Road Development Authority

Japan International Cooperation Agency

Bridge Inventory Development Manual

October 2017

The Project for Capacity Development on Bridge Management In The Democratic Socialist Republic of Sri Lanka

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Abbreviations

Organizations	
GOSL	Government of Sri Lanka
MHEH	Ministry of Higher Education and Highways
JICA	Japan International Cooperation Agency
RDA	Road Development Authority
Division in RDA	
CD	Construction Division
ES	Engineering Services
M&M	Maintenance and Management
BD	Bridge Designs
P	Planning
PMU	Project Management Unit
RBCU	Rural Bridges Construction Unit
R&D	Research and Development
BM&AU	Bridge Management and Assessment Unit
BAU	Bridge Assessment Unit (1990s)
Position	
DG	Director General
ADG	Additional Director General
DD	Deputy Director
C/P	Counterpart
PD	Provincial Director
CE	Chief Engineer
EE	Executive Engineer
TO	Technical Officer
Manual	
BMM1997	Bridge Maintenance Manual /1997 RDA
RMM1989	Road Maintenance Manual /1989.2 RDA
VRCSG	Visual Road Condition Surveys Guidelines / 2012.6 RDA Planning Division
Others	
BMS	Bridge Management System
OJT	On-the-Job Training
BOQ	Bill of Quantity
RMTF	Road Maintenance Trust Fund
BIV	Bridge Inspection Vehicle
PPE	Personal Protective Equipment
DP	Damage Point
HI	Health Index
II	Importance Index
FOI	Functionally Obsolete Index
LHS	Left Hand Side
RHS	Right Hand Side
BDS	Bridge Database System
BRMS	Bridge Repair and maintenance System
BISS	Bridge Inspection Support System

1. Purpose of Developing Bridge Inventory

Bridge Inventory is developed for the purpose of storage and collection of basic data and information on the present condition of bridges for repairing, widening and reconstruction.

Bridge Inventory should have information of existing condition of bridges for repairing, widening and reconstruction. The basic rules for developing Bridge Inventory are given below:

(1) At the time of new construction and reconstruction of the bridge, the drawings must be stored in database while developing Inventory data.

(2) If the Bridge Inventory is not available, it should be prepared at the time of inspection by collecting information referring to design documents.

(3) If the design documents are unavailable, the major dimensions must be measured at the site and the inventory data must be prepared.

(4) When the bridge type of the widened section is different from the original bridge type, Inventory data of the widened section shall also be collected.

2. Content of Bridge Inventory

Inventory data should be based on following items.

Inventory data contains:

- Basic Information
- Importance Index for Repair
- Bridge Function Obsolete Index for Reconstruction
- Structural Information

2.1. Basic Information

Definition of a Bridge: Single Span > 3.0m

Multiple Spans: any Span > 3.0m

(1) a) Route Number

National Roads maintained by RDA is categorized as, AA, AB, AC or B. Route Number shall be shown by 3digits

(e.g. AA002)

b) Name of Road

Shall be shown as in the roads list of RDA.

(e.g. Colombo-Galle-Hambantota-Wellawaya)

(2) a) Bridge Number

The location of the bridge on the route, serial number of the bridge where n is the serial number of that culvert / bridge within that kilometer. Before passing N^{th} km post, the bridge Number is called N/n

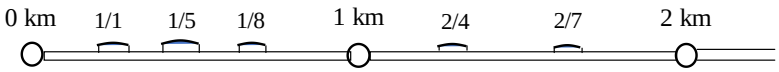


Figure 2.1 Bridge numbering

b) Name of Bridge

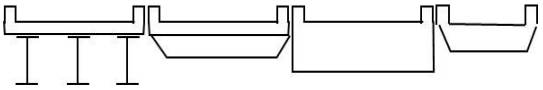
Name of the Bridge shall be mentioned in this section. If not, keep it blank.

(3) Separation/Widened

a) Separation

The Bridge is separated structure such as different lanes, shall be mentioned here.

Separation has data up to 4 sections. For example, if the bridge is separated 4 section with name of Br.1-1, Br.1-2, Br.1-3, Br.1-4, separate structure data shall be given.



Br.1-1 **Br.1-2** **Br.1-3** **Br.1-4**

Figure 2.2 Separation of structure

b) Widened

The Bridge is widened from original condition. Record this condition. One side or both sides of widening are noted but cannot be recorded as different structure types, but notes can be given.

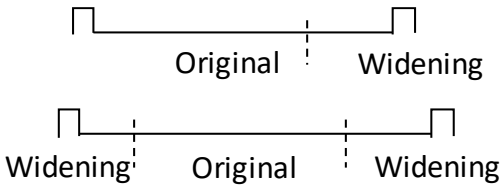


Figure 2.3 Widening to one side/two sides

(4) Province /District

a) Province

Administrative divisions in Sri Lanka consists of 9 Provinces. Choose codes accordingly.

Table 2.1 Province

Province code	Province name
1	Western
2	Central
3	Southern
4	Northern
5	Eastern
6	North Western
7	North Central
8	Sabaragamuwa
9	Uva

b) District

The number of districts in each province and their codes are given below.

Table 2.2 District

Province Name	Province Code	District code	District name
Western		Western	
	1	11	Colombo
	1	12	Gampaha
	1	13	Kalutara
Central		Central	
	2	21	Kandy
	2	22	Matale
	2	23	Nuwara Eliya
Southern		Southern	
	3	31	Galle
	3	32	Matara
	3	33	Hambantota
Northern		Northern	
	4	41	Jaffna
	4	42	Vavuniya
	4	43	Mannar
	4	44	Mullaitivu
	4	45	Kilinochchi
Eastern		Eastern	
	5	51	Batticaloa
	5	52	Trincomalee
	5	53	Ampara
North Western		North Western	
	6	61	Kurunegala
	6	62	Puttalam
North Central		North Central	
	7	71	Anuradhapura
	7	72	Polonnaruwa
Sabaragamuwa		Sabaragamuwa	
	8	81	Ratnapura
	8	82	Kegalle
Uva		Uva	
	9	91	Badulla
	9	92	Monaragala

(5) EE Division

There is a RDA Provincial Director’s Office in each Province and under Provincial Director’s office there are CE offices & under one CE office there are number of EE offices as well. Exception is having an additional Provincial Director in Akkaraipattu, in-charge of Ampara CE region.

Table 2.3 EE Division

EE division code	District code	EE division name
Western		
111	11	Colombo
112	11	Avissawella
121	12	Gampaha
122	12	Negombo
123	12	Nittambuwa
131	13	Kalutara
132	13	Agalawatta
133	13	Horana
Central		
211	21	Kandy
212	21	Kadugannawa
213	21	Kundasale
221	22	Matale
222	22	Nalanda
231	23	Nuwaraeliya
232	23	Norwood
233	23	Haguranketha
Southern		
311	31	Galle
312	31	Hiniduma
321	32	Matara
322	32	Deniyaya
331	33	Tangalle
332	33	Kataragama
333	33	Hambanthota
Northern		
411	41	Jaffna
412	41	Point Pedro/Palle
421	42	Vavuniya
431	43	Mannar
441	44	Mullativu
451	45	Kilinochchi
Eastern		
511	51	Batticaloa
521	52	Trincomalee
531	53	Ampara
532	53	Kalmunai
533	53	Akkaraipattu
North Western		
611	61	Kurunegala
612	61	Maho
613	61	Kuliyapitiya
621	62	Chilaw
622	62	Puttalam
North Central		
711	71	Anuradhapura
712	71	Medawachchiya
713	71	Maradankadawala
721	72	Polonnaruwa
722	72	Habarana

Sabaragamuwa		
811	81	Ratnapura
812	81	Pelmadulla
813	81	Embilipitiya
821	82	Kegalle
822	82	Ruwanwella
Uva		
911	91	Bandarawela
912	91	Badulla
913	91	Mahiyangana
921	92	Monaragala
922	92	Bibile

(6) Location Start / Location End

Record the latitude and longitude measured by GPS at each abutment/edge (A1 LHS and A2 RHS) of the bridge

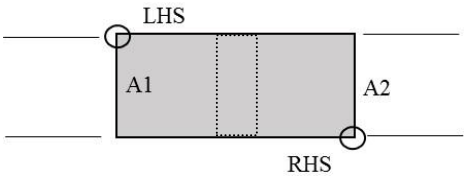


Figure 2.4 Location for GPS Coordinates

(7) Length of Bridge /Total Number of Span:

Recording method of span length. (e.g.: Bridge length = 90.0 m)

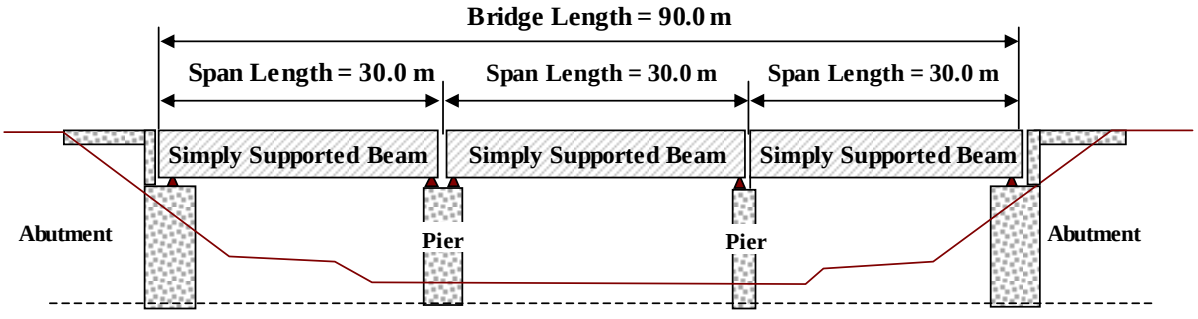


Figure 2.5 Length of Bridge

Bridge length of an Arch Bridge is given as follows.

