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**Development of Prestressed Steel Truss "Super Wing"**

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Synopsis :

Kawasaki Steel Corp. and Shimizu Corp. have developed a unique long span structural system called Super Wing, which utilizes a prestressed steel truss (PSST) and a sliding construction method. During the development of Super Wing, a full-scale 100-meter-span model was tested, and the structural behavior of the PSST was observed both during the prestressing stage and execution of the sliding construction. In addition, the relaxation of prestressing stands was studied experimentally. The wind pressure coefficient of this long span structure was also investigated using a wind tunnel. As a result of these test, Super Wing was proven to be successful as a structural design concept and construction method.

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**The body can be viewed from the next page.**

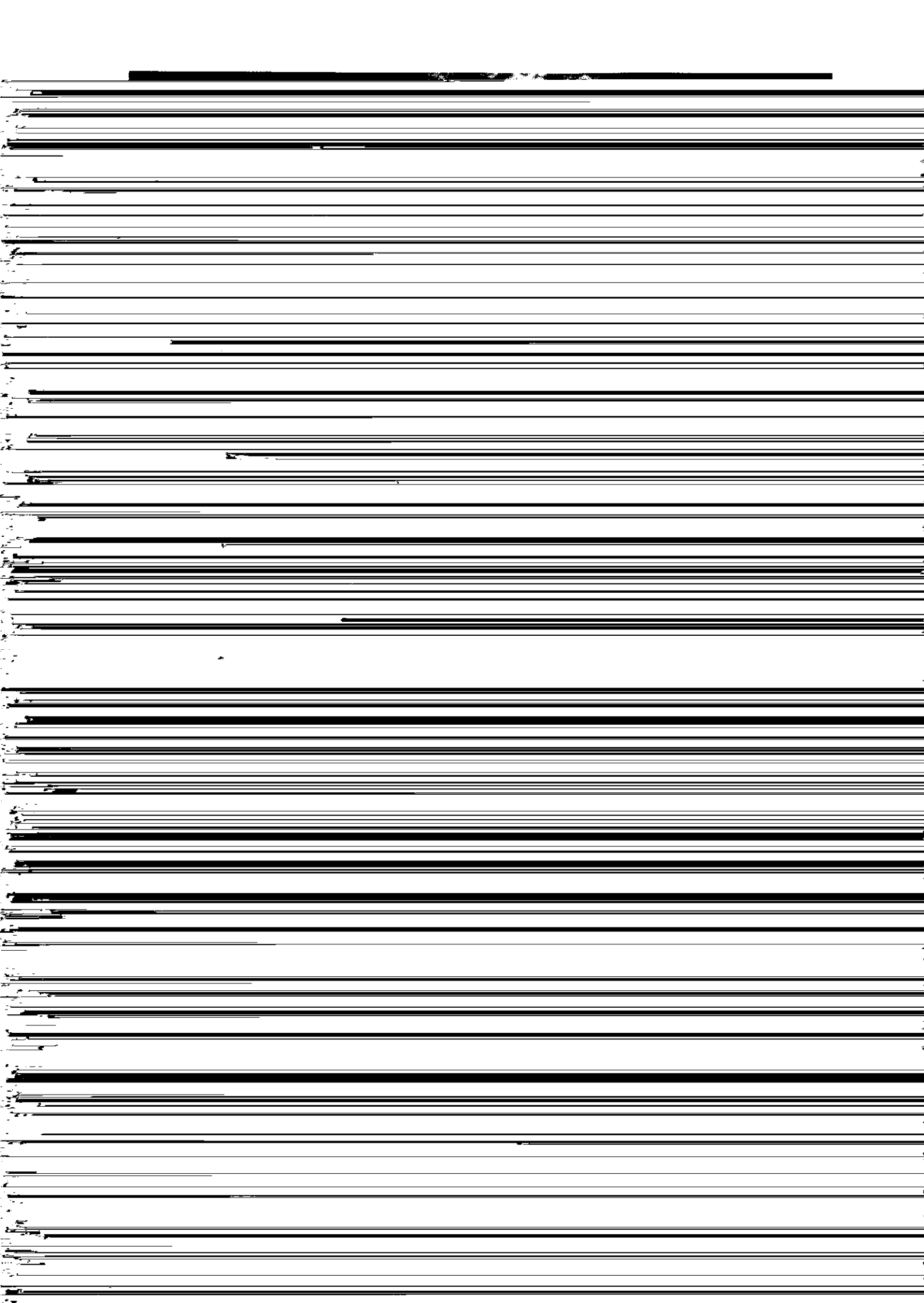
# Development of Prestressed Steel Truss "Super Wing"\*



**Synopsis:**

*Kawasaki Steel Corp. and Shimizu Corp. have developed a unique long span structural system called Super*

