:

i. Deterioration of paint or galvanizing or metallizing on all main and cross girders.

ii. Corrosion of steel: Special attention should be given to wet areas and areas where debris accummulates. Ends of beams and girders also get badly corroded. Corrosion causes two very serious problems. These are:

(a) Lamination &

(b) Steel sections forced apart by increase in volume due to rusting. This causes rivets, bolts or welds to snap.

iii. Bends in webs and flanges of girders and bends in stiffeners and bracings: Serious overloading could cause bends along the length of girders. These are serious. Tfie size of the bends should be measured by using a string-line and mapped as far as possible.

iv. Loose bolts, rivets and lost welds: All these shoulfi be marked clearly on the structure with paint and on a sketch. Joints with loose bolts/rivets or lost welds should be shown (Sketch 41)

v. Cracking: Cracks at the locations of welds and holes should be sketched and marked on the girfier with paint. Cracking can be very dangerous.

13.4 Steel trusses: During inspection of steel trusses, attention has to be given to the following points:

i. Deterioration of paint, galvanizing or metallizing. This should be looked for especially at joints.

ii. Corrosion: Corrosion normally starts at joints. The joints of the bottom chord are affected first. Where corrosion is apparent, lamination should be looked for. Signs of forcing apart of plates should also be searched.

iii. Bends in truss members: Any bend member should be marked with paint and a sketch drawn. As far as possible, the size of the bend should be measured.

iv. Bent or damaged joints: Damaged or bent joints should be marked with painl and a sketch drawn.

v. Bent or damaged bracings: The pattern of the bracing system should be sketched and damged members should be clearly shown on the sketch and marking done in paint on the members. The bends should be measured, if possible.

vi. Loose bolts/rivets and lost welds: All these should be marked on site with paint also indicating the affected joints. A sketch showing the locations of damage should be drawn. Any bending or displacement of truss as a whole out of plane should be measured and marked and also shown on sketch. Any distress or any displacement in pins of pin-joints should be noted.

vii. Cracking: This is serious in trusses as it can lead to sudden collapse as the members are usually small. The cracks should be marked with paint and sketched. Cracks in trusses should be reported to the higher authorities as soon as possible.

13.5 Timber decks: These include log bridges, timber beam bridges and bridge decks made from laminated timber. Log bridges normally have a short life, being used for temporary bridges. However, these can last for a long time if properly constructed and maintained. For timber bridge decks, it is necessary during inspection, to give attention to the following points:

(i) Decay any where in the timber: Areas of dampness and locations around nails and spikes should be closely inspected for decay. If beam ends rest on ground or are likely to come in contact with soil, the ends decay faster. The ends of beans should be carefully inspected for decay. Logs having bark in place should be inspected very carefully and the bark should be removed wherever possible without endangering safety. The extent of decay should be assessed and noted.

(ii) Insect attack: The extent of insect attack should be assessed and noted. The spike test, hammer test and/or drill tests should be used. The size and depth of bad area should be ascertained upto a point where good timber is encountered. These should be sketched and recorded.

(iii) Splitting of timber: In timber, two types of splits are important and need be noted:

(a) Very large splits, tending to get larger, and

(b) Splits which may allow entry of water into the member but will not allow it to drain. In this context, splits in the top are dangerous as they do not drain. Cracks near the soffit can drain water off. Splits in glue laminated bridges can be serious, but these beams are not used in India.

(iv) Loose or corroded nails, spikes or fixing wires.

14.0 Masonry jack-arches: For masonry jack arches, the following points should be properly inspected:

(i) Change in shape of arch: This is usually a result of overloading or failure of arch material. If the change of shape is significant, the arch may have to be rebuilt.

(ii) Cracking or spalling of the bricks or stones,

(iii) Pointing of arches: Poor quality pointing or lost pointing can cause serious damage.

15.0 Masonry arches

15.1 For masonry arches, the most important observation is the change in shape of the arch. This could be observed in the following manner:

(i) Standing a long distance away, compare the shape on the left of the arch centre with that on the right. Sometimes, observing the shadow lines reveals a lot of information.

(ii) Look for any shift in the key stone at centre of face walls.

(iii) From underneath the arch look for any change in shape of barrel, even locally,

15.2 The arch barrel should be checked for any cracking. The cracks should be mapped. Cracks across the roadway are usually dangerous signs. Other important crack is due to separation of the face walls from the arch barrel. These cracks run in traffic direction. Alternatively, there may be bulging of the face walls. Any bulge in the face walls should be sketched.