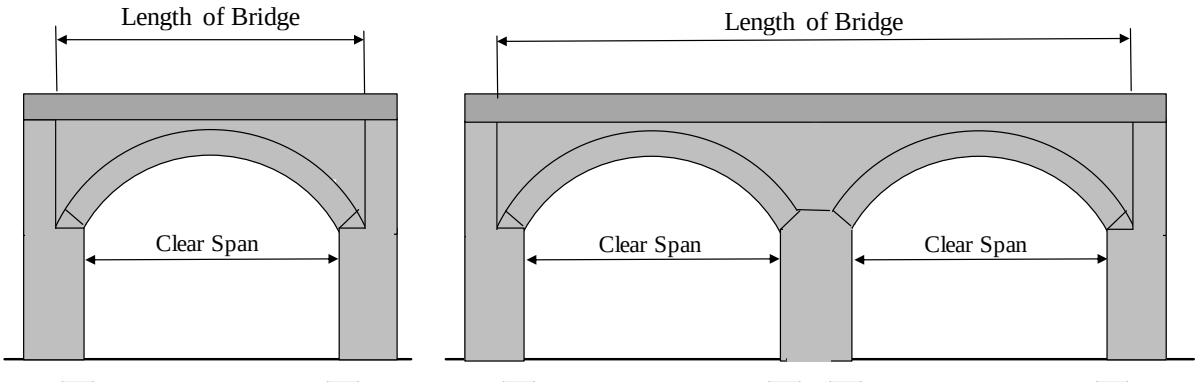


Figure 2.6 Length of Arch Bridge

Bridge length of the Box Bridge is given as follows.

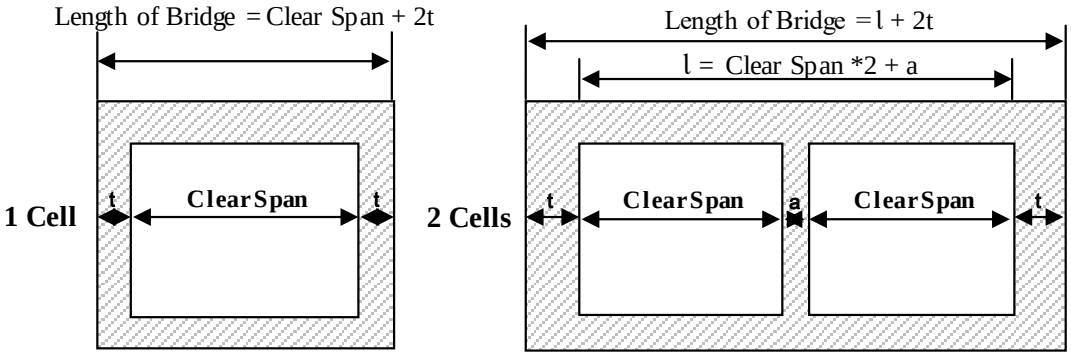


Figure 2.7 Length of Box Bridge

If the structure is skewed the bridge span can be referred as a perpendicular distance between the walls.

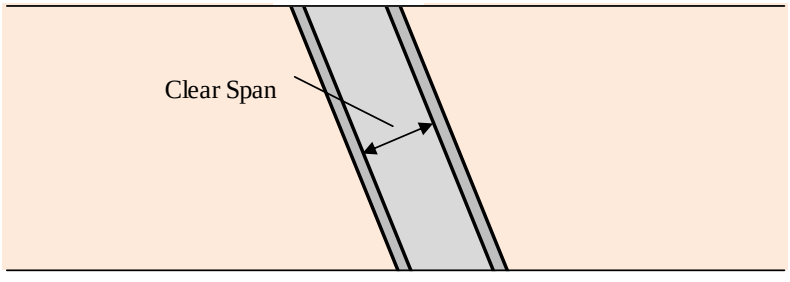


Figure 2.8 Skew Bridge

(8) Span Arrangement (Refer (7) Length of Bridge / Total Number of Spans)

(9) Width: (Overall / Effective)

a) Overall Width (From outside to outside of bridge); Effective Width (Overall Width – Handrail width)
b) Overall Width = Measured distance between outside of handrail.
c) Effective Width = Carriageway Width + Sidewalk Width

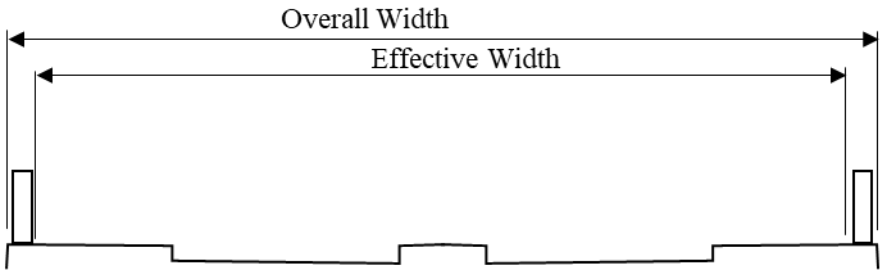


Figure 2.9 Width of Bridge

(10) Width of Cross section

If there are sidewalks, record the width of each sidewalk.
Record left side Carriageway, Center median & Right Carriageway

a) Left Sidewalk
Separated pathway for pedestrians to pass on the left side should be mentioned here

b) Right Sidewalk
Separated pathway for pedestrians to pass on the right side should be mentioned here

c) Left Carriageway
The part of a road intended for vehicles rather than pedestrians which usually have one or more lanes on the left side should be mentioned here

d) Centre median
The median strip is the reserved area that separates opposing lanes of traffic on divided roadways should be mentioned here.

e) Right carriageway
The part of a road intended for vehicles rather than pedestrians which usually have one or more lanes on the right side should be mentioned here

f) Single lane carriageway
When the Bridge has only one lane, record the width as a single lane, with or without sidewalks.

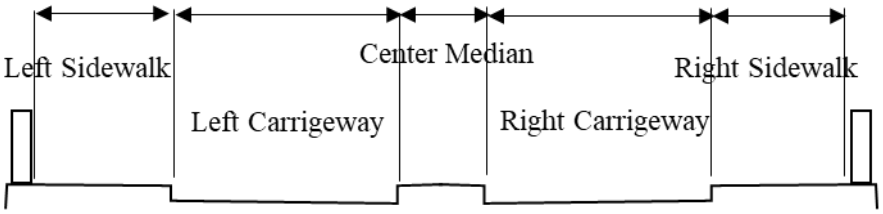


Figure 2.10 Carriageway and Sidewalk

(Additional explanation on Bridge absolute condition: BMS calculates the bridge absolute condition in the system following codes based on kerb -to -kerb width of roads and traffic capacity.)

(11) Skew Angle

Skew angle of 0° is described perpendicular to the road axis; the inclination from the center of the road axis. (Refer to the figure below) is the skew angle (Positive or Negative).

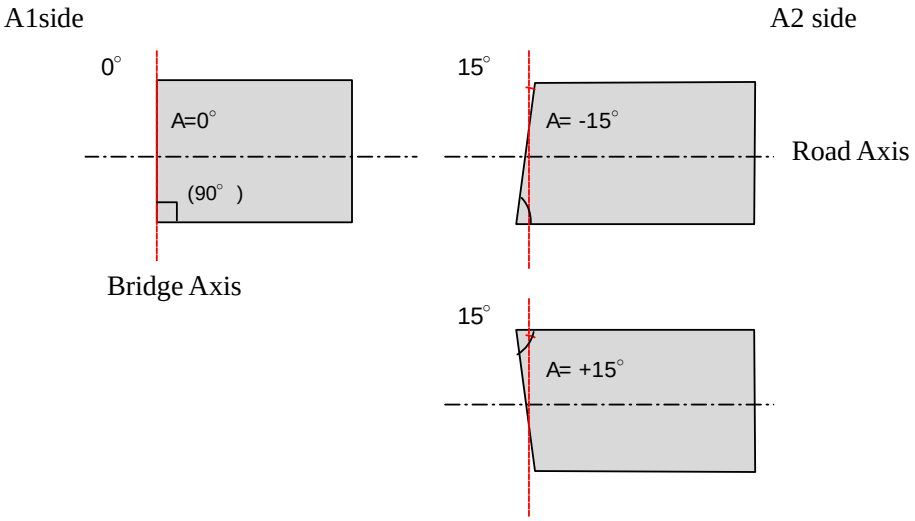


Figure 2.11 Skew Angle

(12) Types of Bridges

Table 2.4 Types of Bridges

Type of Bridge	Description
RCS	Reinforced Concrete Slab
PSC	Prestressed Concrete Bridge
Box	Box Bridge
Steel	Steel/Truss Bridge
Arch	Arch Bridge
Other	Timber/Brick Bridge etc…

(13) Design Documents

Availability of technical design calculations including drawings and construction history, should be mentioned here.

(14) Year of Construction

Construction year is entered according to the available information.

(15) Design Live Load

Live loads are the weights of pedestrians, vehicles, borne by the bridge during its use and occupancy which should be mentioned here.
a) British Standard
b) Comment:

(16) Load Limit

Bridges having an axle load limit (or gross weight load rating) indicated by a sign posted in a visible position in front of the bridge, should be mentioned here.

(17) Traffic Volume - (v/d) & Commercial Vehicle Ratio (%)

Record traffic volume in vehicle/day (v/d) with the rate of heavy vehicles in %. This information is an indicator to grasp the deterioration factor (deck fatigue).

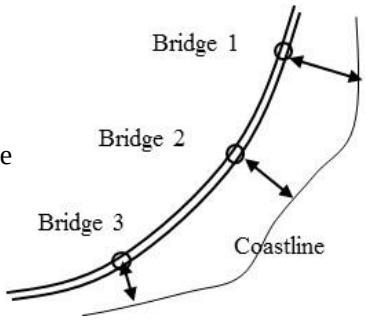
(18) Road Surface to Water Level (WL)

The height of the bridge across the river is from bridge surface to Normal Water Level (N.W.L) As for High Flood Level (H.F.L), record the height from road surface to H.F.L in case of flooding. Collect the information regarding H.F.L by interviewing local residents or markings etc... In case the road surface is submerged due to the flooding, record H.F.L height as negative “(-x.xx m)”.

