



IT (Intelligent Technology) GIRDER BRIDGE SYSTEM

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CONCRETE **S**TRUCTURAL **E**NGINEERING **L**AB



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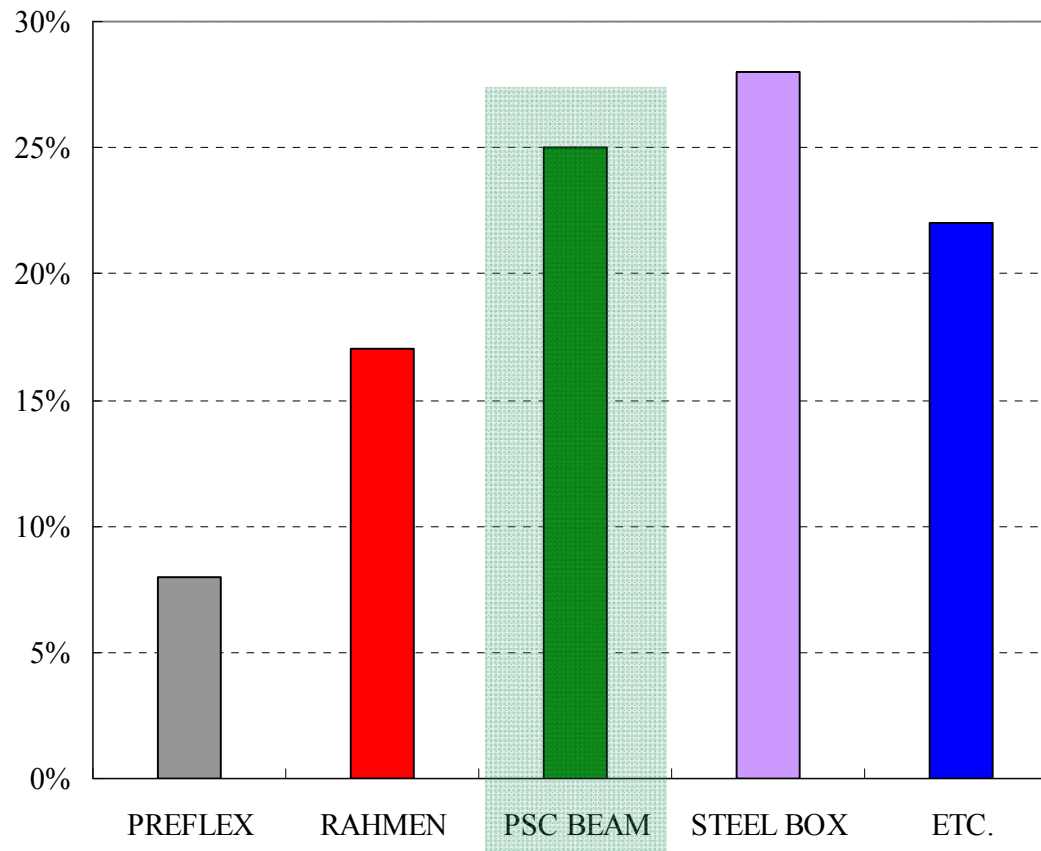
- ◆ **Background**
- ◆ **Design Philosophy of IT GIRDER**
- ◆ **Experimental Performance Verification**
- ◆ **Structural Analysis and Discussion**



BACKGROUND

❖ Prestressed Concrete Girder

Proportion of Bridge Type in Highway In Korea (1998)



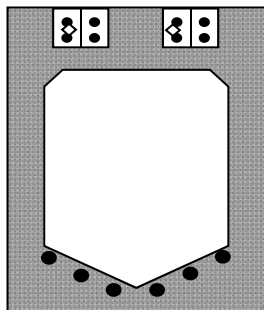
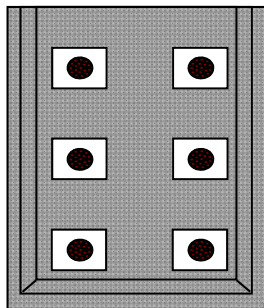
- Rapid improvement after WW2
- Constructability and economic efficiency, easy maintenance
- ~35m span bridge
- Standard section design with concrete of 40MPa for 25~35m span
- Extended application(~45m span) of PSC girder for improvement in 2000



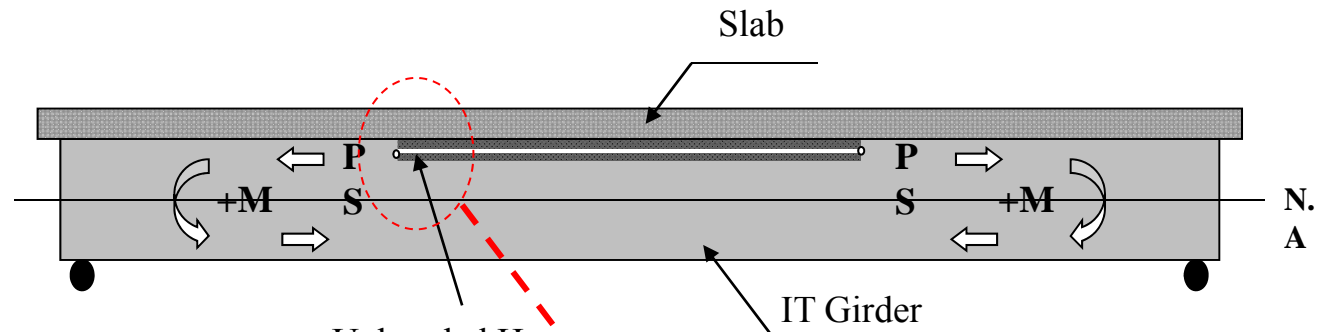
Design Philosophy of IT GIRDER

❖ Cross Section and Details of IT Girder

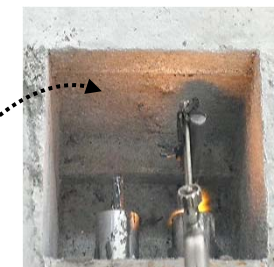
< BOX TYPE >



Application 30~60m



Unbonded H-type steel member



- Performance recovery by removal of unbonded PS and compressive force on upper section



