1. Introduction

SMart BEAM™ is a welded light gauge H section steel manufactured by Nippon Steel & Sumitomo Metal Corporation, which primarily has been used as a beam material of steel prefabricated house, whose market share in Japan has been over 80%. Recently, the manufacturing technology of welded light gauge H section steel, which has been established in the former Sumitomo Metal Industries, Ltd., is combined with the manufacturing technology of highly corrosion-resistant steel sheet, which has been brought up in the former Nippon Steel Corporation as “SuperDyma™”, succeeding in developing and commercializing high corrosion resistance welded light gauge H section steel “SD-SMartBEAM™”. In addition, the utilizing method of SMart BEAM, which can ease the vertical vibration problems, has been developed and proposed to the market as the substitute for wooden beams of the wooden houses, especially for the large span part. In this paper, a brief outline, as for the SD-SMartBEAM and the substitution technology for large span wooden beam, is introduced.

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Abstract

SMart BEAM™ is a welded light gauge H section steel manufactured by Nippon Steel & Sumitomo Metal Corporation, which has primarily been used as a beam material of steel prefabricated house, whose market share in Japan has been over 80%. Recently, the manufacturing technology of welded light gauge H section steel, which has been established in the former Sumitomo Metal Industries, Ltd., is combined with the manufacturing technology of highly corrosion-resistant steel sheet, which has been brought up in the former Nippon Steel Corporation as “SuperDyma™”, succeeding in developing and commercializing high corrosion resistance welded light gauge H section steel “SD-SMartBEAM™”. In addition, the utilizing method of SMart BEAM, which can ease the vertical vibration problems, has been developed and proposed to the market as the substitute for wooden beams of the wooden houses, especially for the large span part. In this paper, a brief outline, as for the SD-SMartBEAM and the substitution technology for large span wooden beam, is introduced.

Nippon Steel & Sumitomo Metal started the commercial production in October 1973, and the accumulated amount of the production reached 5 million tons in July 2014. At the early stage, light gauge H section steel was used mainly for the main frame of low-rise buildings like manufacturing plants from the view point of saving steel material weight. However, as such manufacturing plants grew larger in size along with the elapse of time and the rolled H section steel has come to be used for main frame of such buildings as materials in mainstream. On the other hand, since around the end of 1970s, in the steel-framed prefabricated houses, light gauge H section steel has come to be used from the viewpoint of sectional performance efficiency, substituting the beam material that was built up of two light gauge channel sections jointed together back to back.

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As factors lying in the background, following features of light gauge H section steel are listed: the production of light H with relatively thin thickness is possible, the dimensional accuracy is very high, and the surface is flat and smooth. Such features mean that light gauge H section steel is well suited to automatic processing lines such as of hole opening by a punching machine, of cutting a member material by shearing, and of electrodeposition coating. Since after, as the steel-framed prefabricated houses have evolved to high quality industrialized houses and spread as the result of defect from the extension of temporary houses in the early period, light gauge H section steel have established the position as a standard beam material. Furthermore, in the spreading stage of light gauge H section steel in the steel-framed prefabricated houses, Nippon Steel & Sumitomo Metal played an influential role and has come to supply more than 80% owing to its quality and production capacity.

In addition to the features mentioned above, SMart BEAM is characterized by that both as-rolled specification and pre-coating specification types are producible by selecting the kind of steel strip to be used as the mother material. A hot-rolled steel strip sheet is used for the as-rolled-specified products and the products are used for the case where the all member materials are painted by customers after processing such as hole opening and welding. For the pre-coating-specified products, presently a hot-dip galvanized steel sheet (GI) is used as the mother material and the standard coating weight of GI is specified as Z27 (minimum total coating weight of both sides to be 275 g/m²) that satisfies the Grade 3 provided in “The Law Pertaining to the Promotion of Securing of Quality of Houses (hereinafter referred to as Quality Securing Law),” which is classified as the highest in the deterioration countermeasure classification (assessment criteria: countermeasures to ensure durability of a structural frame for an approximate period of three generations (75–90 years)).

Listed as the merit of the SD-SMB over the GI specification is the possibility of reducing the coating weight with the effect of compliance with the deterioration countermeasures (corrosion resistance) specified in the Quality Securing Law.