(19) Distance to Coastline (m)

Bridge close to the sea is affected from wind and waves containing chloride ion. As a basic information of the bridge, record distance from Coastline approximately.

Figure 2.12 Distance to Coastal Line



2.2. Important Index for Repair

(20) Densely Inhabited Areas (DIA)

As per inhabited areas, following relevant code should be recorded in the inventory form.

Table 2.5 DIA Section

Classification	Code
Apply - A speed limit is applied (i.e. ; The road is in built-up areas)	2
Not Apply - A speed limit is NOT applied (i.e. ; The road is outside the built-up areas)	1

A road performs an important role on daily living function and economic activities in regions. In order to decide whether bridges are within DIA or outside DIA, a road that runs in Built-Up Areas and has a speed limit is referred to by The Gazette of the Democratic Socialist Republic of Sri Lanka (No.1763/26-Friday, JUNE 22, 2012). Therefore, this item should be updated in accordance with The Gazette.

(21) Connectivity to Important Facilities

As for facilities connected by a road, following relevant code should be recorded in the inventory form.

Table 2.6 Important Facilities

Classification	Code
Extremely important facilities; airports, seaports, major bus terminals, major train stations, government hospitals	3
Important facilities; national schools, places of tourist attraction, agricultural farms, industrial facilities, places of religious importance, national shrines, bus station, train stations	2
No important connectivity	1

(22) Difficulty in Restoration

a) Space for temporary bridge

In respect of space for temporary bridge for repair works, following relevant code should be recorded in the inventory form.

Table 2.7 Temporary Bridge

Classification	Code
No space for temporary bridge	3
Space for temporary bridge, outside ROW	2
Space for temporary bridge, within ROW	1

In case of significant damages / a collapse of a bridge, a temporary bridge would be necessary parallel to the damaged bridge in order to maintain the flow of traffic.

b) Bridge Length

As per bridge length, following relevant code should be recorded in the inventory form.

Table 2.8 Bridge Length

Classification	Code
Bridge length is more than 50 m.	2
Bridge length is 50 m or less.	1

In case that bridge length is 50 meters or more, it could require a long duration for repair works, a long temporary bridge, much labor, and much cost.

c) Span Length

For span length, following relevant code should be recorded in the inventory form.

Table 2.9 Span Length

Classification	Code
Span length is more than 25 m.	2
Span length is 25 m or less.	1

In general, the span of pretention beam is 25 meters or less. In case that span length is more than 25 m, it takes a long duration for restoration of traffic due to additional works, such as detailed design, assembling rebar, assembling form, concrete placement and so on.

d) Bridge Piers in water

As per bridge piers in water, following relevant code should be recorded in the inventory form.

Table 2.10 Bridge Pier

Category	Code
Bridge piers in water in need of cofferdam - The cofferdam is necessary for repair work due to bridge piers in water.	2
Bridge piers outside water or not crossing river - The cofferdam is NOT necessary for repair works, in case that bridge piers are NOT in water or a bridge does NOT cross a river.	1

In case of repair of bridge piers in water, a cofferdam is necessary. This work require a long duration, much labor, and much cost due to the work in / near water.

(23) Access to Isolated Villages / Towns

If there is a possibility of isolation of villages / towns due to collapse of a bridge, following relevant code should be recorded in the inventory form.

Table 2.11 Access to Village, Town

Classification	Code
Apply- Villages / towns could be isolated due to loss of access when a bridge is collapsed,	2
Not apply- Villages / towns NOT isolated even if a bridge is collapsed.	1

(24) Traffic Characteristics

As per traffic volume (PCU/day), following relevant code should be recorded in the inventory form.

Table 2.12 Traffic Characteristics

Classification	Code
50,000 or more	5
20,000 – 49,999	4
5,000 – 19,999	3
500 – 4,999	2
0 – 499	1

Note: Relation of traffic volume and carriageway width

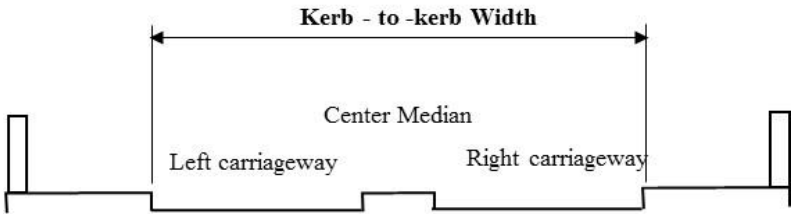


Figure 2.13 Carriageway Width

Table 2.13 Types of Cross-Section and Traffic Capacity

Type of Cross Section	Traffic Capacity (PCU/day)	Carriageway	Median (m)	Required Kerb-to-Kerb Width (m)
R0	72,000 – 108,000	2 x 10.50	1.20	22.20
R1	40,000 – 72,000	2 x 7.40	1.20	16.00
R2	25,000 – 40,000	2 x 7.40	1.20	16.00
R3	18,000 – 25,000	2 x 3.70	-	7.40
R4	300 – 18,000	2 x 3.10	-	6.20
R5	< 300	3.50	-	3.50

(25) Detour (Additional Period of Time)

For the requirement of additional time in case of detour, following relevant code should be recorded in the inventory form.

Table 2.14 Detour

Classification	Code
60 minutes or more	3
30 – 59 minutes	2
0 – 29 minutes	1

Drivers must choose alternative roads when a bridge is impassable. Detour should be on AA, AB, AC, B and C class roads (not only on AA and B class roads). It is difficult to measure the length of detour; therefore, it is decided to judge by the additional time needed when the detour occurs.

(26) Strategically Important Route

For the strategically important routes, relevant code should be recorded in the inventory form.

Table 2.15 Important Route

Classification	Code
Apply	2
Not apply	1

(27) Crossings

As per crossing condition, following relevant code should be recorded in the inventory form.

Table 2.16 Crossings

Classification		Code
Railway		5
Expressway		4
Road	Traffic volume on PCU basis: 20,000 or more	33
	Traffic volume on PCU basis: 500 – 19,999e	32
	Traffic volume on PCU basis: 499 or less	31
River		2
None		1

Collapse of bridge crossing over railways, expressways and roads could result in serious accidents leading to loss of lives, serious injuries and heavy adverse impacts on economic activities and day-to-day activities of the concerned people due to closure of traffic.

(28) Utilities Attached

As per attached utilities, following relevant code should be recorded in the inventory form.

Table 2.17 Utility Line

Category	Code
Oil pipeline	6
Water supply / sewage pipes	5
Power cable	4
Telecommunication cable (metal)	3
Telecommunication cable (optic)	2
Others	1

Utilities are indispensable to support the daily living function. Utilities could be damaged during the collapse of a bridge, and this damage would have an important influence on the public.

(29) Disturbance to water flow at flood times

As per the number of span, following relevant code should be recorded in the inventory form.

Table 2.18 Flooding

Classification	Code
Single spans	3
2 spans	2
3 or more spans, no crossing the river	1

In case that a bridge is crossing a river in single span, the reduction of the water opening could occur due to collapse of a bridge. This could cause a serious case, such as overflow and washing away abutments / piers by erosion at riverbank behind abutments or scour at piers.

2.3. Bridge Function Obsolete Index (for Reconstruction)

(30) Geometry, Clearance

Record relevant codes according to Alignment of approach road or clearance of bridge.

Table 2.19 Geometry, Clearance

Classification	Code
Bad alignment, Horizontal/Vertical alignment is bad, driving speed is reduced. Or Horizontal/Vertical clearance is not enough, it will restrict safe driving . There are history of accidents.	3
Bad alignment, Horizontal/Vertical alignment is bad, driving speed is reduced. Or Horizontal/Vertical clearance is not enough, restrict safe driving. No accident history.	2
Meets the requirement. No issues on Horizontal/ Vertical alignment, horizontal/Vertical clearance.	1

(31) Design Loading

To record the relevant code for the design load of bridge.

Table 2.20 Loading

Classification	Code
Do not meet design requirement	3
－（No use at the moment）	2
Meet design requirement	1

(32) Nature of Bridge

Record relevant codes for the following nature of bridges.

Table 2.21 Nature of Bridge

Classification	Code
Temporary Bridge（Photo-1） Fatigue durability on main structure is not reliable.	3
Modular bridge（Photo-2） Due to hinge connection of main structure, redundancy is low.	2
Permanent Bridge. Ordinary bridges, other than the above bridges,	1

Photo 1 (Temporary Bridge)

Photo 2 (Modular bridge)

Figure 2.14 Nature of Bridge

(33) Year-Round Mobility

Record usage as evacuation routes using the following codes.

Table 2.22 Year-round Mobility

Classification	Code
Inundated and there was hindrance to critical activities for the public.	3
Inundated in the past, but there was no hindrance to critical activities for the public.	2
No need for evacuation route or no inundation in the past.	1

(34) History of Disaster

Record disaster history code.

Table 2.23 Disaster History

Classification	Code
Several significant disaster records in the past	3
Disaster records in the past	2
No disaster record in the past	1

(35) Remarks

Additional Comments

The reference inventory sheet for Box Bridge is given inTable 2.1.3. The structural dimensions are omitted and the pictures (General Side View and Road / Bridge Surface) are summarized in this form. The important points for recording the data are same as those for other types of bridges.

2.4. Structural Information

(The sub topics come under this section are based on Form 2 – Inventory form)

As structure information, record following items.

(36) Material of Pavement

Material of the pavement should be mentioned here. (E.g. Concrete, Asphalt, etc...)