Design Philosophy of IT GIRDER

❖ Advantages of IT Girder

Safety	Constructability	Economic
<ul style="list-style-type: none">❖ Concrete-Steel hybrid member for safety improvement❖ Box type cross section for high resistance to torsion load❖ Buckling safety considered during PS application	<ul style="list-style-type: none">❖ Formwork same throughout the span❖ Reinforcement work relatively simple❖ General PSC girder construction procedure used❖ Lowered self-weight and prevented overturning	<ul style="list-style-type: none">❖ Relatively inexpensive construction cost❖ Depth-to-span length minimized❖ Additional rehabilitation cost unnecessary due to recovery of plastic strain



Experimental Performance Verification

❖ Material Properties

W/B (%)	S/a (%)	Air Content (%)	Unit Weight (kg/m ³)					SP (%)
			W	C	F/A	S	G	
31.7	44.8	4.0	165	468	52	733	909	0.9

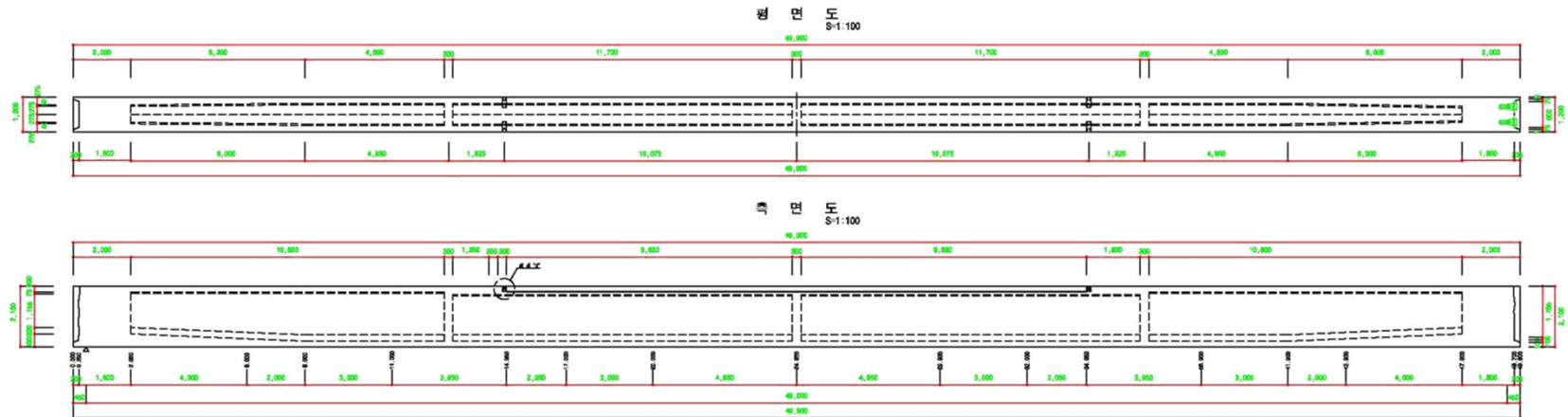
- **Max. coarse aggregate size of 19mm for workability**
- **Concrete design strength of 45MPa**
- **Superplasticizer for workability**

Concrete Strength		$f_{ck}=45\text{MPa}$
I-type Steel	SM 490	$f_{py}=320\text{MPa}$
Tendon	SWPC 7BN	$f_{pY}=1600\text{Mpa}$

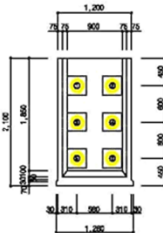


Experimental Performance Verification

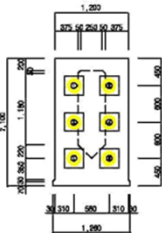
❖ Specimen Dimension



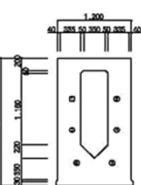
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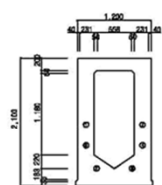
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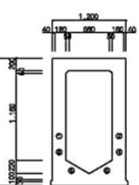
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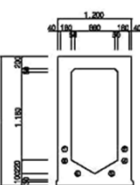
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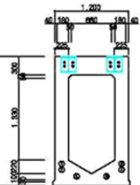
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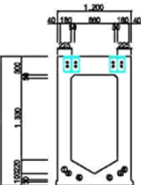
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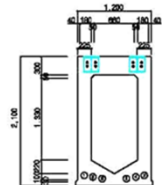
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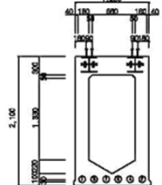
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거더 단부에서의 거리 20.000