Intending for use in the field where the pre-coating-specified materials are used for members of wooden houses, Nippon Steel & Sumitomo Metal has developed and commercialized SMart BEAM™ termed as “SD-SMartBEAM™ (hereinafter referred to as SD-SMB™) that employs for the mother material the high corrosion resistance-coated steel sheet “SuperDyma™” as a means to further improve performance. SuperDyma has high corrosion resistance performance as compared with GI even if coating weight is reduced.

This article introduces the outline of the commercialized SD-SMB at first. Next, it introduces a part of the technological development made for the wooden house field, one of the areas of applications of SD-SMB (partial application of SMart BEAM to the area of large span parts where the use of wooden material is problematic).

2. Development and Commercialization of SD-SMartBEAM

2.1 Outline of merchandise of SD-SMartBEAM

The commercialized SD-SMB is the welded light gage H section steel of 400 N/mm² class that conforms to JIS G 3353 SWH400. In Table 1, the standard values of the mechanical properties of SD-SMB (SWH400) are shown. Furthermore, in Table 2, the type and the standard specification of the coating layer of SuperDyma steel strip that is used as the mother material are shown. The standard coating weight specification is as per K12. The welded portion of the flange and the web (hereinafter referred to as bead) and the flange edge are touch-up with water-soluble-type silver paint.

Pre-coating-specified SMart BEAM is used mainly for members of wooden prefabricated houses and small beams of wooden houses. In case SMart BEAM is used for wooden houses, materials are pre-coating specified in almost all cases for the purposes including compliance with the deterioration countermeasures (corrosion resistance) specified in the Quality Securing Law.
proved corrosion resistance, thereby improving the workability such as welding. Furthermore, as the producible range of the steel strip of the mother material can be expanded by the SuperDyma treatment, increase in flange thickness from 6 mm of GI specification up to 9 mm is possible.

2.2 Development of SD-SMartBEAM

2.2.1 Features of SuperDyma

SuperDyma, which is used as the mother material of SD-SMB, is a hot-dip galvanized steel sheet developed by adding aluminum of 11 mass %, magnesium of 3 mass % and very small amount of silicon to zinc and its corrosion resistance has been improved greatly as compared with that of zinc-coated steel sheet.

Owing to the addition of the abovementioned elements, SuperDyma has a characteristic coating layer structure. In Fig. 2, a sectional secondary electron image (SE) and the element distributions taken by an electron probe micro analyzer (EPMA) are shown. The coating solidification structure exhibits a primary crystal Al phase, a MgZn$_2$ intermetallic compound and a three-component eutectic structure of Al phase/Zn phase/MgZn$_2$. High corrosion resistance of SuperDyma is considered to be attributed to the effect of the dense corrosion product containing Mg and Si. These corrosion products formed in the early stage of corrosion and covering the surface layer of the coating, acting as a protective coating.

In Fig. 3, the quantity of the corrosion loss of bare SuperDyma in an outdoor exposure test is shown. SuperDyma exhibits the corrosion resistance about 3.8 times higher than that of the hot-dip galvanized steel sheet in a country environment and 5.1 times higher in the coastal and subtropical environments. From these results, the authorization by the special assessment method stipulated in the Housing Quality Assurance Act that SuperDyma has the corrosion resistance 3.8 times higher than that of GI has been obtained. Furthermore, along with the spread of high corrosion-resistant zinc-coated steel sheets, JIS G 3323 (Hot-dip zinc-aluminum-magnesium alloy-coated steel sheet and strip) was standardized in 2012 and Super Dyma has become a hot-dip zinc-coated steel sheet that conforms to the said JIS.

2.2.2 Assessment of corrosion resistance of SD-SMartBeam

Although the mother material of SD-SMB is SuperDyma, coat-

<table>
<thead>
<tr>
<th>Grade</th>
<th>Yield point or proof stress (N/mm$^2$)</th>
<th>Tensile strength (N/mm$^2$)</th>
<th>Elongation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWH400</td>
<td>245 min</td>
<td>400–510</td>
<td>≤5 JIS 5 23min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≤5 JIS 1A 18min</td>
</tr>
</tbody>
</table>

Table 1: Mechanical properties of SD-SMB (SWH400)