Table 2.24 Material of pavement

Pavement material code	Pavement material name
1	Asphalt
2	Concrete
3	Steel
4	Stone
5	Timber
6	Bricks
7	Macadam
8	DBST
9	SBST
10	Other

(37) Type of Expansion Joint

Table 2.25 Expansion Joint

Expansion joint type code	Expansion joint type name
1	Covered by Pavement Material
2	Steel Angle
3	Rubber Joint
4	Steel Finger Joint
5	No Expansion Joint
6	Others

(38) a) Railing, Parapet

Railing/Parapet if exist on the bridge should be mentioned here.

b) Material

Material of the railing/parapet should be mentioned here.

Table 2.26 Railing

Railing material code	Railing material name
1	Concrete
2	Steel
3	Stone
4	Bricks
5	Rubble
6	Others

c) Height

Height of the railing/parapet should be mentioned here.

(39) Type of Drainage

Drainage is selected from below.

Table 2.27 Drainage

Drainage type code	Drainage type name
1	Down Pipe
2	Channel Drainage
3	Others
4	No Drainage

(40) Superstructures Type / Dimensions

Table 2.28 Superstructure

Superstructure material code	Superstructure material name
1	Concrete
2	Steel
3	Composite
4	Concrete Block
5	Stone
6	Bricks
7	Others

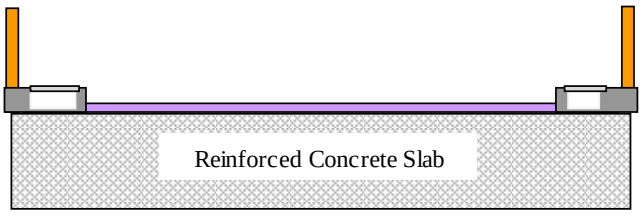
Structure type of bridge is classified into concrete, steel, stone, brick, timber and others bridges are selected from the tables below.

Table 2.29 Structure Type - Concrete

Concrete		
Type of Bridge		Abbreviation
Slab	RCS	RC-S
	RCS-Rigid	RC-S-R
	RCS-Encased Steel I Beam	RC-S-E
Slab and Beam	RCS-RCB	RC-B
	RCS-RCB-Rigid	RC-B-R
	PSC-PRE-Beam	PSC-PRE
	PSC-POS-Beam	PSC-POS
	PSC-POS-Box	PC-BOX
Box	Box-Bridge	Box-Br

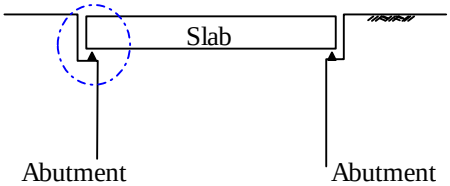
Type of Bridge		Abbreviation
Slab	RCS	RC-S

Cross Section



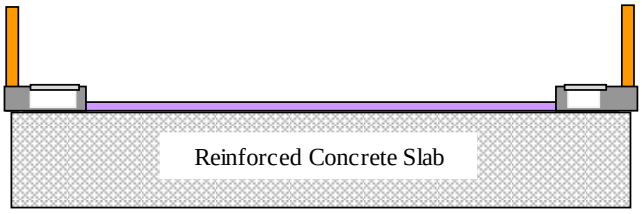
Side View

Superstructure and Substructure is separated.



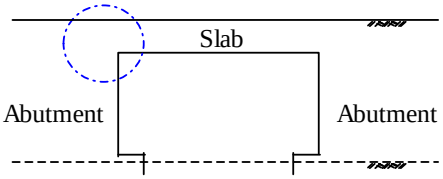
Type of Bridge		Abbreviation
Slab	RCS-Rigid	RC-S-R

Cross Section



Side View

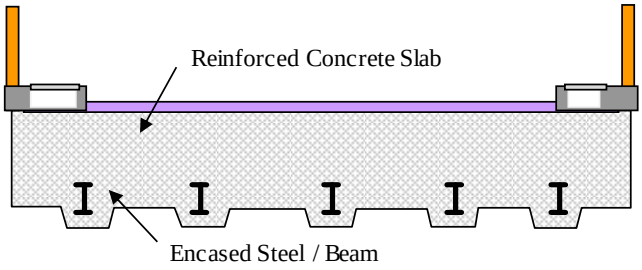
Superstructure and Substructure is integral.



Foundation is separated.

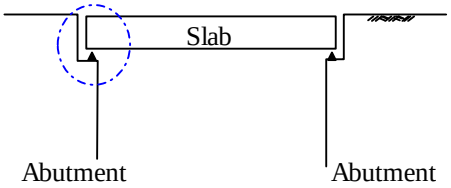
Type of Bridge		Abbreviation
Slab / Beam	RCS-Encased Steel I Beam	RC-S-E

Cross Section



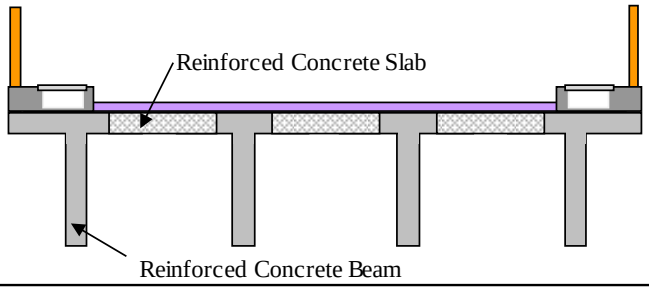
Side View

Superstructure and Substructure is separated.



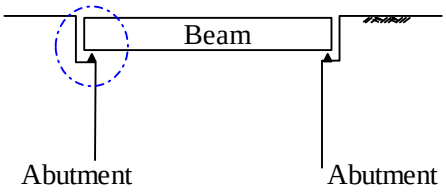
Type of Bridge		Abbreviation
Slab / Beam	RCS-RCB	RC-B

Cross Section



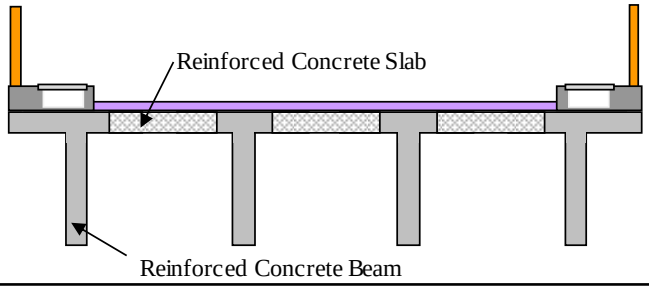
Side View

Superstructure and Substructure is separated.



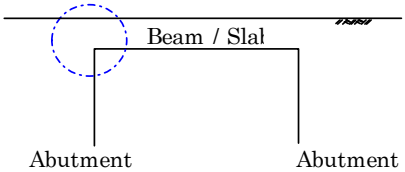
Type of Bridge		Abbreviation
Slab / Beam	RCS-RCB-Rigid	RC-B-R

Cross Section



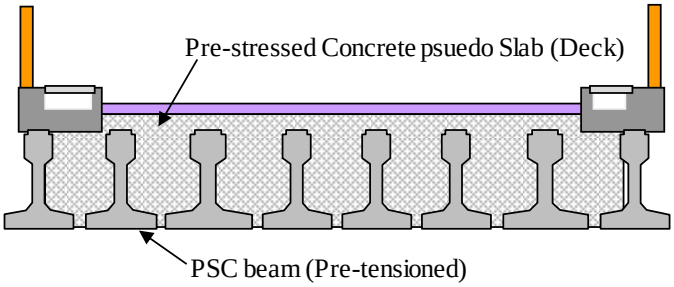
Side View

Superstructure and Substructure is intergral.



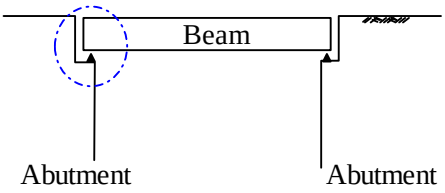
Type of Bridge		Abbreviation
Slab / Beam	PSC-PRE-Beam	PSC-PRE

Cross Section



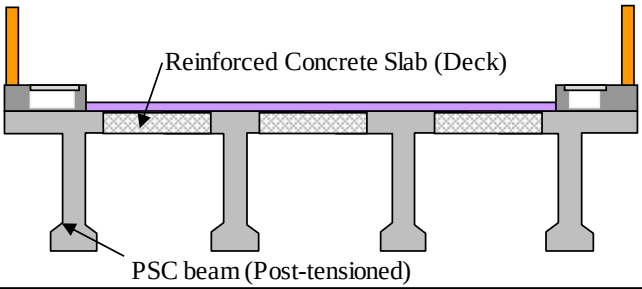
Side View

Superstructure and Substructure is separated.



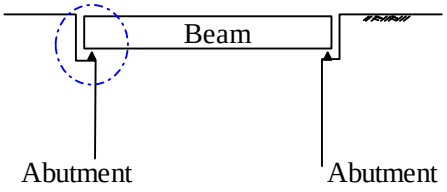
Type of Bridge		Abbreviation
Slab / Beam	PSC-POS-Beam	PSC-POS

Cross Section



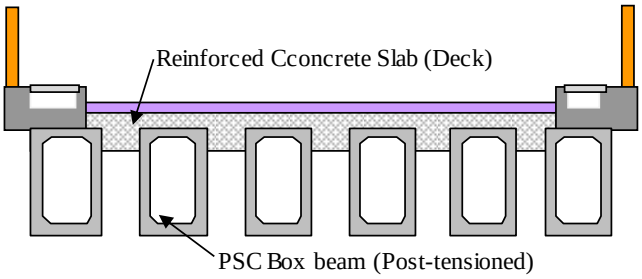
Side View

Superstructure and Substructure is separated.



