

Research on methods to improve collaborative design efficiency

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Abstract: The field of architectural design is developing with the progress of the times, and with the gradual popularization of computer-aided design, the level of Designer's design drawing is also improving. At present in China's domestic design enterprises, the more common is to use collaborative software design, how in unit time, faster and better completion of the design task is placed in each design enterprise and designer of the actual problem. From the angle of architectural design, this paper discusses how to improve the efficiency of collaborative design, and through the application of invention patents, to expand and explore the field of architectural design subdivision.

1. Introduction

The field of architectural design continues to develop with the progress of The Times, from the earliest manual plate design to computer-aided design more than 30 years ago, to the web disk sharing design more than 20 years ago, to the collaborative platform design in the last 10 years, and finally to the current stage of drawing level collaboration between various professions, each progress has brought a substantial increase in design production efficiency^[1].

Collaborative design is a common design method in the construction industry. At present, in the process of collaborative design, various majors will repeatedly draw the common parts, which leads to low work efficiency. In addition, various majors also name different parts in different ways, which leads to many external reference errors and low efficiency^[2], and each major cannot see the latest modified drawing content in time.

2. Introduction to the invention

In order to improve the efficiency of collaborative design, after many professional discussions and practices of the R & D team, and after accumulating experience in improving the efficiency of collaborative design, the R & D team made an invention application for the results, which was authorized on January 9, 2024.

The name of the invention is a method for improving the efficiency of collaborative design, application number: CN202010766842.3, application date: August 3, 2020, public date: November 17, 2020, authorization date: January 9, 2024, the first inventor: Zhu Xiaosong.

The purpose of the invention is to provide a method for improving the efficiency of collaborative

design to solve the problems raised in the background technology.

2.1 Summary

The invention discloses a method for improving the efficiency of collaborative design, which comprises the following steps: S1, each specialty draws a construction drawing in a new file; S2, the construction major is funded by document A200, and the other majors are funded by single part drawing; S3, all the contents related to mechanical and electrical engineering in the document A200 of architecture major are roughly located, and the capital shall be proposed by the major of mechanical and electrical engineering in the later stage. After the capital proposal, the pipe hole in the original plan shall be deleted after being covered and quoted by the document A200 of architecture major, and the capital proposal documents of each major shall be subject to the standard. Compared with other cooperative operation methods, the invention can be cited at least one more level, and in the aspect of timeliness, the designer, proofreader and auditor of each post can see the latest drawing at any time; The contents of the public drawings are only drawn once, and the rest are for reference. To avoid adjustment of this part, the corresponding contents of the drawings must be replaced for other specialties. Reduce duplication of work and improve the efficiency of each profession.

2.2 Technical Solution

2.2.1 To achieve the above purpose, the invention provides the following technical scheme

A method for improving the efficiency of collaborative design, including the following steps:

S1, each specialty draws construction drawings in new files;

S2, construction majors are funded by document A200, and other majors are funded by a single part;

S3, all the contents related to mechanical and electrical majors in the architectural document A200 drawings are roughly located, and the capital shall be proposed by the mechanical and electrical majors in the later stage. After the capital proposal documents are covered and quoted by the architectural document A200, the pipe well holes on the original plan shall be deleted, and the capital proposal documents of each major shall be subject to the standard.

S4, the remaining specialties raise funds and draw and position according to uniform requirements^[1].

Preferably, the blocks and text in the professional drawings and funding files use different layers.

Preferably, the professional drawings and the funding document shall have A rectangular box of the size of the picture frame in the funding document. Each layer of the professional drawings and the funding document shall have a positioning cross star, and the positioning cross star shall be based on axis 1 and axis A, and the positioning of one layer shall be based on 0,0,0 points.