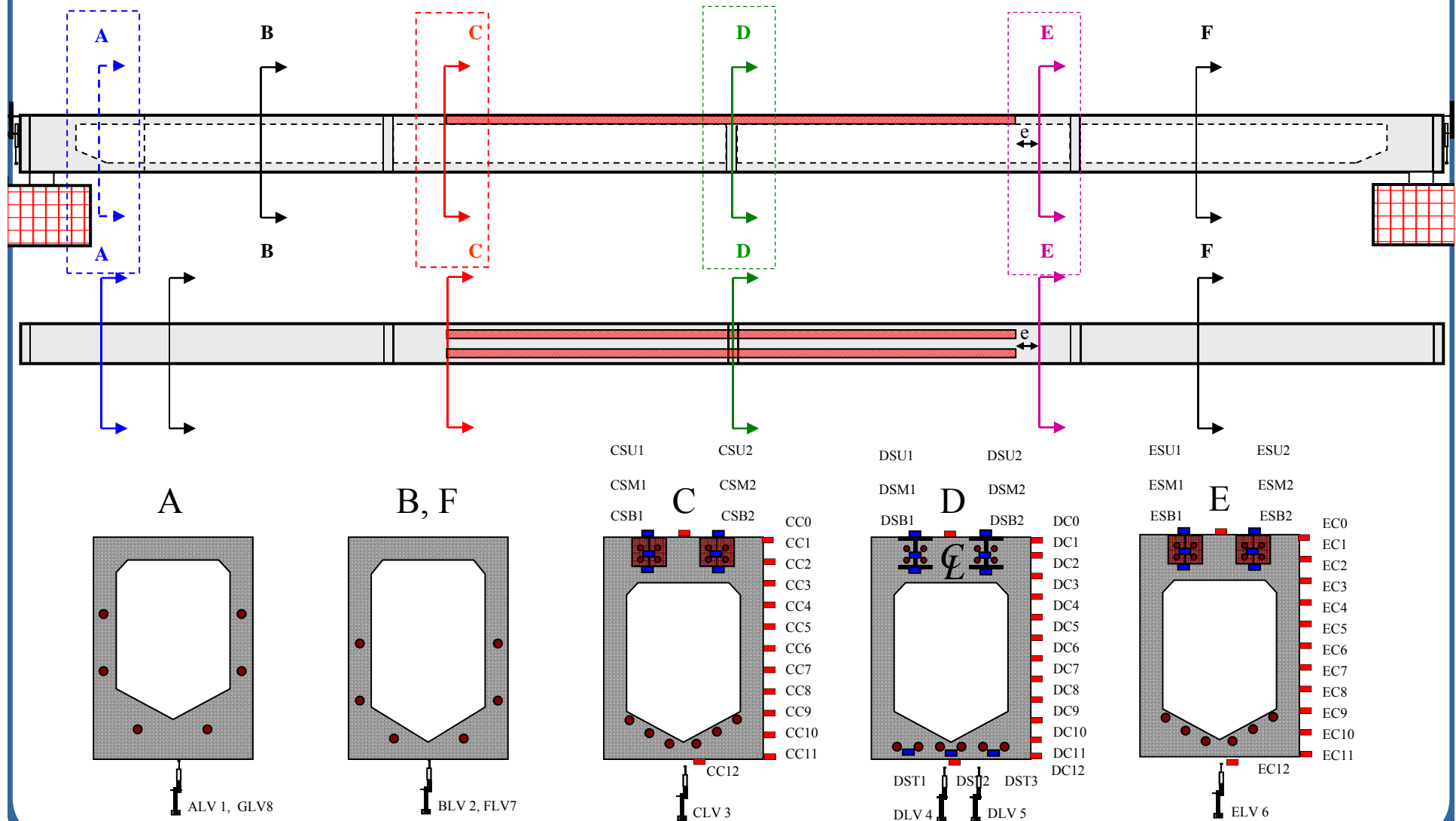
거더 단부에서의 거리 24.950





Experimental Performance Verification

❖ Measurement Locates and Gauge Types





Experimental Performance Verification

❖ Gauge Types

Strain Gauge



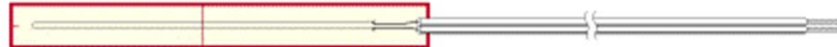
Rebar

FLA-2-11-1L



I-type beam

WFLA-6-11-3L



Concrete

PL-60-11-5L

Deflection Gauge



LVDT

CDP-50

CDP-25

Holder

Wire type LVDT





Experimental Performance Verification

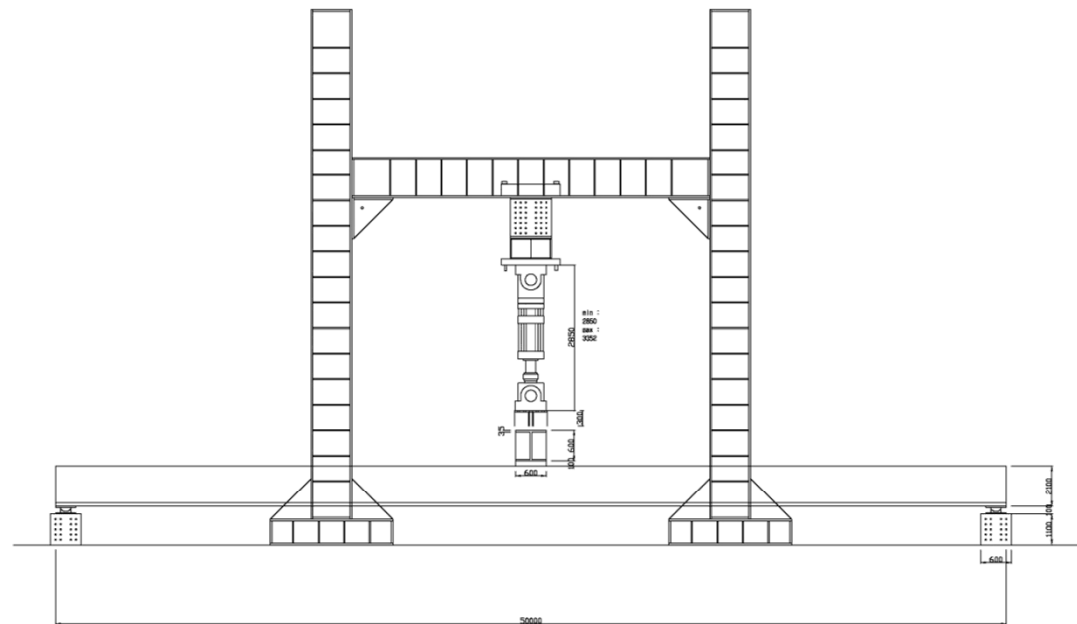
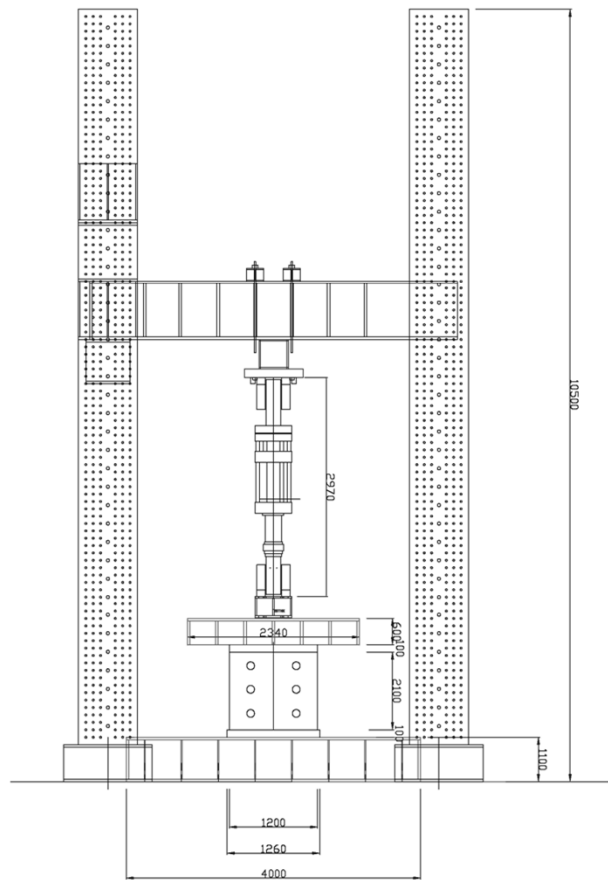
❖ Experimental Photos