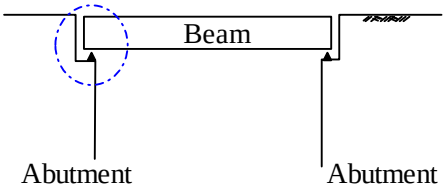
Type of Bridge		Abbreviation
Slab / Beam	PSC-POS-Box	PC-BOX

Cross Section



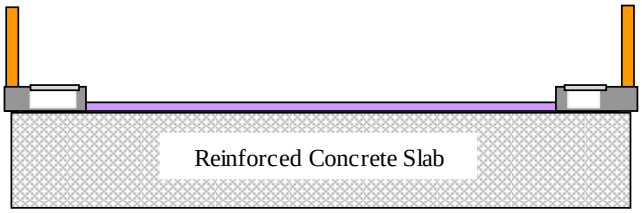
Side View

Superstructure and Substructure is separated.



Type of Bridge		Abbreviation
Box	Box-Bridge	Box-Br

Cross Section



Side View

Superstructure and Substructure is integral.

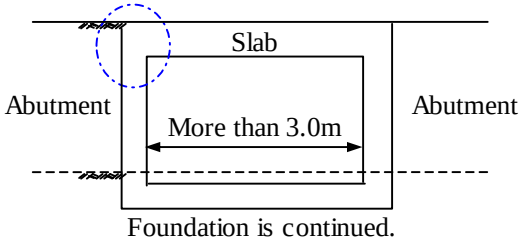
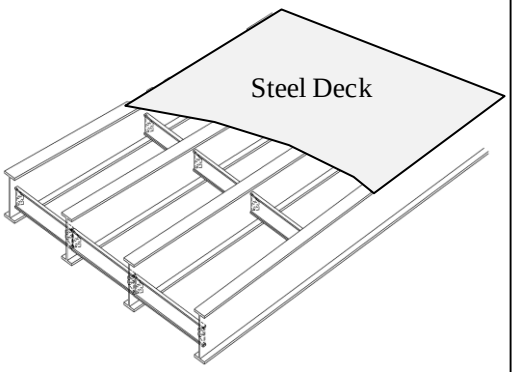


Figure 2.15 Section of Superstructure

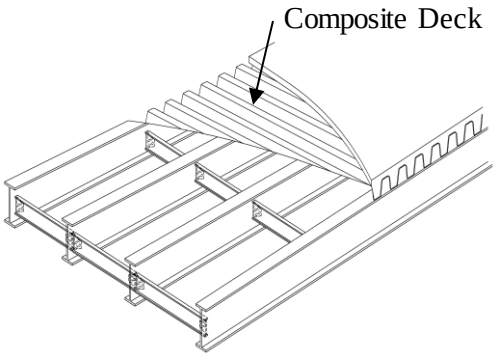
Table 2.30 Abbreviation of Superstructure (Steel or Composite)

Steel or Composite			
Situation		Type of Bridge	Abbreviation
Steel	Composite		
√		Steel-RSJ-Steel Deck	ST-RSJ-S
	√	Steel-RSJ-Composite	ST-RSJ-C
√	√	Steel-Beam-Composite	ST-B
√	√	Steel-Truss (Through)	ST-TR-T
√	√	Steel-Truss (Half Through)	ST-TR-H/T
√	√	Steel-Truss (Deck)	ST-TR-D
√	√	Steel-Truss (Arch shaped)	ST-TR-Ar
√	√	Temporary Bridge	Temp
√		Steel-Modular / Semi-Temporary Bridge	ST-Mod
	√	Steel-Composite	ST-Comp
	√	Steel-Timber Deck	ST-Other

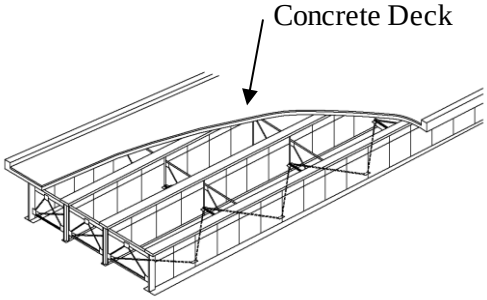
Type of Bridge	Abbreviation
Steel-RSJ-Steel Deck	ST-RSJ-S



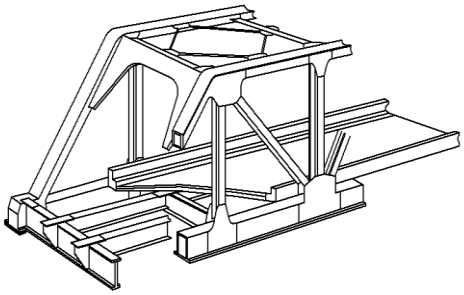
Type of Bridge	Abbreviation
Steel-RSJ-Composite	ST-RSJ-C



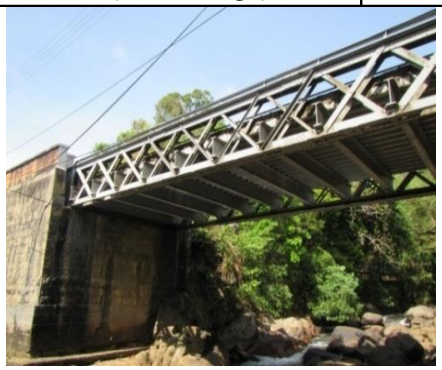
Type of Bridge	Abbreviation
Steel-Beam-Composite	ST-B

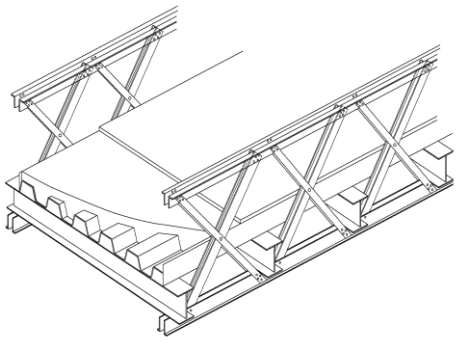


Type of Bridge	Abbreviation
Steel-Truss (Through)	ST-TR-T

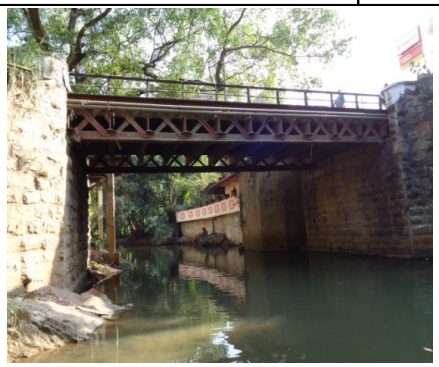


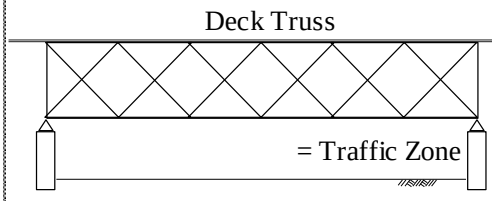
Type of Bridge	Abbreviation
Steel-Truss (Half Through)	ST-TR-H/T



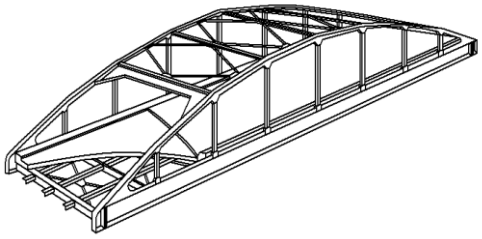


Type of Bridge	Abbreviation
Steel-Truss (Deck)	ST-TR-D

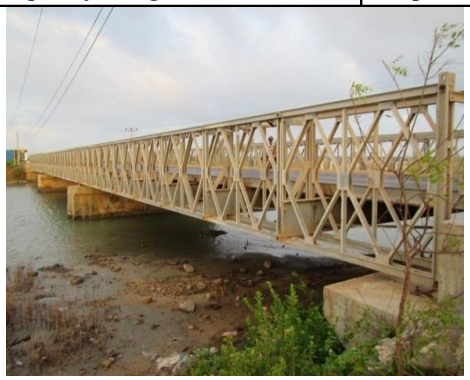


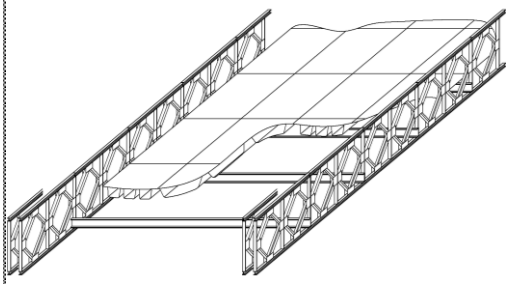


Type of Bridge	Abbreviation
Steel-Truss (Arch Shaped)	ST-TR-Ar



Type of Bridge	Abbreviation
Temporary Bridge	Temp





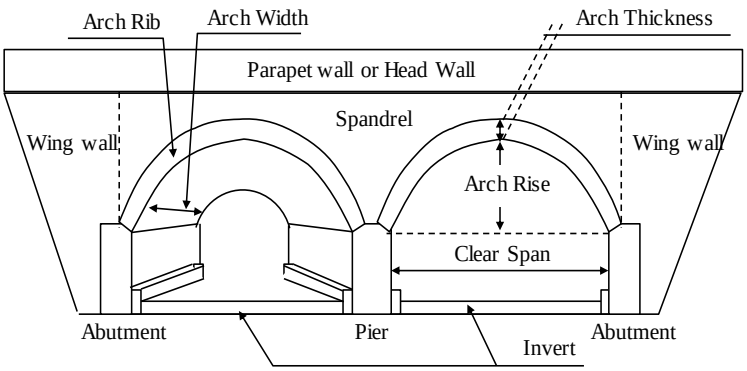
Type of Bridge	Abbreviation
Steel-Modular / Semi-Temporary Bridge	ST-Mod

Type of Bridge	Abbreviation
Steel-Composite	ST-Comp

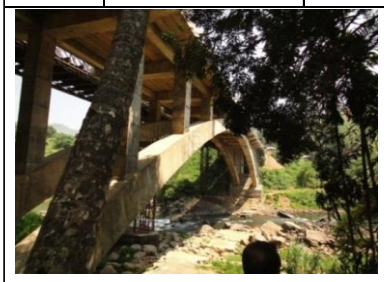
Table 2.31 Abbreviation of Superstructure (Arch)