*Wing, a prestressed steel truss (PST) and*



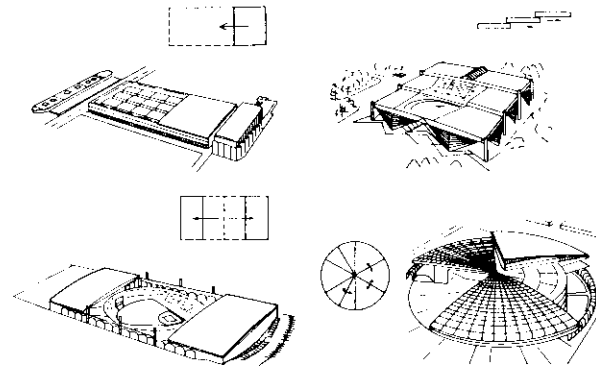
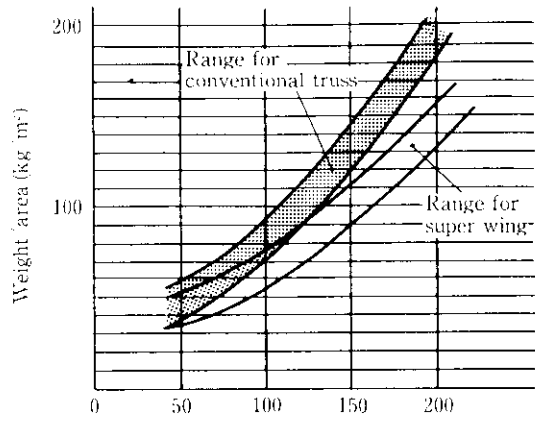


Fig. 4 Open and shut pattern

Fig. 3 Typical weight comparison of roof structure

under snow load and compression load under wind load, then the cross sectional area of the lower chord member can be minimized, resulting in a reduction of steel weight.

Advantage for Heavy Snow Load and for Long

tion and an unobstructed view to the sky can be obtained by opening or closing the roof according to weather conditions. In plants, warehouses, etc., an opening roof is effective in replacing equipment, as well as generally in the delivery of materials, shipment of products, etc.

Since PSST is basically a flat, long-span construction method, the roof opening/closing pattern is basically a

### 3 Structural Tests

jacking reaction force decreased theoretically with its introduction, becoming zero at the end.

In order to investigate the behavior of the structure

tests were carried out.

#### 3.1 Behavior of PSST When Prestress

##### Is Introduced

##### 3.1.1 Full-scale model structure

Variations in the axial load in the middle of the upper and lower chords of each truss are shown in Fig. 7. Initially, the upper and lower chord members were

subjected to approximately a 50-t axial load by jacking down, and then as prestress increased, the axial load changed linearly, reaching the bending point at about 40

time of loading.

### 3.2.1 Change in strand axial load due to additional load

## 3.3 Relaxation of Prestressing Strand

The relaxation of the prestressing strands is an important problem relating to the design reliability of PSST.







#### 4 Investigation of Wind Resistance

Although wind resistance designs are usually based on a Japan Building Standards Act or other enforce-

25 cm (depth). For the air current in coastal areas, 17 basic models of varying heights and depths and 2 models of varying heights with a 1/50 roof slope were used. For the air flow in urban areas, 6 models with basic dimensions and one model with a sloped

vided in the law is established by analysis and experimental studies considering uniform laminar flow and

as listed in **Table 4.**

(4) Measurement of Wind Pressure: The outputs from

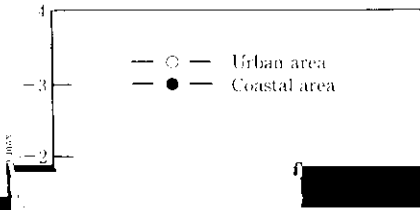
## 4.2 Data Evaluation

The average wind pressure coefficient  $P_{pe}$  is defined by Eq. (2).

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—○—  $h = 5$  cm  
—x—  $h = 10$  cm

Width: 50 mm x Depth: 25 mm



### 5 Slide Method for Construction of Super Wing

While it is conventional practice to erect temporary scaffolds under the entire roof surface, a slide method was developed for construction of Super Wing with the

on this platform. (step 3)

(4) Prestressing Strands Tension Work: After assembl

method or a combination of two such methods, best suited to the actual site conditions. Kawasaki Steel has

determine the finished level of roof accurately, the truss is jacked down to a proper position, taking into account the calculated amount of uplift due to the tension of the prestressing strands. Prestressing strands are then placed and prestress is introduced with jacks. The tension of the prestressing strands is

now that the sliding method has also been proved to be an established technique by these current tests, it has become possible to meet more varied site conditions.

## 6 Conclusions