2.2.2 Preferably, the steps S1 include

When drawing the construction drawings, the CAD files in T3 format must be saved for use. Education version of CAD files, you must remove the label can be used; CAD files have errors, you should use Recover name to repair; CAD files, all graphics must be vertical coordinates of zero; CAD files for the overall clean-up, use Tianzheng software or third-party development of the toolbox to eliminate heavy line/heavy block of the command; CAD files, redundant content, use Lisp to remove; CAD files graphics units should be uniform settings to maintain consistency, if there is a block in the CAD file, it needs to be deleted or put into the block to be cleaned separately Copy part of the graphic element from other CAD files, the source files must be processed by the

above steps before the next work;

For the mechanical and electrical majors to leave holes and raise funds: Mechanical and electrical majors should be checked internally before raising funds to buildings and structures to avoid internal pipeline collision problems, and finally reviewed by the architectural and structural majors;

After the project is carried out, the project manager shall prepare the collaborative management method for all majors of the project, and incorporate it into the unified technical measures of the project. The project manager shall inform the person in charge of each major when the major is finalized, and the project manager and the person in charge of each major shall manage it together in the later stage.

Non-shared graphics should be edited in block form as far as possible to reduce the external reference level;

Non-2d or non-CAD software cannot be used after funding;

Parts avoid naming in Chinese and full Angle input, must be in Chinese, at most 2 level of external references;

All professional parts are named and divided in accordance with the unified principle, and the building number can not be added "#" directly when naming;

External reference type differentiation: The content required by other majors adopts the attachment type reference, and the content not required by other majors adopts the overlay type reference.

2.2.3 Preferably, the steps S4 include

The construction professional shall check the positioning size of the mechanical and electrical professional capital drawing, and notify it to correct the modification if it is wrong; When the shear wall of the structure is covered, the area of the shear wall should be covered in the parts in advance. The proportion of architectural professional printing should be adjusted according to the latest printing style, and the linear printing of some non-major reference parts should be avoided, which will affect the overall beauty of the drawing. The underground reservoir collecting well and structural drainage ditch are financed by the building's unified production parts "X-DK-J". The parts include the range, size, positioning and structural elevation of the well and ditch, and the layer ^[4]of the well and ditch is "A-LOWER"^[5]. For public construction projects, the funding content of the building plan supplements the outline of the edge line of the structural board, which is expressed in the "A-Flor-beam" layer with A closed PL line; All the different parts of the roof express the structural elevation, and the floors are the building elevation. The structural elevation is detailed in the plane descending plate table of the first floor. The descending plate of special parts in the plane is expressed in the form of filling and structural elevation. Building layers are differentiated: furniture "A-FURN", equipment "A-EQPM", area "A-AREA-ROOM", can be turned off individually; For public construction projects, the opening area of the external window number is added.

After the construction major covers and references the construction major's funding document A200, the shear wall parts drawings required by the construction and each major are made. The drawings should include the structural beam layout and beam height, and the final part drawings are reversed in the form of part drawings. The part name is "T-S-1"; There is only one T-S file, and the corresponding building base drawing in the drawing places the wall columns, filling, beams and cross sections of each layer according to their positions; At present, the ladder column is raised in the form of staircase detail assembly drawing, and the structural ladder column and staircase section are set by the architectural stair designer according to the structural staircase detail drawing. Structural foundation, parts drawings must be made;

After the water supply and drainage major covers and references the construction major's funding document A200, it makes and locates the floor drain, rain and sewage standpipe, fire hydrant and hole table required by the construction major, and finally draws the funding in the form of part drawing, whose part name is "T-P-1"; Make 1:50 magnification drawings of the parts, and provide relevant hole table text information and positioning annotation; Provide fire hydrants, water flow indicators, pressure switches and wet alarm valves for electrical professionals, and strictly distinguish the layers of legend, text and annotation;

After covering and citing the document A200 of the construction major, the electrical major makes the telecommunication equipment required by the construction major, leaves holes and positions them, and finally makes the telecommunication equipment in the form of part drawing. The part name is "T-E-1", and the telecommunication can be divided into two parts or one part. The naming method shall be mutually confirmed and informed to the designer of the sub-item of the project before the mechanical and electrical and construction projects begin; Make 1:50 magnification drawings of parts, and provide relevant text information and positioning marks; T-E parts provide relevant text information and positioning marks;

After the HVAC specialty covers and refers to the document A200 of the construction specialty, the wind tunnel, gas standpipe equipment and hole table required by the construction specialty are made and positioned, and the final part drawing is reversed. The part name is "T-H-1". Whether the lining air pipe indicates that the specific project is agreed at the comprehensive final meeting, the characteristics of different projects are different, and the specific projects are analyzed; Make 1:50 magnification drawings of parts, and provide relevant text information and positioning marks; The air valve, fan, differential pressure transmitter, CO detector, and text are all independent layers for layer isolation.