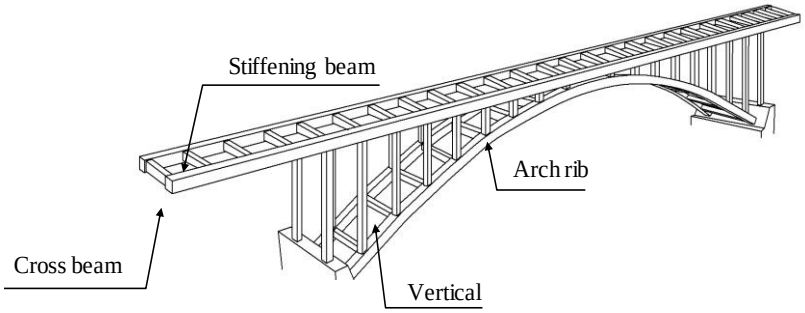
Arch		
Type of Bridge		Abbreviation
Arch	RC-Arch-Closed	RC-Ar-Cl
	RC-Arch-Rib	RC-Ar-Rib
	Stone-Arch-Closed	Stone-Arch
	Brick-Arch-Closed	Brick-Arch
	Concrete-Block-Arch	Co-Block-Arch
	Timber-Arch-Closed	Timber-Arch

Type of Bridge		Abbreviation
Arch	RC-Arch-Closed	RC-Ar-Cl



Type of Bridge		Abbreviation
Arch	RC-Arch-Rib	RC-Ar-Rib





Type of Bridge		Abbreviation
Arch	Stone-Arch-Closed	Stone-Arch

Type of Bridge		Abbreviation
Arch	Brick-Arch-Closed	Brick-Arch

Table 2.32 Superstructure: Type / Code Number

Superstructure type code	Superstructure type name
1	RC-S
2	RC-S-R
3	RC-S-E
4	RC-B
5	RC-B-R
6	PC-PR
7	PC-PO
8	PC-BOX
9	Box-Br
10	Stone-Other
11	Timber-Other
12	ST-RSJ-S
13	ST-RSJ-C
14	ST-B
15	ST-TR-T
16	ST-TR-H/T
17	ST-TR-D
18	ST-TR-Ar
19	Temp
20	ST-Mod
21	ST-Comp
22	ST-Other
23	RC-Ar-Cl
24	RC-Ar-Rib
25	Stone-Arch
26	Brick-Arch
27	Co-Block-Arch
28	Timber-Arch

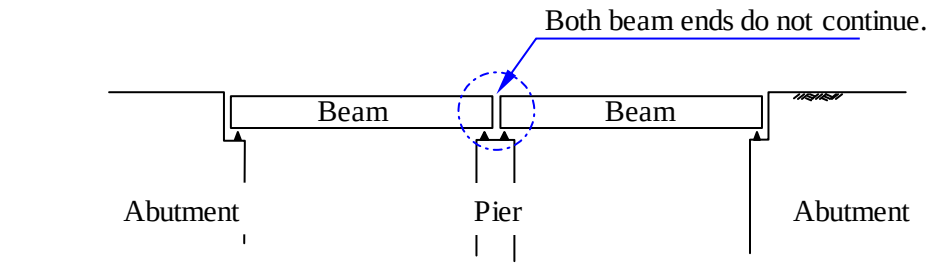
1) Structural Beam Type

Beam type of superstructure is selected from the list below.

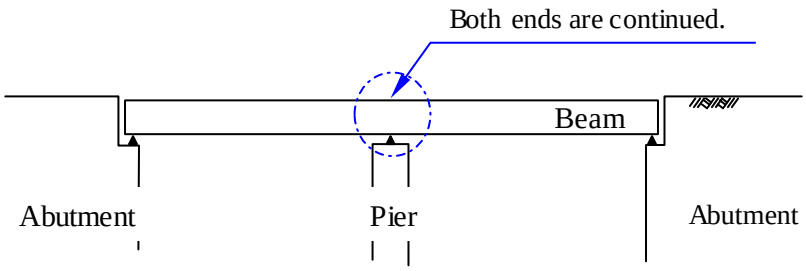
Table 2.33 Beam type

Beam type code	Beam type name
1	Simple
2	Conti
3	Rigid
4	Cant
5	Cant with Sus
6	No Beam
7	Others

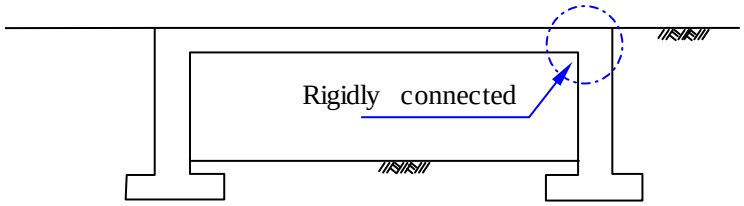
Beam Type		Abbreviation
1	Simple Beam	Simple



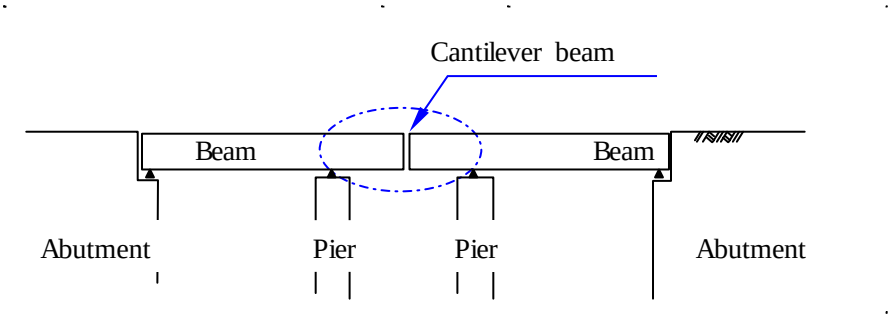
Beam Type		Abbreviation
2	Continuous Beam	Conti



Beam Type		Abbreviation
3	Rigid Frame	Rigid



Beam Type		Abbreviation
4	Cantilever Beam	Cant



Beam Type		Abbreviation
5	Cantilever with Suspended Span/ Beam	Cant with Sus

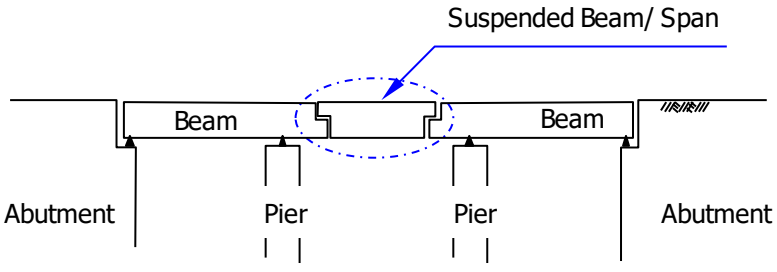


Figure 2.16 Type of Beams

2) Beam Material / Deck Slab Material

Materials of superstructures and substructures are respectively selected from the list below on the left and on the right. In case of a bridge with no slab, leave the column for the superstructure slab blank.

Table 2.34 Beam & Slab Material

Beam & Slab Material	
1	Concrete
2	Steel
3	Composite
4	Concrete Block
5	Others

Table 2.35 Substructure Material

Substructure Material	
1	Concrete
2	Steel
3	Concrete Block
4	Stone
5	Bricks
6	Rubble
7	Others

3) Bearing Material

Material of bearings is selected from the table below on the left. Type of Bearing is selected from the table below on the right.

Table 2.36 Material of bearing

23-1. Material of Bearing	
1	Concrete
2	Steel
3	Rubber
4	No Bearing
5	Others

Table 2.37 Type of Bearing

23-2. Type of Bearing	
1	Rubber Pad Bearing
2	Steel Reinforced Elastomeric Bearing
3	Bearing Plate Support
4	Roller & Pin Bearing
5	No Bearing
6	Others

23-2. Type of Bearing					
1	Rubber Pad Bearing	2	Steel Reinforced Elastomeric Bearing	3	Bearing Plate Support
					

4	Roller Bearing

4	Pin Bearing

Figure 2.17 Type of Bearing

a) Number

Mention Superstructure number in this section

b) Span Name

A1-P1, P1-P2, P2-A2 should be mentioned following the substructure name.

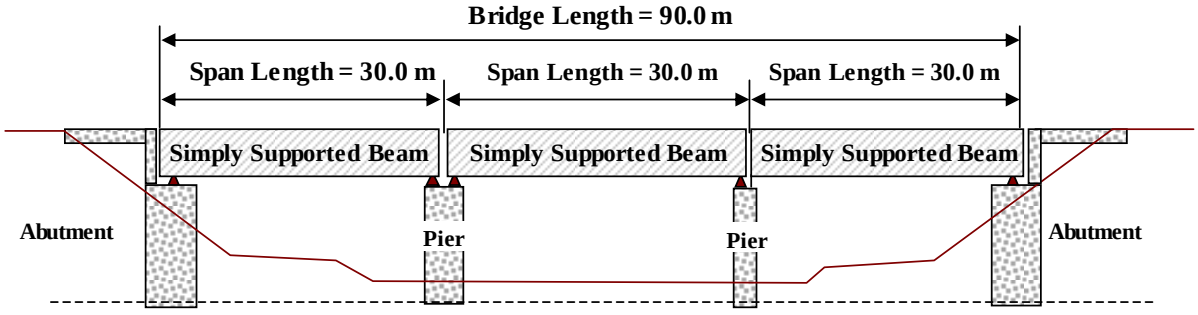


Figure 2.18 Superstructure

c) Span Length

Refer to 2.1. Basic Information (7) Length of Bridge / Total Number of Span

d) Clear Span

Refer to 2.1. Basic Information (7) Length of Bridge / Total Number of Span

e) No. of Main Beams

Count actual number of beams and record.

f) No. of Cross Beams

Count actual number of beams and record.

g) Beam Spacing

Beam spacing represents the intervals of main beams. Refer to the following figure.