Experimental Performance Verification

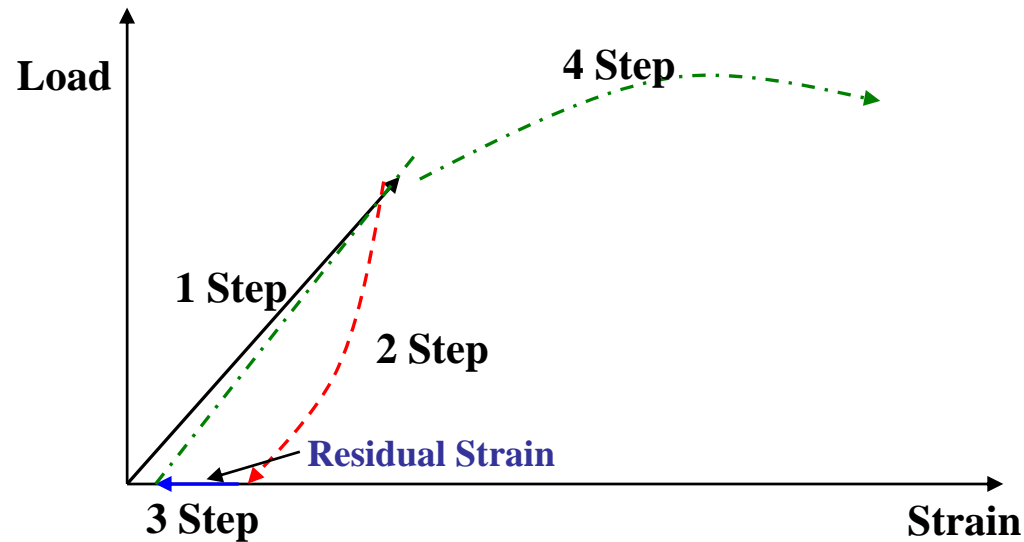
❖ Test Setup





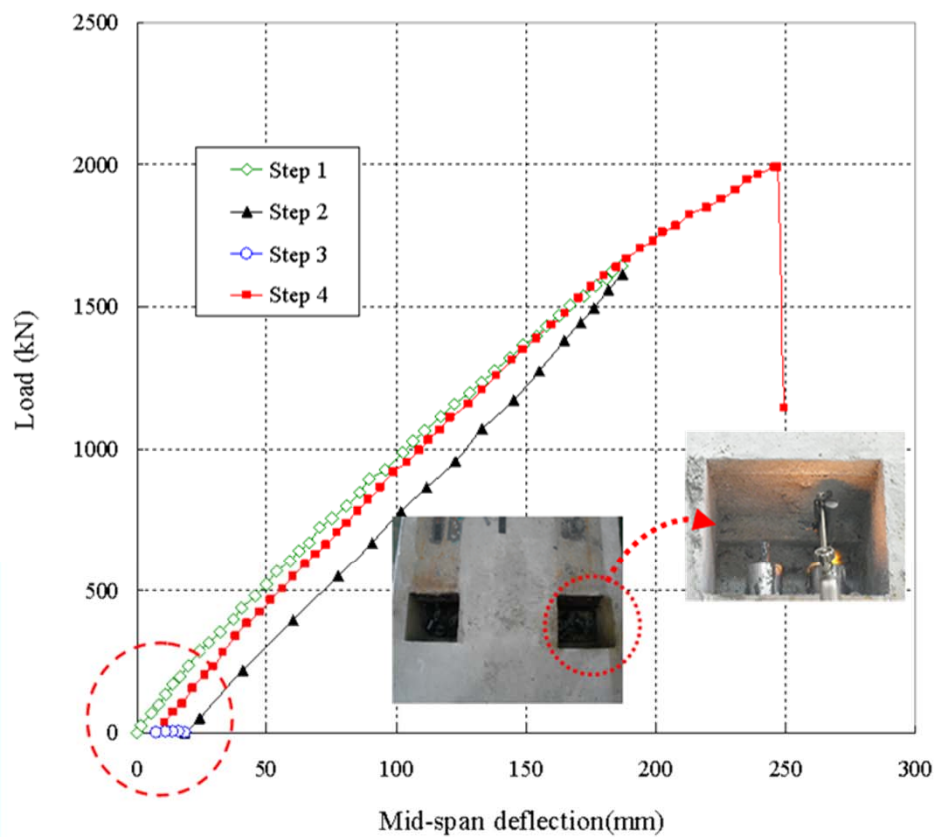
Experimental Performance Verification

❖ Loading Stage and Experimental Results

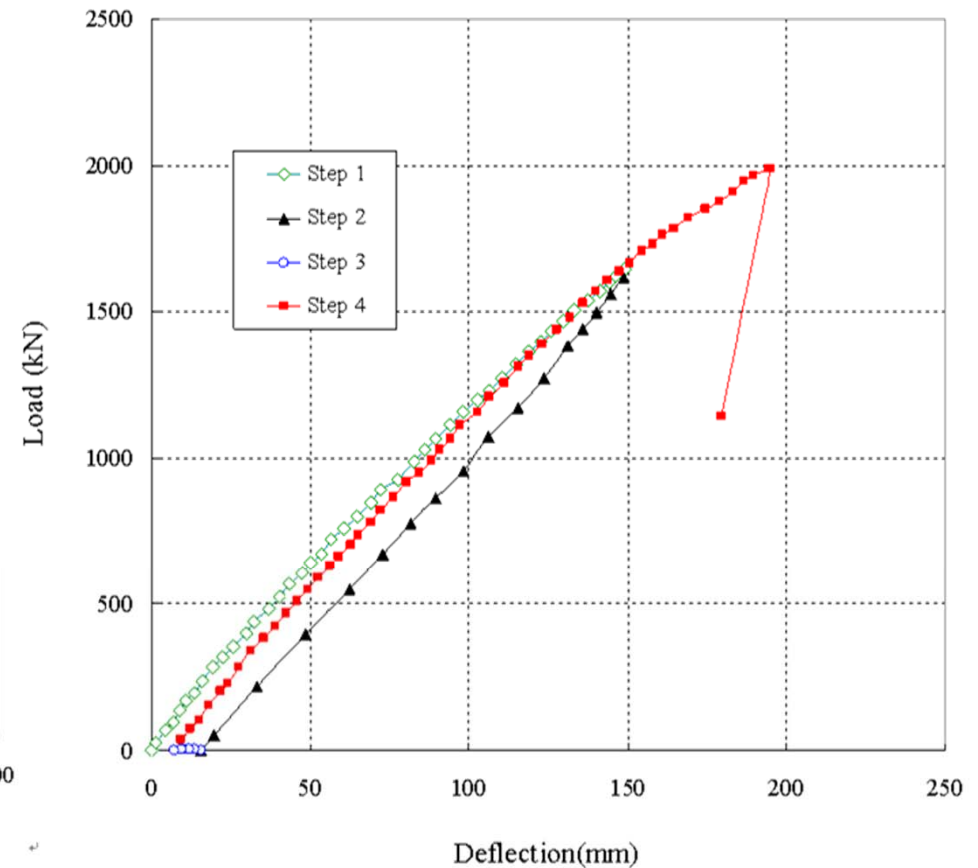


Stage	Load (kN)	Deflection (mm)		
		0.5L	0.3L	0.2L
Step 1	1,615	187.0	148.7	106.2