15.3 Spandrel or face wall should not separate from the arch as shown in sketch.

15.4 Any spalling of stones or bricks from the arch or from spandrel walls should be noted.

15.5 Quality and loss of pointing should be noted.

15.6 Leakage **through** arch: With the effects of weather and water, the materials of the arch generally deteriorate. Som.e water leaks through most arches. Small leakage does not cause problems. If the leakage is large, white stains can be observed near joints and even clear wet areas can be seen. If leakage is excessive, the arch gets damaged.

15.7 Scour **under** arch **foundation:** This can be observed by pushing a long pole into the ground under the foundation of an arch bridge. If the pole can be pushed in, there is a problem of scour.

16 Bearings

16.1 General: Bearings of some kind or the other are provided under the deck. But it is not possible to inspect all parts of a bearing. The parts not inspected should be recorded as "not inspected". Whilé inspecting bearings it is firstly important to identify which bearings are fixed and which are free. Pedestals and areas under bearings are normally wet places where debris and vegetation collect. During inspection, attention should be given to the following:

(i) Debris and Vegetation around bearings and pedestals, these can damage a bearing and can also leadto malfunction due to obstruction to movement or jamming.

(ii) Poor drainage on top of cap under pedestals and of pedestals themselves: Any signs suggesting continued accumulation of water during rainy season and after noods recede, should be recorded.

(iii) **Prevented/Restricted Movements:** This point is difficult to determine. Small debris accumulationcannot usually lead to this as the weight of the deck is large.

(iv) Bearings not properly seated.

(v) Span or deck not properly seated on bearings.Damages to pedestals.

(vi) Damaged or missing grease boxes and missing parts.

(vii) Other extraneous supports inadvertently left in place during construction or inserted later on.

Cleanliness of the area around bearings.

16.2 In addition to the above, there are some important points specific to the type of bearings and these are given below:

16.3 Elastomeric bearings:

(i) Splitting, tearing or cracking of elastomer

16.4 Metal **bearings**

(i) Fallen cut segmental rollers

(ii) Corrosion.

(iii) Problems in lubrication system.

(iv) Damages to pins, knuckles and sliding or rolling surfaces.

(v) Cracks and bends in meral parts.

16.4 Other types of bearings may include concrete roller bearings, PTFE bearings, pot bearings, dish and knuckle bearings. Any damage to these or any malfunction should be recorded.

17. **Restraints:** On bridges in severe earthquake zones or on submersible bridges, deck restraints are usually provided, to prevent the span from falling *off.* The restraints may be of the following types and any damage or looseness should be recorded:

(i) Large bolt or bolts.

(ii) Concrete or R.C.C. Stoppers.

(iii) Special restraining bearings.

18 Expansion joints

18.1 Various types of expansion joints may be provided on bridges. The type provided and locations for a particular bridge should be ascertained from records. Physical verification should be done to ensure that the record is correct. Expansion joints can mostly be inspected from above. But sometimes, sound of loose plates or damage or leakage can be noticed from under the deck.

18.2 For expansion joint, the following points should be inspected:

(i) Damage to the concrete of the superstructure or of the dirt wall.

(ii) Debris or vegetation in the joints-stones or other debris can stop some of the parts from moving.

(iii) Loose or dannged fixtures and fastenings. This is a common problem with bolts and steel parts.

(iv) Damage or corrosion to metal parts of the joints.

(v) Damages to rubber water seals-some joints have a water-seal to prevent water and debris from the deck getting into the joint, Stones rubbing on water-seals can puncture the same.

(vi) Fingers of the finger type expansion joints nay deform or snap or debris can arrest their movement.

19.0 Parapets and railings

19.1 Railings may be removable or fixed and are usually made of angle iron posts and Ct.I. Pipe railings. For submersible bridges, collapsible railings are sometimes used. Parapets are usually solid or with patterns and may be made of masonry, concrete, R.C.C. or steel. For some bridges unsurniountable or deflecting crash-barriers may also be provided. Log bridges or culverts may have only guardstones. Parapets and barriers can get damaged by impact from vehicles. Sometimes, this causes damage to the superstructure near parapets.

19.2 The following poinrs need to be inspected:

(i) **Impact damage to parapets:** A note should be made of any damage to parapets and also to the bridge at that location.

(ii) Loose or damaged fixtures and fastenings.

(iii) **Posts loose at base:** This is relevant when precast R.C.C. or P.C.C. or steel or timber posts are fittedinto holes in the concrete runner members.

In addition, some points specific to the material of the parapet also need be considered.

19.3 Steel parapets

(i) Damaged galvanizing or paint

(ii) Corrosion

19.4 Concrete parapets

(i) Cracking

(ii) Spalling of concrete-at corner posts and rails

(iii) Corrosion of reinforcement-especially at comer posts and rails and at locations of spalled concrete

(iv) Poor Concrete and

(v) Vegetation and debris

19.5 Timber parapets

(i) Decay-especially at bases of posts and at joints

(ii) Insect attaCk

(iii) Splits in timber

(iv) Vegetation and debris

19.6 Masonry parapets

(i) Serious Cracks-Masonry cracks under vehicular impact and gets pushed outwards. Small cracks areusually not important.