<table>
<thead>
<tr>
<th>Type of coating</th>
<th>Coating mass symbol</th>
<th>Minimum coating mass Average of 3 points (g/m$^2$)</th>
<th>Minimum of 1 point (g/m$^2$)</th>
<th>Equivalent thickness of coating (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot-dip zinc-aluminum-magnesium alloy coating</td>
<td>K12</td>
<td>120 (total in both sides)</td>
<td>102 (total in both sides)</td>
<td>0.033</td>
</tr>
</tbody>
</table>

Table 2: Kind and the standard specification of the composed coated steel strips (SuperDyma)

Fig. 2 Section solidification structure of “SuperDyma”

Fig. 3 Quantity of corrosion in the outdoor exposure environment of “SuperDyma”

(Extracted from “Ministry of Land, Infrastructure, Transport and Tourism: Authorization Certificate as per Special Assessment Method: KOKUJUSEI No. 342 Certificate of Test Results”)
color tone adjustment, touch-up is provided using water-soluble silver color paint that contains aluminum flake. Fig. 4 shows the appearance after the touch-up painting.

Upon commercialization, intended for confirmation of the corrosion resistance in the assumed use under an indoor environment, an acceleration test was conducted based on the JASO-CCT test (JASO-M609: composite cycle test provided by the Society of Automotive Engineers of Japan Inc. Standard, hereinafter referred to as JASO Test). The JASO Test is a test that repeats a plurality of a test cycle of 8 h test consisting of 5% salt water spray (2 h), holding in a dry state (4 h), and holding in a wet state (2 h), and it is said that, possibly as early as at about 45th cycle, red rust may start to appear on the sound part of Z27 (GI sheet with minimum total coating weight of front and back sides of 275 g/m²), which is classified as durability grade 3 in the Quality Securing Law. Furthermore, in addition to the JASO Test, a neutral salt spray test (hereinafter referred to as SST) conforming to JIS Z 2371 and a wet-state test were performed for comparison purpose.

The specifications of the test pieces are shown in Table 3. An SD-SMB produced on an actual manufacturing line was cut to a short length of about 150 mm and cut in the center of the web and provided to the test in T shape. In order for the assessment to be made on a safety side, the coating weight of the SD-SMB was set as per K08 (minimum coating weight of both sides together is 80 g/m²) that is less than the standard specification of K12. GI-SMB-Z27, which is a SMart BEAM currently produced using GI sheet as its mother material, was used for comparison.

Fig. 5 shows the appearances of the test pieces after 90th cycle of JASO test. Firstly, as for the general coated surface, contrarily to GI-SMB-Z27 where the partial generation of red rust is remarkably noticed on the web and the flange is almost entirely covered with white rust, in SD-SMB-K08, the area where white rust is generated is less and high corrosion resistance is confirmed. On the other hand, in the weld bead part where touch-up painting was applied, generation of certain amount of red rust was noticed on both test pieces and, consequently almost equal corrosion resistance performance was exhibited.

Table 4 shows the result of the assessment of the comparison with GI-SMB-Z27. It is confirmed that, as for general coated surface, even SD-SMB with K08 that has coating weight smaller than

### Table 3  Test pieces for corrosion resistance evaluation

<table>
<thead>
<tr>
<th>Mark</th>
<th>Coating type of composed steel strips</th>
<th>Thickness $t_w \times t_f$ (mm)</th>
<th>Coating mass symbol</th>
<th>Standard value of minimum coating mass (g/m²)</th>
<th>Touch-up of the weld bead part</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI-SMB-Z27</td>
<td>Hot-dip galvanized</td>
<td>3.2 × 4.5</td>
<td>Z27</td>
<td>Average of 3 points (total in both sides)</td>
<td>Waterborne silver paint</td>
</tr>
<tr>
<td>SD-SMB-K08</td>
<td>SuperDyma</td>
<td>4.5 × 4.5</td>
<td>K08</td>
<td>Average of 3 points (total in both sides)</td>
<td>Waterborne silver paint</td>
</tr>
</tbody>
</table>

### Table 4  Corrosion resistance evaluation result of “SD-SmartBEAM”

<table>
<thead>
<tr>
<th>Mark</th>
<th>JASO 45 cyc</th>
<th>JASO 90 cyc</th>
<th>(Reference data)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coated surface</td>
<td>Weld bead part</td>
<td>Flange edge portion (reference)</td>
</tr>
<tr>
<td>SD-SMB-K08</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