Step 2	0	18.7	15.5	11.0
Step 3	0	7.7	7.0	5.2
Step 4	2,000	246.8	195.2	139.5

❖ Load-Strain Curve



Center section

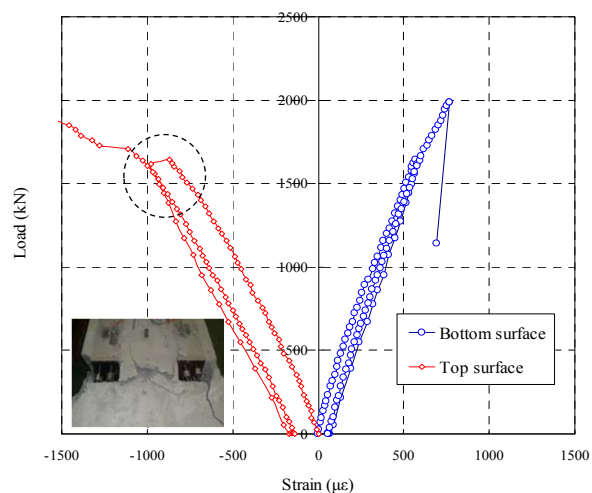


Section at 0.3L

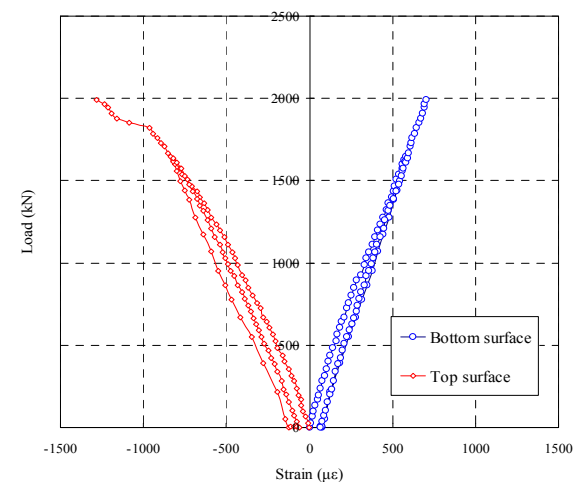


Structural Analysis and Discussion

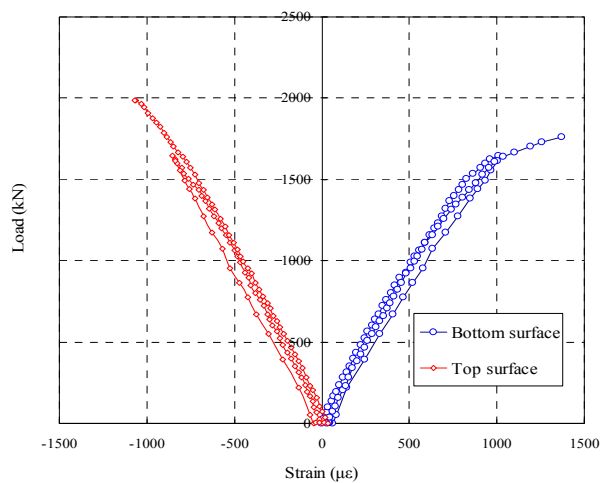
❖ Global Strain Results



C section (0.3L)