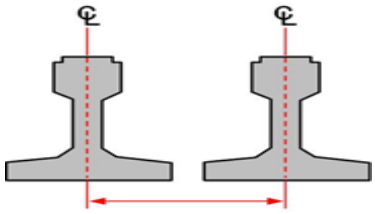


Figure 2.19 Beam Spacing

h) Beam / Slab Depth (m)

Record depth of main beam and deck slab.

(41) Substructures Type / Dimension

Type of substructure is selected from the list below.

i. Abutment

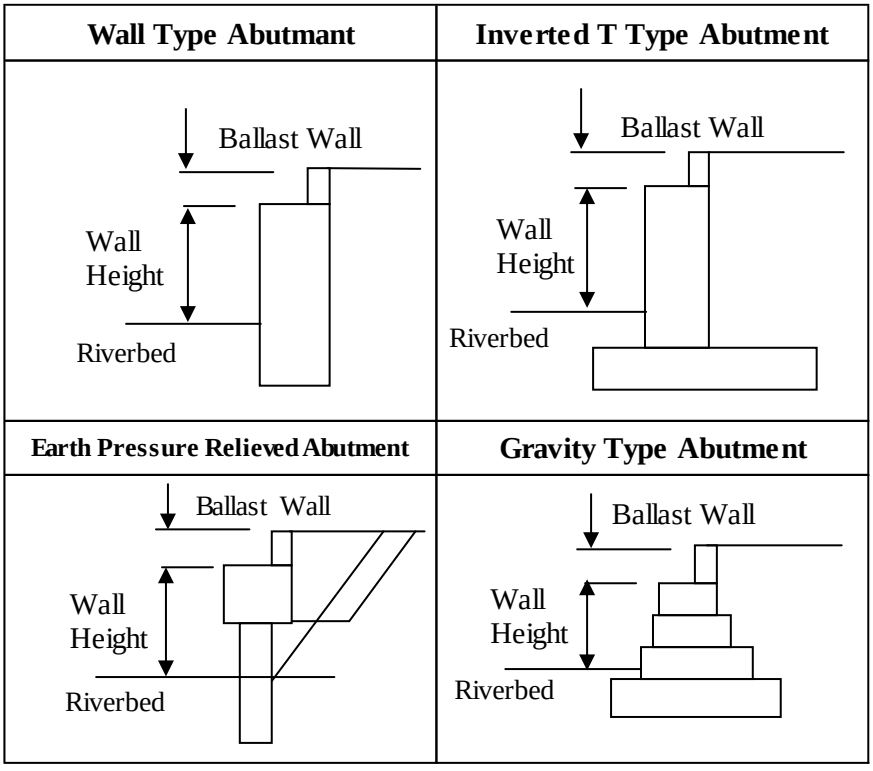


Figure 2.20 Abutment

ii. Pier

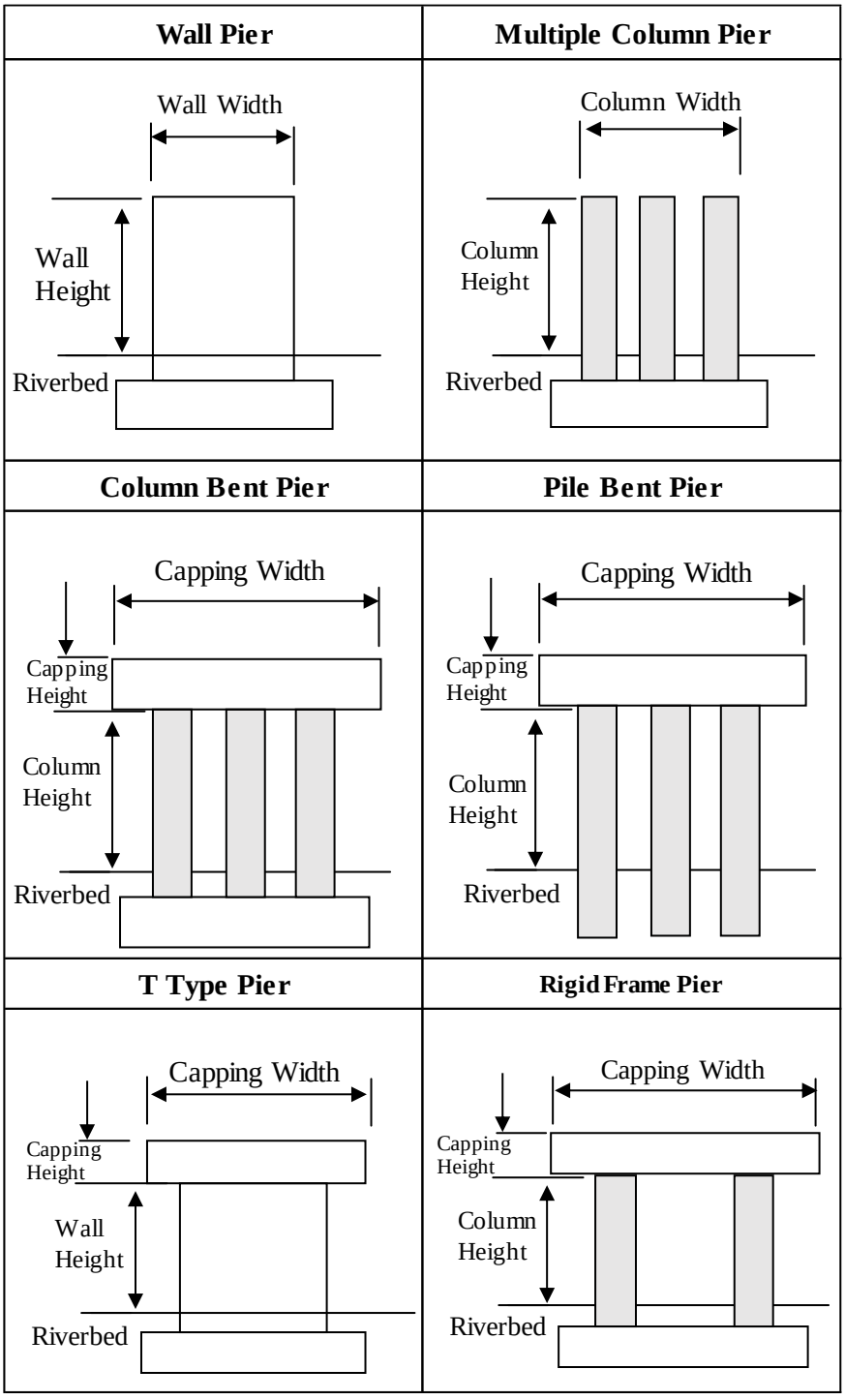


Figure 2.21 Pier

iii. Box Bridge

Separate record of information of Surface, Superstructure and Substructure.

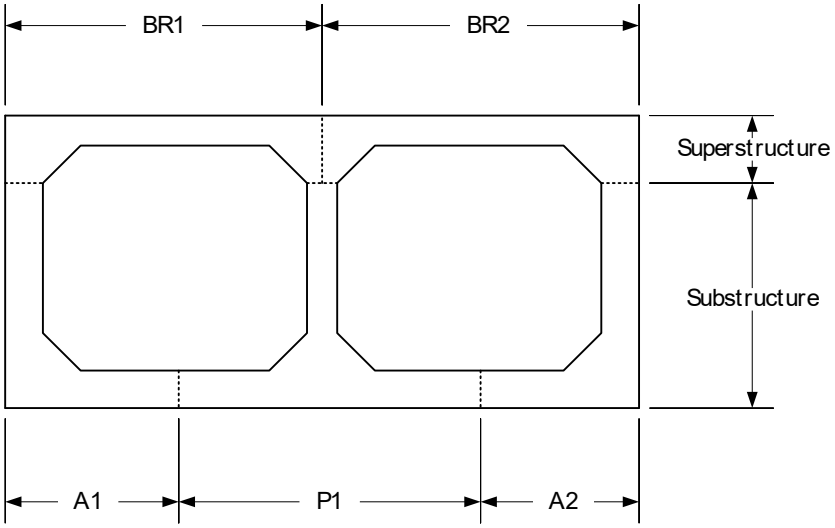


Figure 2.22 Box Bridge

a) Substructure Type

Mention Substructure type in this section

Table 2.38 Substructure Type

Substructure type code	Region class code	Substructure type name
201	2	Wall-Type
202	2	Inverted-T
203	2	Earth Pressure Relieved-Type
204	2	Gravity-Type
205	2	Other
301	3	Wall-Type
302	3	Column
303	3	Column-Bent
304	3	Pile-Bent
305	3	T-Type
306	3	Rigid
307	3	Other

b) Material of Substructure

Mention Substructure Material in this section (ex: Steel, Concrete, etc...)

Table 2.39 Material of Substructure

Substructure material code	Substructure material name
1	Concrete
2	Steel
3	Composite
4	Concrete Block
5	Stone
6	Bricks
7	Rubble
8	Others

c) Shape of Substructure

Shape of substructures is selected from the list below.

Table 2.40 Shape of Substructure

Cross Section of Wall / Column of Substructure			Abbreviation
1	Rectangular Cross Section		Rectangle
2	Hexagonal Cross Section		Hexagon
3	Elliptic Cross Section		Semicircular
4	Circular Cross Section		Circular
5	Other	Other	Other

d) Foundation Type

Structure type of foundation is selected from the list below. Because it is difficult to inspect the foundation on site in many cases, the design drawing should be used to confirm the structure type. If design drawing is unavailable, select [unclear].