(ii) Outward movement or bending of parapets

(iii) Poor Pointing

(iv) Deterioration of brick or stone in parapets

20.0 Wearing course and footpaths

20.1 The road Surface on a bridge i.e. the wearing course, can be of bituminous materials, concrete, steel or timber. If footpaths are of the same materials, the report can be made for both together. Otherwise, report on road and footpaths should be separate.

20.2 Bituniinous wearing course-where small movements are expected at expansion joints, bituminous wearing course can cover the gap at the joint. The surface often cracks or breaks up over these joints. The following points need attention.

(i) Wearing course breaking up or lifting off the deck concrete-especially at expansion joint and water-spouts.

(ii) Cracked wearing course above buried joints-any damage to or exposure of the water proofing layer, if any, between the deck and wearing coat should be noted.

20.3 Concrete wearing course: The following points need attention:

(i) Cracking Of concrete: Any cracks which begin in spalled areas of the superstructure could be serious.

Long span bridges especially cantilevers can deflect considerably and induce cracks.

(ii) Spalling of concrete (Sketch 47)

(iii) Exposed and corroded reinforcement

(iv) Poor concrete

(v) Wear of the surface due to small stones on the wearing course and those lodged in tyre surface.

(vi) Loss of filling in bituminous joints

Potholes in the wearing course

20.4 Steel and Timber Wearing Course are usually not encountered. However, the basic points as for other wearing course remain the same. Points related to materials themselves should also be given attention.

21.0 Utilities:

Utilities like water pipe lines, electric cables, telephone cables, gas lines, etc., may be provided on the deck or under it. The following points need to be checked:

(i) Whether or not the utility is authorised

(ii) Whether any leakage is seen

(iii) Damage caused by leaking utilities

(iv) Damage caused to utilities themselves

21.1 Electric poles: On some bridges near cities, electric street lights are provided. The fixing arrangement may be in concrete pedestals, but holding down is usually by bolts. The pedestals also get damaged by vehicular impact. The poles, at times may get bent. The lights may not be functioning. The holding down bolts may corrode and snap. The condition of all these components should be noted and recorded.

22 Culverts

22.1 As the openings in the culverts are small, blockage by debris and vegetation is often found. At places, people may try to impound water by providing stone slabs or such other obstructions in front of the openings on the upstream of the culverts. Unless these obsuuctions are removed before monsoons, the culverts are likely to be damaged, and outflanking is also possible.

22.2 For culverts, the following points need to be inspected:

(i) Debris, vegetation, etc. inside or near the culvert

(ii) Settlement of parts of the culverts.

(iii) Scour at ends of culverts and at edges of aprons. Usually there is silting on the u/s and scour on thed/s.

22.3 Concrete culverts: For these, the following points should be inspected:

(i) Cracking

(ii) Spalling

(iii) Corrosion of reinforcement

(iv) Poor concrete.

22.4 Culvert aprons: Like some bridges, some culverts may be provided with aprons, usually on the d/s. Scour may cause the aprons to setfle at the edges. Concrete or stone pitching may crack and break up. Any damage to or loss of material from the aprons should be recorded.

22.5 Headwalls: Embankment at the ends of the culverts is retained by headwalls. These walls may be in masonry or in concrete. If the headwalls settle or get pushed outward, the flow can damage the wall as well as the embankment. It is, therefore, necessary to check for movement of headwalls, especially at the joint between the barrel around waterway opening and the headwall. In addition, depending on the material, the following points need to be inspected:

(i) For concrete headwalls, cracking, spalling, corrosion of reinforcement and poor concrete.

(ii) For masonry headwalls, cracking poor pointing, and deterioration of bricks or stone.

23.0 Miscellaneous

23.1 Access: For any inspection or monitoring, easy and preferably comfortable access to all parts of a bridge or culvert is necessary. The bridges should be inspectable and maintainable and access plays a major role in these operations. It is for this reason that mobile inspection units specially developed for the purpose of detailed inspection are used these days. Older bridges may not have been provided with access arrangements. Newer bridges may have some arrangement for access. Where provided, the condition of the access arrangement should be recorded. The problems encountered due to non-provision of access arrangement or inadequate access arrangement should be recorded. If any hollow component, like a box super-structure or hammer head is found to be without access for going inside the box, the same needs to be recorded and brought to the notice of higher authorities.

23.2 Instrumentation: Some bridges under distress or some important long span bridges with innovative design may be provided with instrumentation for monitoring stresses, etc. The condition of the instrumentation provided and whether the same is functioning, may be noted, if possible.