On Cause Analysis, Measures and Countermeasures of Common Problems of Residential Prefabricated Exterior Walls

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Abstract: In recent years, the state has vigorously promoted the construction and development of prefabricated housing projects. In the past two years, prefabricated projects have been completed. Some project owners have raised a lot of complaints about the flatness of the residential facade and the cracking of the outer wall. These problems plagued the owners, but also formed a greater social impact. The purpose of editing this article is to reduce common problems, improve the look and feel, and improve the satisfaction of the owners.
***Keywords*:** common problems of prefabricated exterior walls, cause analysis, prevention and treatment

The problem of flatness and cracking of the exterior wall of prefabricated houses is a new problem in the development of prefabricated houses, and it is gradually developing into a common quality problem that plagues engineers and owners. We need to systematically analyze the cause of the problem, and carry out prevention and governance in an all-round way from the designer, component processing, general contract installation, and professional contracting of exterior decoration. It is necessary to improve the standardization level from in-depth design, component manufacturing, installation process, exterior wall decoration, etc., in order to fundamentally solve this problem. Now, the cause analysis, preventive measures and treatment countermeasures of the prefabricated exterior wall problem are discussed in detail.

1. Reason analysis, prevention and treatment methods for uneven exterior walls

1.1 Analysis of the causes of uneven exterior walls

There are basically two types of exterior walls. One is the commonly used sandwich-type prefabricated exterior wall. The unevenness of the prefabricated exterior wall is mainly caused by the uneven installation of the wall panels; the other is the concrete exterior wall without composite insulation layer. Walls, which are usually used in conjunction with stone curtain walls and metal curtain walls, are not within the scope of this discussion.

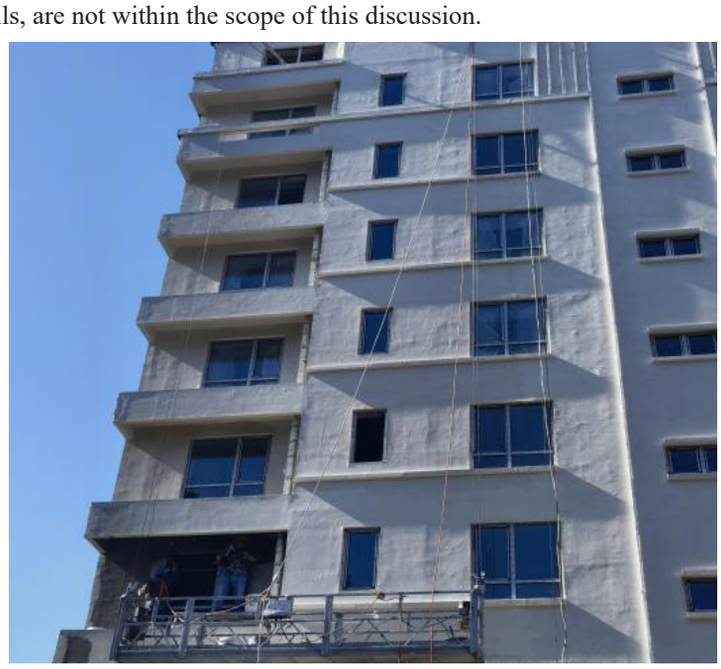

Figure 1. Bolt hole plugging marks and grouting left behind

Figure 2. Plate cracks

1.1.1 Cause analysis of component manufacturing process

First, the external wall processing generally adopts the positive construction method, that is, the construction of the 60mm outer blade is carried out first, the 70mm insulation layer is installed, and then the 200mm inner blade is poured. The flatness of the outer blade is realized by the flatness of the steel plate, so the flatness of the steel mold is the key. Therefore, the flatness of the steel mold should be checked at regular intervals during the production of the template. Second, the steel bars of the outer wall panel plug and the mold hole positions of the sleeve are not uniform. Third, the component is released early, and the rebound of the extruded board may be deformed when the outer blade is lifted.