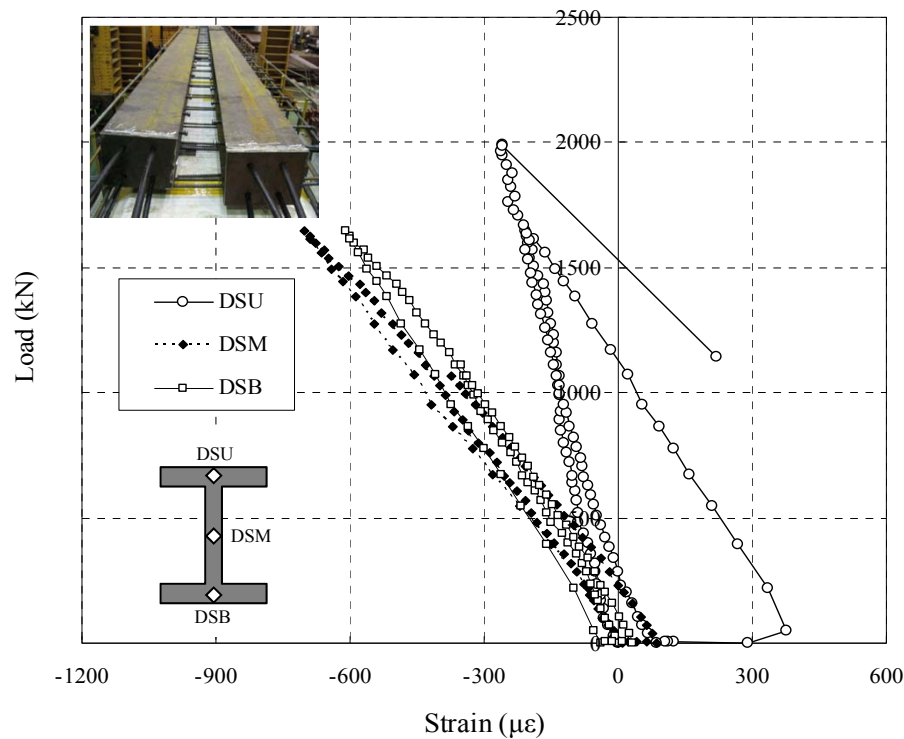


E section (0.7L)

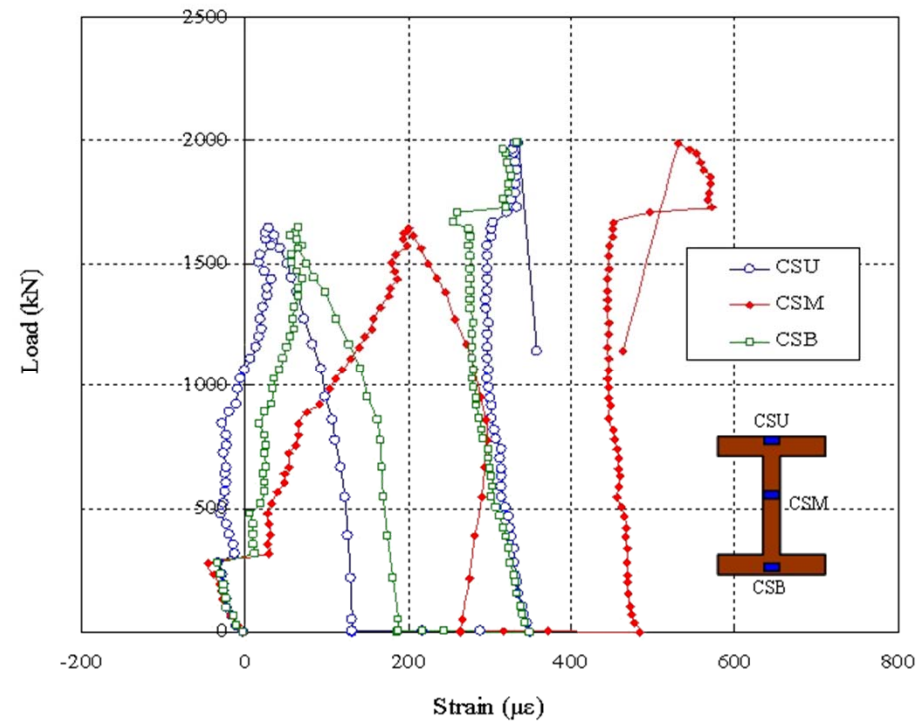


D section (center, 0.5L)

❖ I BEAM Strain Results



D section (center, 0.5L)