○ : Better than GI-SMB-Z27  ○ : Equal to GI-SMB-Z27
3. Application of SMart BEAM to Wooden Structure Building and Assessment of Habitability under Vibratory Condition

3.1 Approach to wooden house field

In the field of wooden houses, which is one of the areas for application of SD-SMB, application to wooden buildings such as nursing and health care facilities for aged people is being developed, exploiting the extended portion of the current technology. A factor lying in the background is the incentive given by the administrative organizations that encourages the spread of wooden architectures. For instance, “The Law Pertaining to Promotion of Application of Wooden Materials to Public Architectural Sector” enacted in 2010, and the co-living of steel with wooden architectures including wooden houses has become an essential subject on the part of steel manufacturers.

Owing to the feeling of warmth, ease of processing and so on, wooden material is widely used in detached houses. However, in case a large span part is needed for instance like in wooden architectures represented by nursing and health care facilities for aged people that exceed in scale the conventional houses, and by houses each of which is partly used as a shop, it is also a matter of fact that the wooden material implies many problems like creep phenomenon (a phenomenon in which deformation progresses along with the elapse of long time, causing floor squeaking and the like) and the high cost brought up by complicated manufacturing process.

Taking into account the current situation of the wooden architectures and characteristics of wooden material, Nippon Steel & Sumitomo Metal is promoting technological development aiming at applying SMart BEAM to the large span part of the conventional wooden houses and wooden structures, and weaving of light gauge wooden columns using hardware. To more than half of the present wooden material (glued laminated timber for structural use) or a wooden structure represented by nursing and health care facilities for aged people is being developed, except in case a large span part is needed for instance like in wooden architectures.

3.2 About SMart BEAM construction method

As shown in Fig. 6, the SMart BEAM construction method is a method that bolt-joints a SMart BEAM with a primary beam of wooden material (glued laminated timber for structural use) or a wooden column using hardware. To more than half of the present wooden structures, a hardware construction method that connects members with hardware and bolts is applied; therefore, consistency of the hardware in detail needs to be maintained. Then, the construction method was jointly developed with TATSUMI, the largest company specializing in wood-hardware construction method. It is a construction method devised to employ SMart BEAM only to secondary beams of a large span part and roof beams, leaving other wooden structures as conventionally structured. Applied usage is for a house with its large span part over the first floor space used as a shop or, for the dining room section of nursing and health care facilities for aged people. Furthermore, the SMart BEAM construction method has acquired the assessment of the Building Center of Japan (a general incorporated foundation), and by conducting following the assessment, practical work like submission of application for building confirmation of small scale wooden structure termed as No. 4 category architectural structure is eased. Fig. 7 shows an example of the actual application of SMart BEAM.

3.3 Vibratory property in SMart BEAM construction method

In developing and expanding the application range of the SMart BEAM construction method, securing of habitability under a vibratory condition is a big technical subject. Stated in this section are the verification of the performance of the present SMart BEAM construction method, and the assessment of the habitability and the study on countermeasures for securing habitability, both conducted aiming at expanding application range.

3.3.1 Method of assessing habitability and performance-deteriorating factor in large span part

The assessment of habitability under a vibratory condition is to be conducted in terms of the index $V(I(2))$ stipulated in the guideline of the Architectural Institute of Japan. $V(I(2))$ is expressed by Formula (1) and shows that the smaller the value is, the higher the performance becomes. In the formula,

$$V(I(2)) = 0.2\log D_{\text{max}} + 0.5\log V_{\text{m}} + \log T_{\text{h}}$$

$D_{\text{max}}$: Maximum displacement of floor
$V_{\text{m}}$: The value of $D_{\text{max}}$ divided by $T_{\text{v}}$, the time from the start of vibration to the arrival of maximum displacement
$T_{\text{h}}$: Time required for the amplitude of acceleration of floor to be dampened to 14.1 cm/s²

From the formula, it is known that in order to enhance the performance in the subject assessment, it is necessary to reduce the maximum displacement and the speed at which the maximum displacement is reached and to dampen the acceleration early. Quite contrarily, when a floor span part is enlarged, the habitability under...
a vibratory condition tends to deteriorate generally due to reasons that “dynamic maximum displacement $D_{\text{max}}$ increases similarly to static displacement and furthermore, $V_m$, the function of $D_{\text{max}}$, also increases,” and “the natural frequency of the floor falls, and the floor becomes prone to resonate with the vibration caused by the behaviors of dwellers like walking.”