1.1.2 Cause analysis of component installation process

First, the positioning deviation of the steel bars in the transfer layer or the deviation during the pouring process. Second, in the process of component installation, we only pay attention to the actual measurement of the flatness inside the outer wall, and do not focus on the flatness control of the outer side. Third, the bolt holes on the wall are blocked and waterproofed higher than the wall. Fourth, the grouting remains are not cleaned up in time, and the strength is too high in the later stage, which is difficult to polish and level.

1.2 Analysis of preventive measures for uneven prefabricated exterior walls

First, the on-site personnel should check the flatness of the large steel formwork of the outer wall every 2 weeks to prevent the deformation of the formwork and the distortion of the components. Second, check the reinforced holes of the upper and lower end formwork of the same project exterior wall panel, and measure whether the aperture, spacing and position of the formwork holes are completely uniform. Third, the outer wall joints should mainly meet the flatness of the outer facade, and the warpage or unevenness of the inner and outer walls can be adjusted during the decoration of the inner wall [1]. Fourth, improve the reinforced positioning plate at the construction site, which is convenient for accurate positioning and convenient concrete pouring [2]. Fifth, before hoisting the outer wall, the sponge strips on the outside of the wall should be nailed to the insulation layer of the lower board, which should be set continuously and the joints should be tight to prevent the grouting liquid from flowing out. Once the grout has flowed to the outer wall, clean it up in time with a shovel or cotton wool.

1.3 Treatment measures for uneven prefabricated exterior walls

① Use a 2-meter ruler to check the flatness of the prefabricated wall base, and mark the parts that do not meet the flatness requirements;

② After the installation of the outer wall is completed, before the construction of the glue joints on the outer wall, use a grinding wheel to grind the uneven marks of the outer wall joints, use a flower drill to chisel or a local anti-cracking mortar to level it, so that the adjacent flatness is within 5mm[3]. Glue the glue seam after the problem; if the outer wall has been glued to the glue seam, it needs to be polished or chiseled in the same way as above. The damaged part of the glue seam should be opened with a wallpaper knife and glued again. Pay attention to the assembly type 30 days in advance. Compatibility test of special adhesive for construction;

③ For the parts with serious protruding wall, such as wall slurries and bolt holes, remove the anti-cracking mortar layer and carry out local grinding or leveling treatment;

④ Do the base pullout strength test on the finished surface of the existing paint. The test data is greater than 5.5KN for the base adhesion at the non-window sill and bolt hole waterproof parts of the wall, indicating that there is no problem with the base adhesion.

⑤ In order to strengthen the adhesion between the finished veneer layer and the leveling layer, the interface agent should be rolled and brushed as a whole after the basic treatment is completed (the glue joint has been applied during the local treatment);

⑥ Paste a customized 30mm wide double-layer special tape at the glue joint position, and push the anti-crack mortar layer no more than 5mm thick in the prefabricated board with a trowel. After completion, ensure that the single prefabricated board and the adjacent board are flat. Within 4mm [4], the flatness of the external wall putty is approved twice and the overall flatness reaches within 3mm of the national standard of high-grade thick coating or multi-layer coating. The key is the acceptance of the smoothness of the adjacent wall panels on the facade, the acceptance of the smoothness of the anti-cracking mortar, and the acceptance of the smoothness of the putty.

Figure 3. Diagram of the rectification of the facade

⑦ Treatment of the outer corner of the prefabricated panel. First, apply the inorganic thermal insulation mortar leveling layer within 10mm as a whole, and then hang the net to apply a crack-resistant mortar layer. After the leveling is completed, ensure that the flatness of the single prefabricated board is controlled within 4mm.