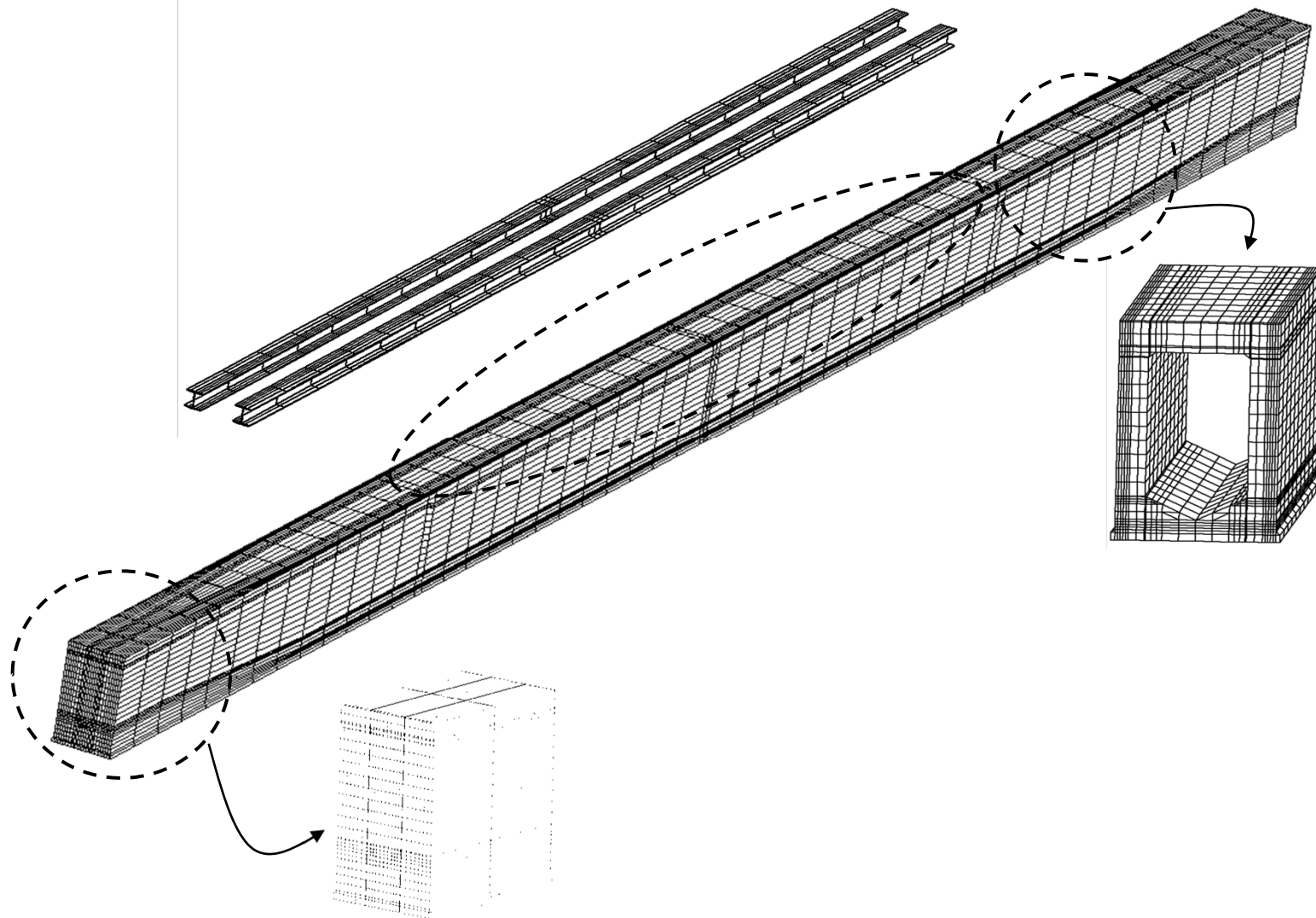


C section (0.3L)



Structural Analysis and Discussion

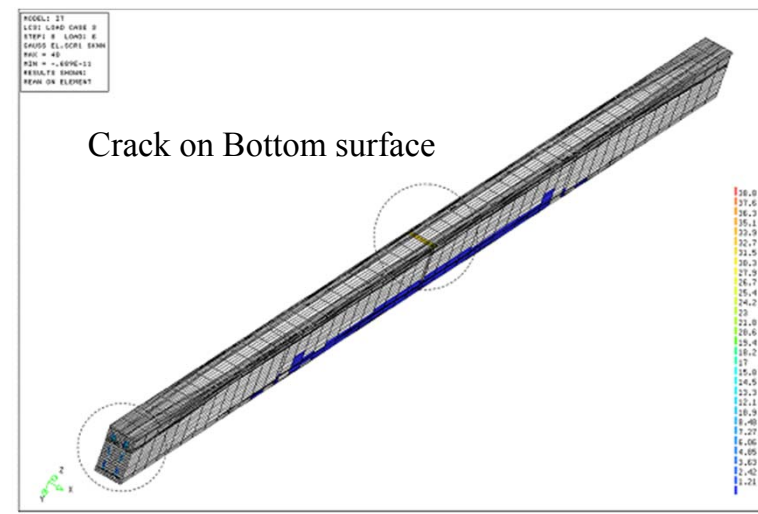
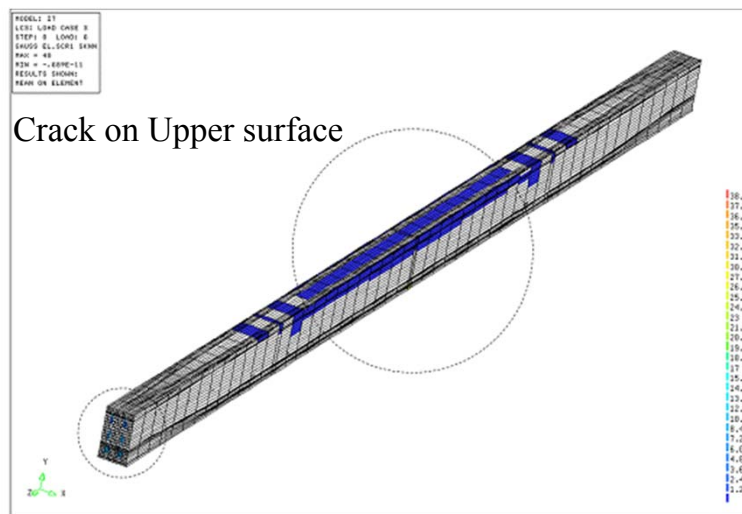
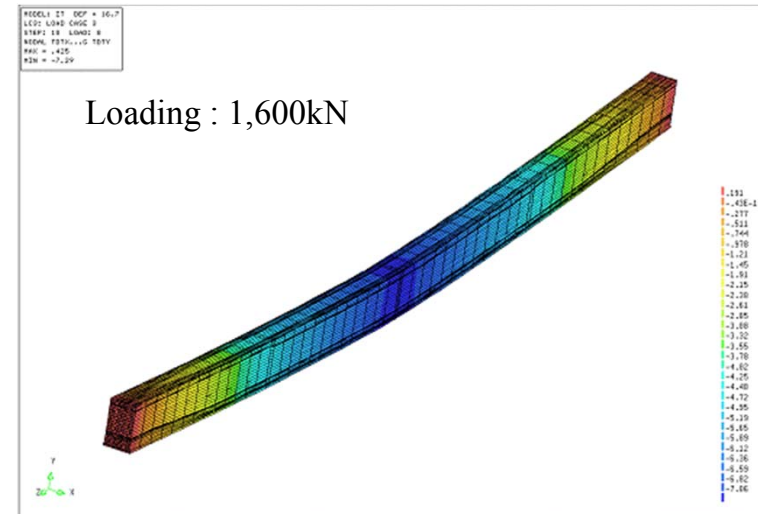
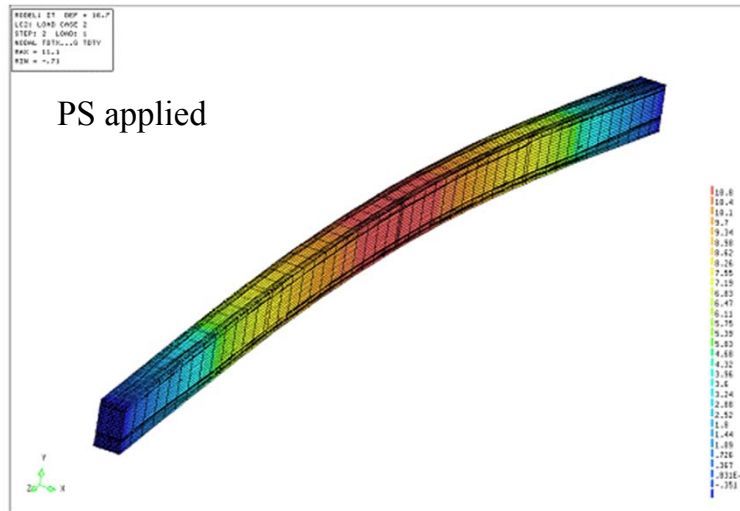
❖ FEM Analysis Results