3. Specific examples

The following is a clear and complete description of the technical scheme in the embodiment of the invention in combination with the drawings attached to the embodiment of the invention. Obviously, the described embodiment is only a part of the embodiment of the invention, but not the whole embodiment. Based on the embodiments of the invention, all other embodiments obtained by ordinary technicians in the field without making creative labor fall within the scope of protection of the invention.

3.1 Basic operations of collaborative mapping among majors

- 1) When starting to draw construction drawings, all majors should be drawn in new files, and cannot be drawn on the basis of old drawings;
- 2) If there are CAD files in Tianzheng format, they must be saved as T3 format before use;
- 3) If there is an educational CAD file, it must be removed before use;
- 4) If there are errors in the CAD file, Recover name shall be used to repair;
- 5) All primitives must return z-axis to zero;
- 6) Use 2D software or toolbox to eliminate heavy line/heavy block command overall cleaning;
- 7) Clean it up again with lisp for large file cleaning;
- 8) The unified setting of graphic units is consistent, and the excess ratio is cleared (format - scale scaling list, only 1:1 ratio is saved);
- 9) When cleaning, if there are blocks in the CAD file, delete them or enter the blocks successively to clean them separately;
- 10) If the pixel is copied to a new CAD file, the cleaning steps such as Z-axis zeroing and weight elimination must be repeated again;

- 11) Copy some primitives from other external CAD files, and the source file must go through the above 2-10 steps before proceeding to the next step;
- 12) Develop good habits, often clean CAD files with special lisp and Puge commands;
- 13) Use the company's latest standard documents (frame, starting file, line line, print style, etc.) to unify the standardized design environment.

3.2 Project BTTLB TAB reference

3.2.1 TTLB TAB is divided into four parts

Project information, drawing phase, subitem information, design signature. Among them: project information, drawing stage and sub-project information are compiled by the project manager and notified to all majors for reference; The design signature shall be prepared by the person in charge of each specialty and notified to the designer of each sub-item of the specialty for reference.

The main identification construction unit and project name naming method: X-TTLB-A1/A0-XX, this part is divided into A1, A0 two parts;

3.2.2 Drawing stage

The main identification project design phase (overall preliminary design/construction drawing design) is named as follows:

- Overall preliminary design: X-TTLB-DD,
- Construction drawing design: X-TTLB-CD;

3.2.3 Subitem Information

- Main logo, each sub-item building information:
- The naming method is:
- Building 1: X-TTLB-1

3.2.4 Design Signature and Specialty

The main identification is called project leader, professional leader, proofreader, auditor, examiner and professional name: X-TTLB-A1/A0-QM;

As for the standard parts of TTLB, they should be compiled into the company's collaborative module library for project managers and professional leaders to call and make;

3.3 All majors coordinate capital raising and reference

3.3.1 General Rules

- 1) The financing documents of each specialty are single parts (except for construction, the financing documents of construction are A200), and the naming details of each specialty.
- 2) The block and text in each professional drawing and funding file should use different layers to facilitate the closure of other majors.
- 3) Each professional drawing and funding document should have a rectangular frame with the size of the picture frame in the funding document, which is convenient for other professional positioning;
- 4) Each layer of the professional drawings and funding documents should have A positioning cross. The positioning cross should be based on axis 1 and axis A, and the positioning of one layer should be based on 0, 0, 0.

5) In order to ensure the smooth downstream professional drawing, the professional drawings and financing parts should not appear in the initial document, and clean up.

6) For the mechanical and electrical majors to leave holes and raise funds: Mechanical and electrical majors should be checked internally before raising funds to buildings and structures to avoid internal pipeline collision problems, and finally reviewed by the architectural and structural majors.