Taking into account the above, the habitability under a vibratory condition when the SMart BEAM construction method is applied to a large span part is assessed by an experiment as stated in the following section.

### 3.3.2 Assessment of experiment for habitability under vibratory condition

In Table 5, the specification of the subject, three test bodies, for assessment is shown. Also in Fig. 8, as an example of the three test bodies, the view of the lower side of the test body 3 looked up at from below is shown. Furthermore, although from the viewpoint of rust prevention, pre-coated SMart BEAM is used for beams as the final merchandize in the SMart BEAM construction method, red coating for simple rust prevention is used in the test.

The test body 1 is simulated for general wooden floor and is equipped with sufficient habitability under a vibratory condition and made to be the standard test body in the experiment. In the test bodies 1 and 2, a large span of 5460 mm, which is generally seen in houses is assumed, and for the beam (the word “beam” mentions secondary beams exactly, which hereinafter referred to simply as beam), glued laminated timber is used in the test body 1 and SMart BEAM is used in the test body 2. The span of the test body 3 is 7280 mm assumed for the large span part in large-scale houses and wooden architectures and SMart BEAM is used for the beam. The sectional dimensions of the beams have been selected so as to control the deflection to below about 1/600 (9.1 mm) in the test body 1 and the test body 2.

On the other hand, in the test body 3, in order to avoid the aforementioned deterioration in habitability under a vibratory condition, a section relatively higher in rigidity has been selected so as to control the deflection to below 1/1120 (6.5 mm). In the test bodies where SMart BEAM is used for the beam, the floor material of ply-

### Table 5 Test body

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Floor</th>
<th>Beam</th>
<th>Wooden girder section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6P-W</td>
<td>5460</td>
<td>3640</td>
<td>Glue laminate timber / 105 × 330</td>
</tr>
<tr>
<td>2</td>
<td>6P-SMB</td>
<td>5460</td>
<td>3640</td>
<td>SMB / 300 × 100 × 3.2 × 3.2</td>
</tr>
<tr>
<td>3</td>
<td>8P-SMB</td>
<td>7280</td>
<td>7280</td>
<td>SMB / 400 × 135 × 4.5 × 6.0</td>
</tr>
</tbody>
</table>

[Fig. 8 Test body No. 3 (look up from lower level)]

[Fig. 9 Time history responses result of acceleration and displacement]

wood of 24 mm in thickness is connected to the beam with self-drill screws. The beams (secondary beams) of the test bodies are connected to the outer peripheral beams (primary beams) with bearing bolts via hardware. Furthermore, the beams are arranged at the separation distance of 910 mm in the width direction.

Excitation and the measurement are conducted at the center position in the span direction and in the width direction of the floor. For the excitation, in order to simulate a dweller walking on the floor, a lump of clay of 3 kg was free-dropped from the height of 400 mm. The vibration was measured, taking the upward direction of the vertical axis as positive, by an acceleration-measuring meter and a laser-type displacement-measuring meter installed on the web axis position of the lower flange of the beam.

Fig. 9 shows the results of the measurement of the timewise responses of acceleration and displacement of the three test bodies. When the results of the test body 1 and the test body 2 are compared, it is found that the factors that influence the assessment of habitability under a vibratory condition, namely the maximum displacement, the speed at which the vibration reaches its maximum displacement, and the damping time of the acceleration exhibit almost similar values. Although the assessment of the habitability using the absolute numerical values is difficult since the excitation is provided for a simulation purpose in the experiment, however, when relatively assessed, it is judged that the test body 1 and the test body 2 exhibit almost equivalent habitability. On the other hand, the test body 3 exhibits values of the maximum displacement and the maximum acceleration speed smaller than those of other test bodies and it is considered that, as aforementioned, the effect of using a beam with rigidity higher than those of other test bodies has been obtained. However, both in acceleration and in displacement, the phenomenon of the amplitude growing smaller once and then growing...
In order to grasp the beat that deteriorates habitability, analysis of the vibration characteristics of the test body 3 was conducted. In Fig. 11, the result of Fast fourier transform (FFT) analysis of the acceleration response of the test body 3 is shown. From the figure, it is known that the test body 3 has its response peaks at the frequencies of 16.4, 20.0, 28.2, and 38.2 Hz. Beat is considered to be produced by the response of the floor, and a plurality of vibration modes having almost same frequencies are produced. It is presumed that the beat is produced by the response of the floor, and for the elimination of the beat, suppression of the torsional vibration in the direction perpendicular to the direction of the span (width direction) to increase the number of antinode of vibration modes in a narrow-ranged frequency band.