Structural Analysis and Discussion

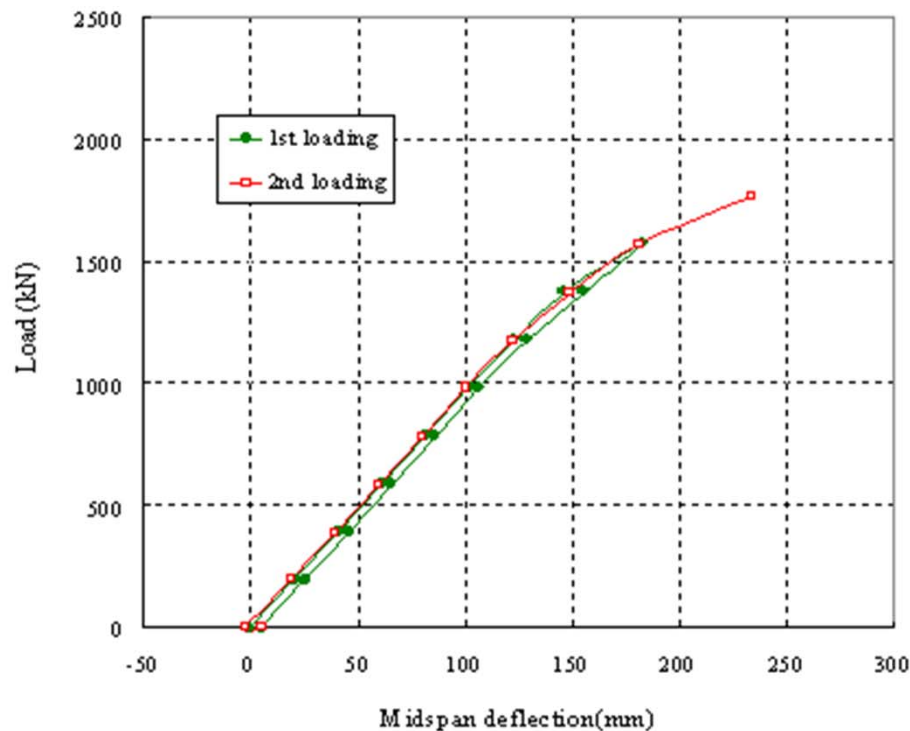
❖ FEM Analysis Results



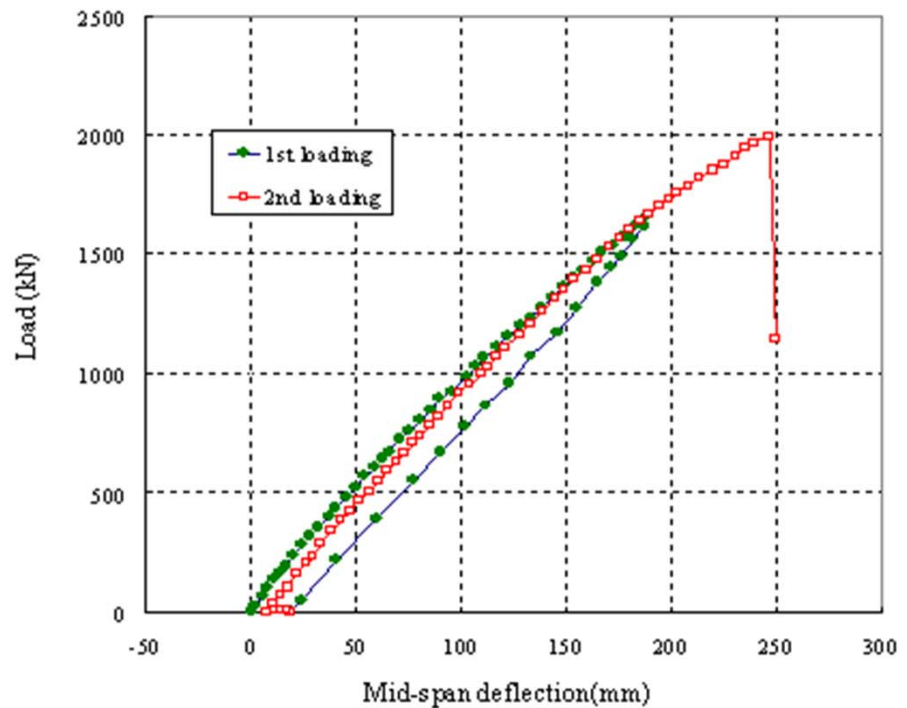


Structural Analysis and Discussion

❖ Test and Analysis Result Comparison



Result of Analysis



Result of Test



Conclusion

- ◆ **Residual deflection(18.7mm) recovery about 60%(11.0mm)**
- ◆ **Because of the low self-weight by using hollow section, IT girder is expected to be used for 50~60m span, or even longer span**



Thank you very much, 多谢