7) After the project is carried out, the project manager shall prepare the collaborative management method for all majors of the project, and incorporate it into the unified technical measures of the project, and inform the leaders of each major when the major is finalized, and the project manager and the leaders of each major shall manage it together in the later stage.

8) The shared graphics should be edited in block form as far as possible to reduce the external reference level, thus effectively reducing the error rate;

9) Non-two-dimensional (Tian-equal) or non-CAD software cannot be used after funding, so as to avoid adding a large amount of useless information, affecting unpredictable problems such as inability to download and slow down the drawing speed of various professional drawings;

10) Avoid naming parts in Chinese and full Angle input. When it is necessary to use Chinese, it is at most a level 2 external reference, which will cause unpredictable problems such as failure to download;

11) All professional parts are named and divided in accordance with the unified principle, and the building number cannot be added "#" directly when naming, such as "235-A200" when naming 2,3,5 buildings or "2-A200" when naming the first building number;

12) Differentiation of external reference types: the content required by other majors is used for attachment reference, and the content not required by other majors is used for overlay reference.

3.3.2 Building Specifications

1) In order to avoid the difficulty of binding drawings, Tianzheng elements and parameters should not appear in architectural professional drawings. The architectural professional drawing software version is CAD2012;

2) The professional plane of the building shall be funded by A200 document. The position of the document shall not be changed after the funding is raised. If it must be adjusted, it shall be adjusted with the consent of the professional designer.

3) All the mechanical and electrical professional content on the building A200 drawing is rough, and the capital will be raised after the mechanical and electrical professional decides. After the documents after capital withdrawal are confirmed by the building cover reference, the pipe well opening on the original plan shall be deleted, and the capital withdrawal documents of each specialty shall be subject to the standard.

4) The construction profession does not need to locate the equipment of water, electricity and HVAC, which is financed and positioned by each profession.

5) The building professional shall check the positioning size of the mechanical and electrical professional drawing, and notify the correct modification if there is any error.

6) When the construction profession covers the structural shear wall, if there is a shear wall opening, the area should be covered in the parts in advance. (CAD - Drawing - Area coverage).

7) Construction professionals should clean up the drawings when raising funds to ensure the orderly conduct of downstream professional work.

8) The proportion of architectural professional printing should be adjusted according to the latest printing style, and the linear printing of some non-major referenced parts should be avoided, which will affect the overall beauty of the drawing.

9) Basement collection Wells and structural drainage ditches shall be financed by the building's

unified production parts "X-DK-J" to the structure, including the scope, size, positioning and structural elevation of Wells and ditches. The well and trench layers are A-LOWER.

10) For public construction projects, the building plan proposal content supplements the outline of the structural board edge line, which is expressed in the closed PL line on the A-FLOR-BEAM layer (not printed).

11) All the different parts of the roof express the structural elevation; All floors are building elevations, and the structural elevations refer to the table of plane descending plates on the first floor. The descending plates in special parts of the plane are expressed in the form of filling and structural elevations.

12) Building layers are differentiated: furniture "A-FURN", equipment "A-EQPM", area "A-AREA-ROOM" (non-print layer), can be turned off individually.

13) For public construction projects, the opening area of the external window number is added.

3.3.3 Professional rules of structure

1) The structure major shall, after covering and quoting the document A200 of the construction major, make the shear wall parts drawings required by the construction and various majors, which shall include the structural beam layout and beam height, and finally withdraw the capital in the form of parts drawings, and the part name is "T-S-1" (illustrated by Building 1, the rest is the same).

2) There is only one T-S file, and the corresponding building base drawing in the drawing places each layer wall column (in the form of part drawing), fill, beam (in the form of part drawing), and section marking (in the form of part drawing).

3) At present, the ladder column is generally raised in the form of stair detail assembly drawing, and the architectural stair designer sets the structural ladder column and stair section according to the structural stair detail drawing.

4) Structural foundation, must make parts drawings;

3.3.4 Professional Rules for water supply and drainage

1) After the water major covers and refers to the document A200 of the construction major, the water major makes and locates the floor drain, storm sewer standpipe, fire hydrant, hole table, etc. required by the construction major, and finally draws the capital in the form of part drawing, whose part name is "T-P-1".