Furthermore, in Fig. 12, as a result of mode analysis of the experiment, the mode pattern of the floor near the peak frequency in the neighborhood of the aforementioned frequencies, having the antinode at the floor center section, in a manner to grow to higher-order vibration in the direction perpendicular to the direction of the span (width direction) is reproduced. Furthermore, the dotted line in the figure represents the wooden primary beam part of the outer peripheral of the test body. From the figure, it is found that the test body 3 vibrates in the neighborhood of the aforementioned frequencies, having the antinode at the floor center section, in a manner to grow to higher-order vibration in the direction perpendicular to the direction of the span (width direction) to increase the number of antinode of vibration modes.

3.3.3 Analysis of beam vibration characteristic

In order to grasp the beat, a numerical analysis is conducted based on the result of the mode analysis of the experiment reported in the previous section, and the vibration characteristic of the beam is analyzed.

For the analysis, an all-purpose software ANSYS was used and shell elements were applied to both of the floor material and the beam. Furthermore, the analysis was made for the entire floor. In Fig. 13, the vibration mode pattern forms of the floor and the beams as a result of the analysis of vibration eigenvalues are shown. Likewise, Fig. 12, the pattern is represented as a contour pattern of standardized mode vector with the maximum amplitude taken as 1. Furthermore, from Fig. 13, it is found that, when the results of the numerical analysis (a)–(d) are compared with the results of the experiment in Fig. 12 (a)–(d), although discrepancies in the frequency by about 10% at highest exist, the vibration mode form is well reproduced. Furthermore, it is found from Fig. 13 that, as the upper displacement of flange of the Smart BEAM is restrained by the floor material whereas the lower flange is not restrained, it is known that some beams vibrate, being twisted in the axial direction of the member. As the torsional vibration of the beam is produced independently in each beam, when the floor span part and the number of the beam installed in the width direction becomes larger, a plurality of vibration modes having almost same frequencies are produced. It is presumed that the beat is produced by the response of the floor, and therefore, for the elimination of the beat, suppression of the torsion-
al vibration of the beam is necessary.

3.3.4 Example of countermeasures for improving habitability under vibratory condition

As an example of countermeasures for suppressing beat and improving the habitability under a vibratory condition for the case of the large span part of about 7.2 m, partial arrangement of beams in lattice pattern was contemplated. In Fig. 14, the countermeasure applied to the aforementioned test body 3 is shown. Furthermore, shown in Fig. 15 is the comparison of before and after of the application of the countermeasure with respect to the timewise response of acceleration excited by the clay lump. From the figure, it is found that, with the partial application of the lattice-arranged beams, the acceleration response is dampened at an early stage. Furthermore, as Fig. 16 shows that the vibration modes are converging to one mode after the countermeasure is taken, it is found that the frequency modes that existed in a narrow-ranged frequency band and caused beat have been eliminated. Also $V(2)$ value has come to $-0.890$, and as found in the previously shown Table 6, the habitability under a vibratory condition has been improved to above that of the wooden beam floor.

4. Conclusion

This article introduced the product development of “highly corrosion-resistant pre-coated welded light gauge H section steel (SD-SMartBEAM)” and the technological development for the application to the field of large span parts of wooden structures that is considered to be promising as a market where the pre-coated light gauge H section steel are utilized. Hence, Nippon Steel & Sumitomo Metal will continue to make efforts to further improve the performance of SD-SMartBEAM, to expand the field of application, and to promote the use of SD-SMartBEAM in a wider range including the field of wooden structures by exploiting the technological development.

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