2. Cause analysis, prevention and treatment of cracking of external walls

2.1 Analysis of the causes of cracks in exterior walls

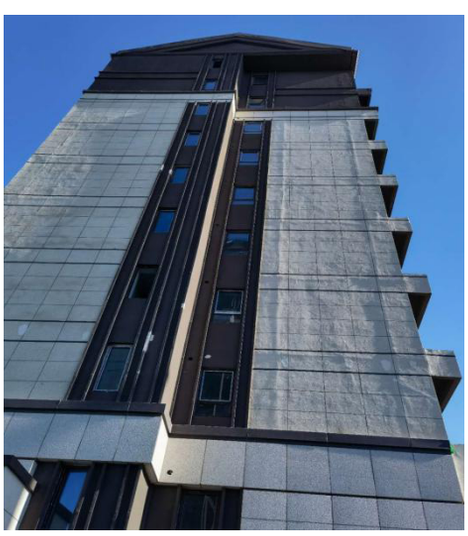

Figure 4. Expansion and cracking of vertical glue joints on the façade

Figure 5. Swelling and cracking of horizontal glue joints on the façade

Design flaws: Improperly designed façade divisions. The exterior façade is divided too much attention to beauty, and the air in the structural cavity in the board seam is not considered to expand with the increase of temperature, and the inorganic coating cannot be pasted on the weather-resistant glue, and it cannot be stretched synchronously with the expansion of the glue seam, resulting in When the coating layer outside the glue joint is pulled and cracked, it is commonly known as external wall cracking.

Construction defects: When the masonry or slats are installed at the interface, there are gaps that are not treated or there is no reinforcing steel wire mesh across the interface, resulting in cracks on the plastering surface.

2.2 Analysis of preventive measures for external wall cracks

① The grid joints should take into account the original structural glue joints, and it should be ensured that the original glue joints are exposed and not covered by paint. Before crack-resistant mortar, putty, and paint, tape must be used to stick the glue seam every time to ensure that the glue seam is exposed at the end, which can not only ensure that the glue seam is not cracked, but also greatly improve the appearance of the flatness of the facade.

② The water and air ducts in the outer wall cavity must be set up according to the required position and quantity, and ensure that the reserved cavity is clean, and the air and water vapor in the cavity can be freely discharged from the wall, so that the gas in the outer wall cavity will not be released. The paint cracks and water is also drained out of the wall through the cavity structure.

③ Parts of integrally prefabricated buildings are often divided and maintained by small masonry or air-entrained slats, and the interface with the concrete wall should be nailed with galvanized steel mesh with a width of not less than 100mm on each side as a crack-resistant strengthening measure.

2.3 Treatment methods for external wall cracks

Governance principle: follow the principle of model guide, first select a unit wall as a model, do a test, then summarize experience, and carry out operations in a large area; strictly inspect and accept the principle, formulate inspection and acceptance points according to the plan, and strictly check and control.

2.3.1 Cracking treatment of panel joint coating

① The glue joint part of the prefabricated board is cut with a toothless saw and the mortar layer on the glue joint is completely removed to expose the original structural glue. The cutting position is not less than 150mm wide on both sides of the glue joint;

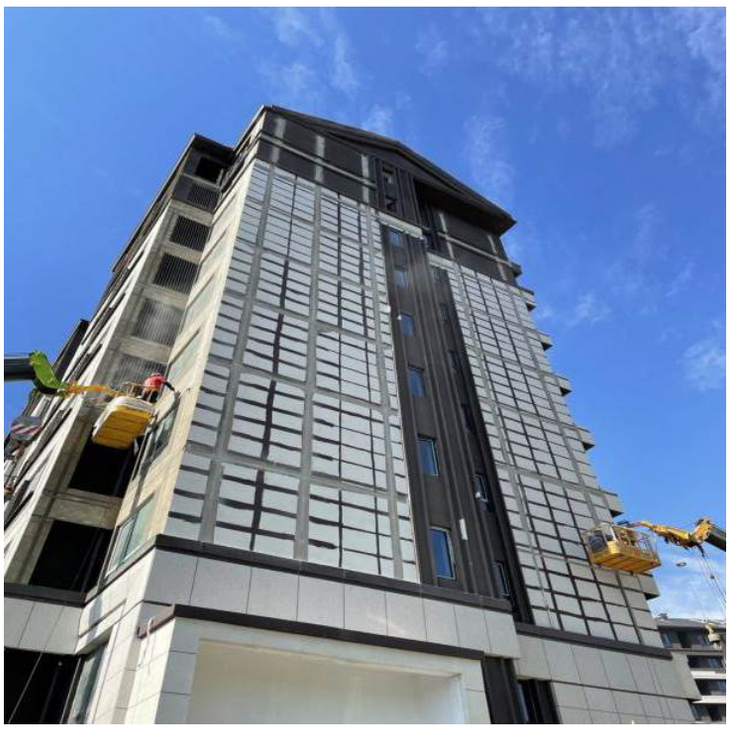

Figure 6. Grid line position change diagram

② In order to reduce the thickness of the leveling layer of a single prefabricated wallboard, the leveling layer and anti-cracking mortar layer that are partially smooth on both sides of the original construction glue joint are removed together, and the total width of the removed is not less than 300mm;

③ After the basic treatment is completed and the floating ash is cleaned, the one-component concrete interface agent should be brushed as a whole. The interface agent should be applied evenly and without leakage;

④ A 30mm wide gelatin seam is set at the seam of the prefabricated component, and a customized 30mm wide double-layer special tape is pasted at the glue seam position;

⑤ Use anti-cracking mortar for local leveling within a wide range of 250mm at the glue joint position. To ensure the smooth glue joint, tear off a layer of tape after the local leveling layer is completed, and keep a layer of tape;

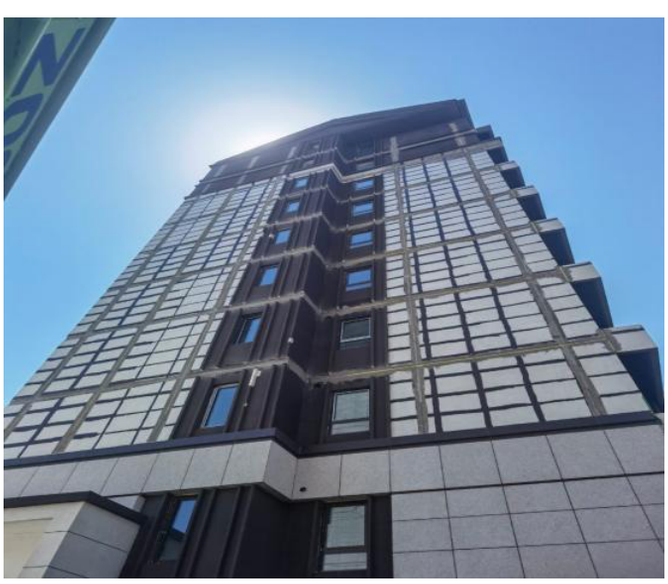

Figure 7. The partition is combined with the exterior wall panel and the glue joint is exposed.

Figure 8. The operation process of the double-layer tape for the partition and joint

2.3.2 Control measures for cracks at the interface of different materials

Use a toothless saw to open the joints, and the shape is V-shaped; fill the joints with inorganic micro-expanded mortar; apply anti-cracking mortar to the outside and press a layer of alkali-resistant and anti-cracking glass fiber cloth to resist cracking.

2.3.3 Construction of prefabricated panel coating finish layer

①After the acceptance of the mortar leveling layer is qualified, according to the requirements of the coating construction process, the whole flexible water-resistant putty is fully scraped;

② After the putty has passed the acceptance inspection, tear off the special tape at the position of the glue joint, make local treatment to ensure the smooth glue joint, and use the toned prefabricated building special glue (silane-modified sealant) for secondary glue;

Figure 9. Construction drawing of secondary glue joint

③ According to the remaining open seam of the prefabricated board, re-adjust the grid seam effect of the façade;

Figure 10. Effect drawing of the rectification of the facade

④ Re-apply the paint finish layer.

3. Supporting scheme of hanging basket for facade work

The background of the façade rectification is that most of the landscaping has been completed, and there are no conditions for erecting external frames. The truck crane is not suitable for large-scale operations. The operation of the façade is very difficult, and conventional measures cannot be used. In this paper, the non-counterweight hanging basket is used as the façade disposal operation facility.

3.1 Installation diagram of hanging basket without counterweight

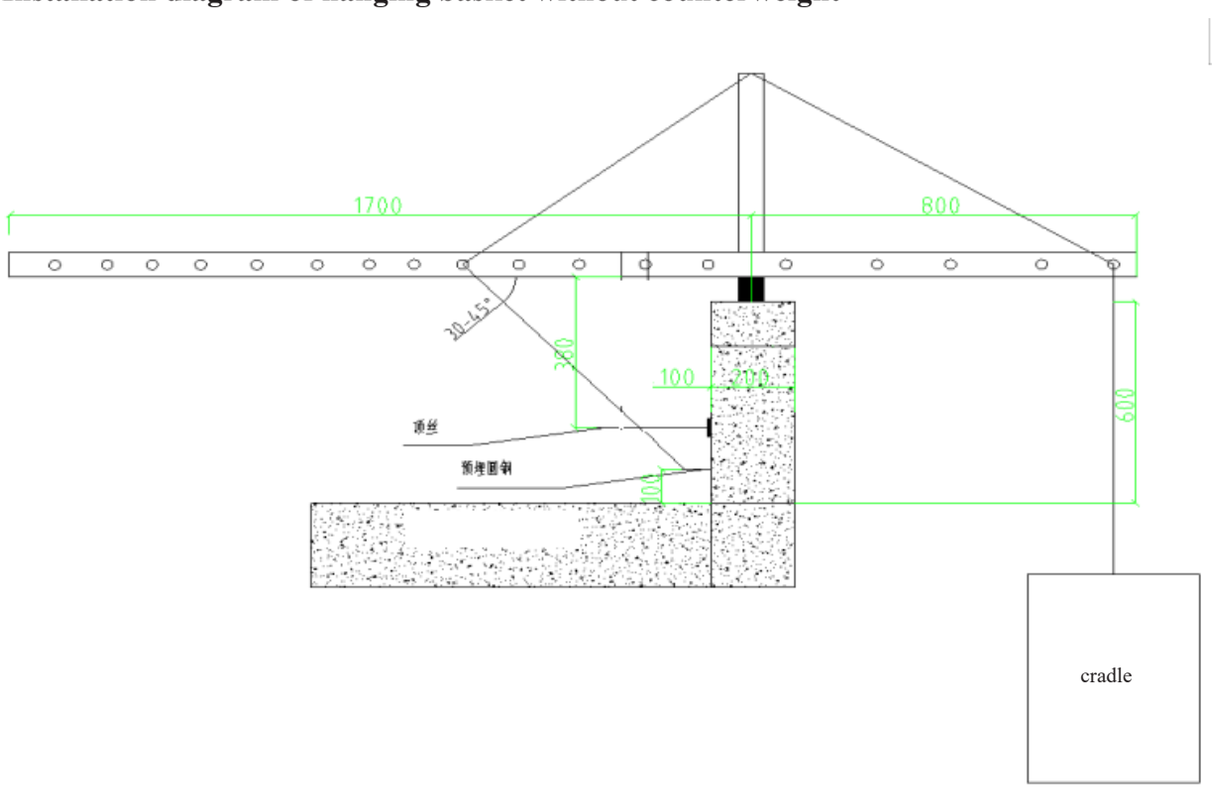

Figure 11. Schematic diagram of the non-counterweight hanging basket

Figure 12. Implementation diagram of the non-counterweight hanging basket at the longitudinal wall

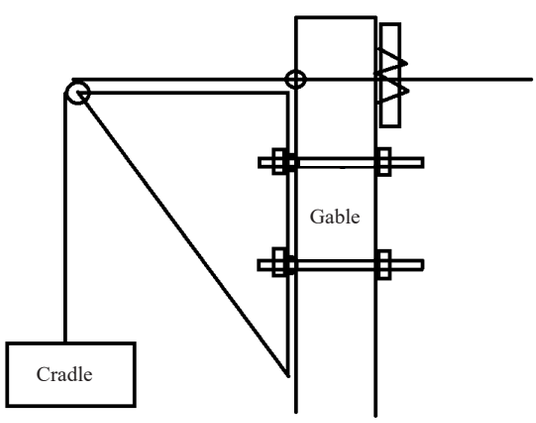

Figure 13. Schematic diagram of the implementation of hanging blue without counterweight on the gable part

3.2 Precautions for hanging basket installation

① The installation plan of the non-counterweight hanging basket should be demonstrated by experts before installation, and perfected according to the opinions of experts;

② After the installation is completed, it needs to be tested by a formal inspection unit before it can be used. Project acceptance must do no-load, full-load and overload operation tests;

③ The exterior wall panels are designed to reduce the counterweight, and the cable-stayed steel strands shall be fixed

by the wall-penetrating method during the safety period;

④ The fixing of the safety rope of the hanging basket should be independently established and used correctly to ensure the safety of persons in danger.

⑤ The hanging basket needs to be operated by two people, and the hanging basket must not be overloaded;

⑥ The auxiliary vehicle hoist shall be operated in a standardized manner during the installation and dismantling process, and shall be certified to work.

⑦ The truck crane should be strictly set on the unreal ground, and the most unfavorable position should be hoisted first in the formal hoisting profession.

4. Finished product protection measures

(1) The window frame glass, air conditioning grille, shutters, the first and second layers of paint, stone aluminum plate, railings, iron art, gas caps, etc. are pasted with protective film for protection.

(2) For the lighting well railings on the first floor of the south and north facades and the aluminum plate shape above the unit door, the protective film should be pasted first. After the protective film is pasted, a wooden springboard should be placed on the railing or aluminum plate to prevent the hanging basket from hitting the railing or aluminum plate when it hits the ground. .

(3) The windows where the boom of the hanging basket is located are blocked with plastic sheets indoors and outdoors to prevent rainwater from entering the room.

(4) Trees, nurseries, curbs, manhole covers, etc. in gardens and small municipal units should be avoided during crane construction.

(5) The top floor is covered with blockboard protection;

(6) The top window sill plate is removed, and the window frame is protected by U-shaped groove with blockboard;

(7) The top exterior windows are sealed with plastic sheets to prevent rainwater from entering the house and damaging the finished product.

5. Conclusion

Today, when everyone is pursuing efficiency, people are in a relatively impetuous mood. All labor-intensive processes are not easy to attract people's attention. People are mostly concerned about economic benefits, and they do not focus on improving the quality of project construction, so the quality of the project has not been greatly improved. promote. This article proposes that everyone return to the essence of the craftsmanship spirit, do the most basic craftsmanship well, and truly improve the quality of the project, first do it well and then make it bigger. We can no longer take the old path of one-sided low-price bidding, low-quality delivery, big but not strong, and low-level circulation.

References

[1] Regulations for construction and quality acceptance of prefabricated concrete structures [S]: DB11/T1030-2013. Beijing: Beijing Municipal Commission of Housing and Urban-Rural Development, Beijing Municipal Administration of Market Supervision, 2016.

[2] Zhou Qiang. Application Practice of Refinement Construction Measures for Assembled Integral Shear Wall Structure. Jiangsu Architecture [J], 2021(04):74-76.

[3] Regulations for construction and quality acceptance of prefabricated concrete structures [S]: DB11/T1030-2013. Beijing: Jointly issued by Beijing Municipal Commission of Housing and Urban-Rural Development and Beijing Municipal Administration of Market Supervision, 2016.

[4] Specifications for quality acceptance of building decoration engineering [S]: GB50210-2018. Beijing: Ministry of Housing and Urban-Rural Development of the People's Republic of China, General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, 2018.