2) Make 1:50 enlarged drawings of the parts, and provide relevant text information and positioning marks.

3) Provide fire hydrants, water flow indicators, pressure switches and wet alarm valves for electrical professionals, and strictly distinguish the layers of legend, text and annotation.

3.3.5 Electrical professional rules

1) The electrical major shall make and locate the telecommunication equipment and hole table required by the construction major after covering and citing the document A200 of the construction major, and finally withdraw the telecommunication equipment in the form of part drawing. The part name is "T-E-1", and the telecommunication can be divided into two parts or one part. The naming method shall be mutually confirmed and informed to the designer of the sub-item of the project before the mechanical and electrical and construction projects begin.

2) Make 1:50 enlarged drawings of the parts, and provide relevant text information and positioning marks.

3) T-E parts provide relevant text information and positioning marks.

3.3.6 HVAC professional Rules

1) After the HVAC major covers and references the document A200 of the construction major, the HVAC major makes and locates the wind tunnel, gas risers and other equipment required by the construction major, and the hole table, etc., and finally draws the capital in the form of part drawing, whose part name is "T-H-1".

2) Whether the lining air pipe is indicated will be agreed at the comprehensive final meeting in combination with the specific project. Different project characteristics are different, specific project specific analysis.

3) Make 1:50 enlarged drawings of the parts, and provide relevant text information and positioning marks.

4) The air valve, fan, differential pressure transmitter, CO detector and text are all independent layers, which can be isolated.

5) Notwithstanding that embodiments of the invention have been shown and described, it is understandable to a person of ordinary skill in the art that these embodiments may be varied, modified, replaced, and modified in a variety of ways without deviating from the principle and spirit of the invention, and that the scope of the invention is limited by the attached claims and their equivalents.

4. Effectiveness and innovation

On the basis of not increasing the workload of the original design, the invention improves the cooperation efficiency between different specialties and greatly reduces the error rate in the cooperation process through uniform requirements and operating standards.

4.1 Beneficial effects compared to prior art

Compared with other cooperative operation methods, the invention can be referenced at least one more level;

In terms of timeliness, designers, proofreaders and auditors of all posts can see the latest drawings at any time;

The contents of the public drawings are only drawn once, and the rest are for reference, so as to avoid adjustment of this part, and the corresponding contents of the drawings must be replaced for other specialties, so as to reduce repetitive labor and improve the work efficiency of each specialty.

Unified parts naming principles and the unification of anchor points can greatly reduce the errors caused by external references;

Clarify the content and requirements of each major in the process of re-collaboration, and clarify the content of each major to avoid squabble;

Emphasis on team strength, decomposition of drawings, can be faster than before to complete the drawing task, the more complex the project can reflect the superiority of the invention;

4.2 Innovation, advancement and technology of the invention

Innovation: to realize the division of labor according to the profession, according to the module division, the formation of a unified design standard, a unified quota of hours, a unified verification requirements, a unified production of results, the establishment of cross-regional cross-company cooperation premise, and ultimately achieve a variety of innovative business models.

Advanced nature: Through unified collaborative operation, efficient cooperation between various departments of the enterprise can be achieved to improve the quality and efficiency of the enterprise

and upgrade the technology. Increase innovation and transformation efforts, and contribute to the development of the company from a design company to a smart service provider for the whole life cycle of the project.

Technical: The invention is mainly aimed at collaborative operation, which will provide an efficient and reliable information technology means for design enterprises and improve production efficiency^[6].

5. Conclusion

With the development of the "14th Five-Year Plan", modularity, digitalization, green and low-carbon are frequently mentioned, which have become an important starting point for the transformation and upgrading of the construction industry. As an effective way to improve architectural design drawing, collaborative design has gradually become popular more than ten years ago, but how to further improve the original foundation combined with national instructions is the key. As collaborative users, the majority of architectural designers should think, explore and study as much as possible, combine with all kinds of designs, change their ideas, break through the original design scope, innovate as much as possible, and adopt green and sustainable development methods to promote design development more effectively, and respond to the call of the state, combining theory with practice. Make a small contribution to the "14th Five-Year Plan".

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