Table 2.41 Abbreviation of Foundation

Foundation	Abbreviation
Spread Footing	Spread
Pile Foundation (Cast-in-Place Concrete Pile)	Pile(CCP)
Pile Foundation (Steel Pipe Driven Pile)	Pile(SPP)
Pile Foundation (Precast Concrete Pile)	Pile(PCP)(Driven Pile)
Pile Foundation (Timber Pile)	Pile(Timber)
Caisson Foundation	Caisson
Unclear	Unclear
Other	Other

3. Inventory Forms and Recording

3.1 Record of Inventory data

Bridge Inventory needs to be recorded accurately based on this Bridge Inventory Development Manual.
Bridge Inventory data and updated data should be stored in the database immediately.

3.2 General Procedures for Developing Bridge Inventory

Developing Bridge Inventory should be conducted by using Inventory Forms 1 to 3.

- Form 1 Inventory Form (General Information)
- Form 2 Inventory Form (Structural Dimensions)
- Form 3 Inventory Form (General View Photos)

Bridge Inventory is classified into four types: Concrete Bridge, Steel Bridge, Arch Bridge and Box Bridge. For Box Bridges, number of items in Form 1 was reduced.

Inspection forms are classified into four types: for Concrete Bridges, Steel Bridges, Arch Bridges and Box Bridges. In case of widened bridges, use the forms originally used for the bridges before the widening.

Contents of each form are described as follows.

- Form 1 Inventory Form (General Information):

  Fill in the basic information about Bridge Length, Bridge Width and Clear span, Year of Construction, Used Materials and Crossings.

- Form 2 Inventory Form (Structural Dimensions):

  Record the Bridge Type, Beam Type, Basic Dimensions of Superstructure/Abutment/Pier and Material Used for Superstructures and Substructures.

- Form 3 Inventory Form (General View Photos):

  Photos of General Side Views, Bridge Surface, Expansion Joints, Superstructures, Substructures, Bearings, Abutment and Piers.

-Sample Worksheet-

Form 1 Inventory Form (General Information)

In Form 1, the following information is recorded: bridge name, road name, EE office, bridge location, bridge length and bridge width, span length, year of construction, used materials, repair history and other information. It's desirable to prepare the Form based on the design drawings before implementation of inspection. However, if the design drawing is not available, major dimensions must be measured on site. Supplementary explanation to support understanding of the basic inventory data and information on serious damages should be written in "Notes".

Inspection form number (REF.No) is located in the upper right corner of Form 1. It should be entered in the following order: Road number, Bridge number and then (Inspection date). (e.g. A001_10.1_ (04.09.2015). The information of widened bridges as well as existing bridges is recorded in the form.

When information concerning route number, bridge name, bridge number, EE office, inspection date and inspector's name are entered in Form 1, they are automatically reflected to other forms. When number of spans is input into the span column, relevant information in Form 2 are automatically updated, unnecessary sheets are deleted and span number and schematic view are automatically updated.

In the bottom right corner in Form 1, the remarks should be recorded at the site.

Information about widened bridges, supplementary information along with schematic view of bridges of complicated structure, and specific damages occurred to the bridges (e.g. large settlement on riverbed, tilting of substructure, needs of urgent treatment, unusual vibration, etc.) should be recorded under "Note".

Sample Worksheet - Inventory Form (General Information)

Form 1 Inventory Form (General Information)

1	Route No. :		Name of Road :	1
2	Bridge No. : / in Km		Name of Bridge :	2
3	Separation :		Widened : ☐Not Widened ☐Widened	3
4	Province :		District :	4
5	EE Division :			5
6	Location Start : N ° ' "		Location End : N ° ' "	6
	E ° ' "		E ° ' "	

7	Length of Bridge (m) :		Total Number of Span :	7
8	Span Arrangement :			8
9	Width (m) :	Overall:	Effective:	9
10	Width of Cross Sec. (m) :	Left Sidewalk:	Right Sidewalk:	10
		Left Carriageway:	Centre Median:	Right Carriageway:
11	Skew Angle (degree) :			11
12	Type of Bridge :	☐RCS Bridge ☐PSC Bridge ☐Box Bridge ☐Steel Bridge ☐Arch Bridge ☐Other Bridge		12

13	Design Documents :			13
14	Year of Construction :	Exact:	Rough: ☐UK Era	14
15	Design Live Load :	British Standard:	Comment :	15
16	Load Limit (ton) :			16

17	Traffic Volume :	Volume (vehicle/day):	Commercial Vehicle Ratio (%):	17
18	Road Surface to WL :	N.W.L:	H.F.L:	18
19	Distance to Coastline (m) :	------		19
20	Densely inhabited districts :	☐ Apply	☐ Not Apply	20
21	Connectivity to important facilities :	☐ 1:No connectivity	☐ 2:Important facilities ☐ 3:Extremely important facilities	21
22	Difficulty in restoration :	☐ 1:Space for temporary bridge, Within ROW	☐ 2: Space for temporary bridge, outside ROW	22
		☐ 3:No space for temporary bridge		
		☐ Bridge length is more than 50 m	☐ Span length is more than 25 m	
		☐ Bridge piers in water in need of cofferdam		
23	Access to Isolated Village / Town :	☐ Apply	☐ Not Apply	23
24	Traffic characteristics :	☐ 0-499 ☐ 500-4,999	☐ 5,000-19,999 ☐ 20,000-49,999 ☐ 50,000-	24
25	Detour (Additional Period of Time) :	☐ 0 – 29 minutes	☐ 30 – 59 minutes ☐ 60 minutes or more	25
26	Strategically important route :	☐ Apply	☐ Not Apply	26
27	Crossings :	☐ Railway	☐ Expressway ☐ River	27
		☐ Road (traffic volume on PCU basis: 499 or less)		
		☐ Road (traffic volume on PCU basis: 500 – 19,999)		
		☐ Road (traffic volume on PCU basis: 20,000 or more)		
28	Utility Attached :	☐ Telecommunication cable (optic)	☐ Telecommunication cable (metal)	28
		☐ Power cable ☐ Water supply / sewage pipes	☐ Oil pipeline ☐ Others	
29	Disturbance to water flow at flood times :	☐ 3 or more spans, no crossing the river	☐ 2 spans ☐ Single span	29
30	Geometry, Clearance :	☐ Meet the requirements		30
		☐ Bad alignments, Insufficient overhead clearance and / or sight distance (Accidents rarely occur)		
		☐ Bad alignments, Insufficient overhead clearance and/ or sight distance (Accidents frequently occur)		
31	Design Loading :	☐ Meet design requirements	☐ Do not meet design requirements	31
32	Nature of Bridge :	☐ Permanent Bridge	☐ Modular Bridge ☐ Temporary Bridge	32
33	Year-Round Mobility :	☐ No inundation in the past	☐ Inundated in the past, but was no hindrance to critical activities for the public	33
		☐ Inundated and was hindrance to critical activities for the public		
34	History of Disaster :	☐ No disaster record in the past	☐ Disaster records in the past	34
		☐ Several significant disaster records in the past		
35	Remarks :			35

Sample Worksheet - Inventory Form (Structural Information)

Form 2 Inventory Form (Structural Information)

Route No.	:		Name of Road	:	
Bridge No.	:	/ in Km	Name of Bridge	:	
Separation	:	☐Not Separated ☐Separated	Widened	:	☐Not Widened ☐Widened
Province	:		District	:	
EE Division	:				

《Surface》

36	Material of Pavement	:			
37	Type of Expansion Joint	:			
38	Railing, Parapet	:	Material:	Height (m):	
39	Type of Drainage	:			

40 《Superstructures: Type》

	No.	Span Name	Type of Bridge	Type of Superstructure	Beam Type	Beam Material	Deck Slab Material	Bearing Material
Original :								
Widened :								

《Superstructures: Dimensions》

	No.	Span Name	Span Length (m)	Clear Span (m)	No. of Main Beam	No. of Cross Beam	Beam Spacing (m)	Beam / Slab Depth (m)
Original :								
Widened :								

41 《Substructures: Type》

	No.	Substructures Designation	Type	Material	Shape	Foundation Type
Original :						
Widened :						

《Substructures: Dimensions》

	No.	Substructures Designation	Ballast Wall / Capping Length (m)	Width (m)	Depth (m)	Wall / Column Length (m)	Width (m)	Height (m)
Original :								
Widened :								

Sample Worksheet - Inventory Form (Photographs)

The following types of photographs should be attached in Form 3: photos of general side view of the bridge, photos of road surface condition, expansion joint, superstructure, bearings, abutment (A1, A2) and piers. If the conditions are found to be changed at the second inspection onwards, the photos should be updated accordingly. The comment column should be used when necessary.

- General Side View

  Take photos, which shows condition of entire bridge, from the lateral direction. It is desirable to take photos by making left side as “A1” and right side as “A2”.

- Road / Bridge Surface

  Take photos, which shows condition of road surface. If it is a narrow bridge, it is desirable to take photos so that they show approach and bridge surface have different widths.

- Bridge Expansion Joint

  Take photos, which typically show structure type of bridge expansion Joint.

- Superstructure

  Take photos, from underside of bridge, which typically explain situation of superstructure. Arrangement of main beams should be shown in the photos. It should be noted that, in case of beam bridges, photos of slabs could not be taken sometimes, according to the height of the bridge.

- Bridge Bearing

  Take photos, which typically show structure type of bridge bearing.

- Abutment A1 / A2

  Take photos, which typically show material and shape of abutment.

- Pier

  Take photos, which typically show material and shape of pier.

-Sample Worksheet-

Form 3 Inventory Form (General View Photos)

Route No.	:	B304	Name of Road	:	Nagoda - Kalawellawa - Bellapitiya
Bridge No.	:	17 / 1 in Km	Name of Bridge	:	
Separation	:	Not Separated	Widened	:	Not Widened
Province	:	Western	District	:	Kalutara
EE Division	:	Agalawatta			

General Side View

Remarks:

Road / Bridge Surface

Remarks:

Superstructure 1

Remarks:

Superstructure 2

Remarks:

Substructure 1

Remarks:

Substructure 2

Remarks: