

Research Paper

Façade design recommendations towards visual compatibility of infill buildings with the Qajar architecture of the cities of Mazandaran province

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Abstract

In the current study, an endeavor is undertaken to formulate specific recommendations for the design of facades pertaining to infill buildings situated in the proximity of valuable urban Qajar residences within the Mazandaran province. The conspicuous lack of such directives within the regulatory framework of this region is noteworthy. The imposition of guidelines pertaining to façade design is imperative to establish visual congruence between contemporary structures and historical Qajar edifices in the urban fabrics of Mazandaran province. The present investigation employs a combined research strategy, integrating both the interpretive-historical strategy and the logical argumentation strategy. A scrutiny of 30 valuable urban Qajar residences in Mazandaran province is conducted, wherein their distinctive features are systematically classified under eight discernible categories. Subsequently, a conceptual framework is developed by leveraging Semes' design strategies model and drawing inspiration from Groat's theoretical framework. Concurrently, the practicalities inherent in Mazandaran's urban conservation system are taken into consideration. This conceptual framework serves as the foundation for the articulation of facade design recommendations, delineating acceptable design approaches for its constituent elements. Within this framework, a concerted effort is exerted to advocate conservative strategies for the macro elements of facade design, juxtaposed with latitude for more abstract approaches when addressing the micro elements. It is noteworthy that the intentional opposition approach is deemed unsuitable. Ultimately, drawing upon typological analyses of the compiled samples and adhering to the established framework, a series of recommendations for facade design is proffered. This study serves as a foundational step toward the formulation of design guidelines tailored to the historic districts of Mazandaran.

Keywords: *Infill architecture, Façade design guidelines, Architectural conservation, Qajar architecture, Mazandaran Province.*

1. INTRODUCTION

Presently, an unwavering emphasis is placed on contextual sensitivity as an indispensable criterion for exemplary architectural design, a principle of particular significance within historically significant fabrics. The aesthetic congruity between contemporary and historic structures holds the potential to enhance the visual allure and overall pleasantness of urban landscapes (Brolin, 1980). The concept of "architectural compatibility" can be viewed

as a response to inherent human psychological needs (Elaeishe, 1994, 45). A substantial body of scientific literature is dedicated to infill buildings, and in numerous developed nations, meticulous building control procedures, coupled with comprehensive technical documents, are established to regulate the construction of new edifices within historical fabrics.¹

In contrast, the state of building control within historical fabrics in most Iranian cities is notably deficient, resulting in a gradual erosion of the integrity and coherence of these contexts over time. The province of Mazandaran is no exception to this

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prevailing trend. The conspicuous absence of pertinent building control regulations and procedures for these historical fabrics is acutely evident, leading to substantial and readily discernible impairments. Instances of new constructions, lacking congruence with the established character of the historical fabric, proliferate throughout the ancient cities of this province (Figure 1).

Despite the legal mandate for buildings listed in the Iranian Cultural Heritage Organization (CHO) to be afforded specific protective measures, the inadequacies inherent in the local development control system frequently result in insufficient oversight. Consequently, it is not uncommon to observe a lack of proper regulation in the environs surrounding these protected structures. Furthermore, the registered

monuments themselves are susceptible to unprofessional interventions and a gradual destruction over time (figure 2).

In the context of Mazandaran province, the authors' empirical investigations reveal a deficiency in effective and competent regulations or design guidelines pertaining to the construction in the vicinity of registered buildings. Existing design guides, albeit scarce, are found to be limited in scope, encompassing only a few general and rudimentary statements. These guidelines primarily address superficial aspects of new construction. Evidently, such regulatory frameworks lack the requisite efficacy to provide comprehensive guidance for new developments that align harmoniously with the historical significance of registered buildings.



Fig 1. The listed Qajar house of ‘Sardar Jalil’ in the historical context of Sari is among a multitude of new buildings that severely damage the coherence of the historical context. Above-left: aerial photo from 1966; below-left: aerial photo from 2022. Right: photo from 2016.



Fig 2. Valuable historical houses surrounded by inharmonious new buildings; left: Ghoreishi house (Amol); middle: Sadeghian house (Sari), right: Ramedani and Mirgati houses (Sari).

Evidently, the attainment of harmony between new and historic constructions in historical contexts mandates the establishment of precise and effective conservation policies alongside comprehensive design guidelines that address diverse facets of construction. As posited by Mageean (1998), a two-tier approach may be warranted, incorporating city-wide 'codes of conduct' and area-specific guidelines. The latter may further entail distinctions for conservation areas, transitional zones, and areas necessitating reconstruction. Within area-specific guidelines, crucial determinations such as building placement, plot coverage ratio, height, and volume are imperative to ensure alignment with the pertinent historical fabric.

Nevertheless, an observable trend in the urban landscapes of cities along the southern shores of the Caspian Sea is that, for diverse reasons encompassing economic, societal, and political factors, the development control system frequently lacks the requisite authority to regulate a comprehensive array of factors, including those previously mentioned. Instead, it tends to focus predominantly on some superficial aspects of new developments.

Examining this state of disorder and the limited influence of the development control system on new constructions within historical contexts, it becomes evident that a pressing intervention is required to implement specialized control measures, particularly with regard to the facade design of new buildings in the immediate vicinity of registered buildings. Consequently, the primary inquiry addressed by the present study is: *In the historical urban contexts of Mazandaran, what guidelines should be followed in the design of building facades to ensure that the facades of new infill buildings exhibit the sought-after visual compatibility with the adjacent valuable Qajar buildings?* To answer this main question, it is necessary to answer the following sub-questions:²

1. To achieve visual compatibility between a new infill construction and its neighboring registered Qajar houses of Mazandaran cities, what features of the facade design may be addressed and regulated in facade design guidelines?

2. Regarding each of the head topics examined by the facade design guideline, what vernacular rules and patterns governed the facade design of the registered Qajar houses?

3. Regarding each of the head topics of the proposed facade design guideline, what architectural approaches should be adopted for new infill buildings?

Finally, this study formulates a comprehensive set of design suggestions and recommendations intended to serve as guidelines for the design of new

constructions in the vicinities of registered Qajar houses within the cities of Mazandaran.

2. CONCEPTUAL FRAMEWORK

While the expertise of discerning judgment is paramount in conservation efforts (Oc, Heath and Tiedsell, 2010, 72), acknowledging the inherent complexity and unpredictability of design (Davies, 2003), development control systems consistently endeavor to ensure an acceptable standard of design quality in historical contexts through various tools. Design guidelines emerge as pivotal instruments in this pursuit. Specifically tailored for infill buildings, these guidelines are crafted to safeguard the intrinsic character of a locale and foster coherence between newly introduced structures and existing historical buildings.

As an initial measure towards achieving this objective, a thorough examination of the patterns and regulations governing the contextual architecture becomes imperative. The design of new architecture should adeptly respond to its historical context, guided by "an understanding and informed analysis of its character and quality" (NSW Heritage Office and the Royal Australian Institute of Architects NSW Chapter, 2005, 2). In this context, consulting diverse and valuable experiences documented in the literature concerning typo-morphologic studies of urban contexts proves to be an invaluable resource.³

Numerous authors have presented diverse categorizations for architectural approaches applicable to infill buildings⁴. The Preservation Alliance for Greater Philadelphia (2007) has, in its publication, adopted the classification articulated by Semes. According to this classification, architectural approaches for infill buildings encompass the following categories: 1. literal replication, 2. invention within the same or a related style, 3. abstract reference, and 4. intentional opposition. This framework serves as the basis for the present study as well.

The pivotal criterion for determining the most suitable architectural approach for an infill building lies in the extent to which each approach contributes to realizing the essential qualities desired within the relevant historical context. Semes (2007, 9-10) underscores the complexity of this decision, emphasizing that it revolves around what best respects the existing architectural and urban conditions, or in instances where these conditions are not conducive, what approach will generate the highest degree of harmony and integrity in the built environment. In essence, the overarching objective is for new buildings within historical contexts to either preserve or enhance the character of the desired surroundings or, at the very

least, refrain from diminishing their quality through the development process (English Heritage and CABE, 2001, 4).

In an effort to establish a checklist for assessing the compatibility of a new building with its historic counterparts, Groat (1983) formulated a conceptual framework that interlinked architectural approaches under the umbrella term of "design strategies" with specific architectural factors identified as design tactics. Adopting a somewhat analogous approach, the present study endeavors to delineate essential physical elements and components intrinsic to the facades of Qajar houses in Mazandaran. Simultaneously, it seeks to outline acceptable architectural approaches corresponding to these elements. This two-dimensional matrix serves as the foundational structure for the formulation of the proposed facade design guide.

To populate this foundational table, due consideration must be given to the realities and constraints inherent in the conservation of urban fabric within the Mazandaran province. Broadly speaking, the architectural conservation initiatives in this province have been unsuccessful in safeguarding the historical character of its valuable urban contexts. Consequently, a strategic focus should be directed towards the preservation of the few remaining vulnerable historical fabrics by maintaining the existing historical structures and advocating the emulation of their architectural style in adjacent infill constructions. As a result, a literal imitation emerges as the most fitting and judicious approach in this context. Indeed, it can be asserted that within the context of Iran, this imitative approach is generally accorded greater preference by the legislator (refer to: Bureau of Preservation and Revitalization of Historical Buildings, Contexts and Areas, 2016, clause 7-1). Faced with these prevailing circumstances, there is a distinct lack of prioritization within the conservation regime for the manifestation of a contemporary character in new infill constructions. Given this rationale, the current research

predominantly advocates the use of the imitative approach whenever feasible, occasionally allowing for the interpretive approach. However, the severity of the damage to the historical context leaves no room for the intentional opposition approach.

Within the present research, Table 1 outlines the acceptable architectural design approaches for each architectural element of the infill building facade. Recognizing the development of design guidelines as a negotiation process involving various stakeholders from the target society, it is evident that adopting different strategies in this development process could yield varied outcomes. The recommendations put forth in the current research are grounded in the conceptual framework delineated in Table 4.

In the context of utilizing the provided table, consider a specific urban setting where hip roofs are the prevalent type of roof design, constituting an established tradition in that area. The design guide could approach this architectural element in the following ways:

Literal replication: In a new infill construction, the roof should exactly be hipped the same way as its adjacent buildings.

Invention within a style: The roof should follow the rules governing the design of the neighboring traditional hip roofs.

Abstract reference: The roof should be an abstract interpretation of the neighboring traditional hip roofs.

Intentional opposition: The roof should not be hipped at all.

So, if the design guideline specifies that "the roof should be hipped according to the traditional rules," it encompasses both the Literal replication and Invention within a style design approach. On the other hand, if it suggests that "it is recommended that the roof be hipped," it allows for the use of Literal replication, Invention within a style, and Abstract reference. The absence of a prohibition against the Intentional opposition approach implies that, while not explicitly discouraged, it is not the preferred or recommended approach in this context.

Table 1. The framework behind the proposed design guide

No.	Façade Elements	Design Approach			
		Literal Replication	Invention Within A Style	Abstract Reference	Intentional Opposition
1	General Visual Arrangement	✓	✓	×	×
2	General Façade Dimensions	✓	✓	×	×
3	Roof	✓	✓	×	×
4	Building Materials	✓	✓	✓	×
5	Openings	✓	✓	✓	×
6	Decorations	✓	✓	✓	×
7	Semi-open Spaces	✓	✓	✓	×
8	Entrance	✓	✓	✓	×

3. RESEARCH METHOD

Indeed, according to Groat and Wang's classification for research strategies in architecture (2013), the current research falls under the category of combined strategy. In this particular research type, it is feasible to employ a combination of various strategies in diverse ways (refer to Creswell, 2009, and Creswell, 2018) to comprehensively address different facets of the research. Such a research strategy is typically employed in fields that encompass a blend of the imperative to acquire knowledge and the necessity for actionable outcomes (Greene, 2008, 8).

In the design of the current research, a hybrid approach has been adopted, combining the historical-interpretive strategy with the logical argumentation strategy (refer to Groat and Wang, 2013). In the initial phase of the research, the structure and key themes of design guidelines for historic districts are examined through a review of relevant documents from developed countries. Subsequently, the research shifts to identifying and categorizing the character-defining features present in the facades of urban Qajar houses in Mazandaran province. During this stage, the research aligns with an interpretive-historical research strategy (refer to Groat and Wang, 2013, Chapter 6).


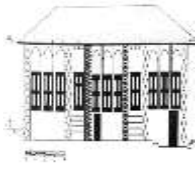


In the subsequent phases of the research, a specialized conceptual framework is developed for approaches towards architectural elements of infill buildings' facade design. This framework is informed by Semes' classification of different design approaches in historical contexts (2007) and draws inspiration from the conceptual framework utilized by Groat in her doctoral thesis (1983). Subsequently, a comprehensive plan is formulated based on an analysis of the conservation regime's realities within the research area, outlining how to address the facade design elements of infill buildings. Finally, a set of










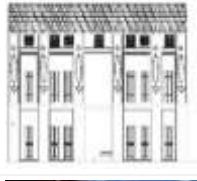








architectural design recommendations is presented. Throughout these stages, the research employs the logical argumentation strategy (refer to Groat and Wang, 2013, Chapter 11), placing emphasis on "persuasion instead of proof" (Mirjani, 2009, 45). It is noteworthy that, due to the research design and the interconnected nature of its stages, revisiting and reviewing the results of each stage is inevitable, leading to iterative adjustments and refinements.









To discern the vernacular patterns and regulations governing the facade design of Qajar houses in Mazandaran, the initial step involved identifying such houses. Information from over 50 houses was gathered through consultations with the Mazandaran Cultural Heritage Organization (CHO), available literature, and student dissertations. Due to incomplete information regarding some houses that were either abandoned or inaccessible, not all identified Qajar houses could be utilized in the study. Consequently, efforts were made to carefully select and identify appropriate cases. Ultimately, 30 houses were chosen for detailed examination, and these were situated in the historic districts of Sari, Amol, Babol, and Behshahr (Table 2).

In the process of selection, meticulous attention was given to include only those houses that, based on available historical records and oral documentation, exhibited minimal alterations to their original facade design. Houses that had undergone significant detrimental changes to their facades were intentionally excluded. Information and visual records of the selected houses were obtained from the library and archives of the Cultural Heritage Organization (CHO). Subsequently, efforts were made to enhance and refine this information through fieldwork, which involved on-site observations, visits to the houses, capturing photographs, and scrutinizing and, in some instances, correcting their floor plans. It's noteworthy that these selected houses are approximately 100 to 150 years old.

Table 2. Selected Qajar houses of Mazandaran studied in this paper (The no. of each house is used for reference purposes throughout the paper).

No.	House name	location	Figure	No.	House name	location	Figure
1	Siamei	Behshahr		2	Central Afghan- nezhad house	Behshahr	
3	East Afghan- nezhad house	Behshahr		4	West Afghan- nezhad house	Behshahr	

No.	House name	location	Figure	No.	House name	location	Figure
5	Kardeli	Behshahr		6	Tavakkoli	Behshahr	
7	Hezarjaribi	Behshahr		8	Shahriari	Behshahr	
9	Tahmasebi	Behshahr		10	Bikae	Babol	
11	Najafi	Babol		12	Aghajan-nasab	Babol	
13	Madani	Amol		14	Manavi	Amol	
15	Sehhat	Amol		16	Manouchehri	Amol	
17	Ghoreishi	Amol		18	Haj Mahdi soltan	Amol	
19	Darzi	Amol		20	Malek	Amol	
21	Shafahi	Amol		22	Sadeghian	Sari	

No.	House name	location	Figure	No.	House name	location	Figure
23	Nazeri	Sari		24	Kolbadi	Sari	
25	Kolbadi2	Sari		26	Khanoumlegha	Sari	
27	Fazeli	Sari		28	Mirgati	Sari	
29	Ramedani	Sari		30	Sardar Jalil Saravi	Sari	

4. VERNACULAR RULES AND PATTERNS FOR FAÇADE DESIGN

Through an examination of the chosen historical houses in Mazandaran, the research yielded specific insights into the distinctive elements and features characterizing the facade design of these houses.

4.1. General visual arrangement

An analysis of the Qajar architecture in Mazandaran province underscores that the overall composition of a mansion's facade serves as a direct reflection of the internal room arrangement within the house. In essence, the primary masonry piers on the facade, acting as the principal vertical components shaping the facade's articulation, typically convey the layout of the rooms within the building. Building upon this observation, the facades of the examined Qajar houses can be categorized based on the count of their principal constituent bays in the horizontal direction, referred to as twofold, threefold, fourfold, and so forth (Table 3).

It appears that during the Qajar period, societal preferences leaned towards the incorporation of overall symmetry in the facade of a mansion, deeming it closer to an idealized aesthetic. The examination of samples indicates that architects, whenever feasible, favored the utilization of complete symmetry in the building's facade over partial symmetry or asymmetry.


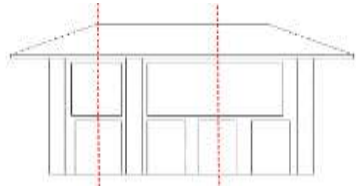

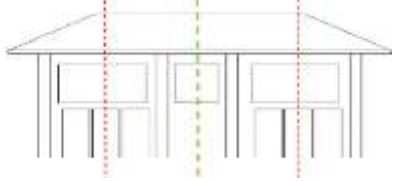




4.2. General facade dimensions

Concerning the number of floors in houses, the examination of the remaining significant Qajar urban houses in Mazandaran province reveals a predominant preference for two-story structures. Out of the 30 samples studied, 80%, 24 samples, encompassed two stories, with an equal distribution of three houses each for one-story and three-story configurations. A visual representation of the height examination of these houses is depicted in Figure 6 (Figure 3).

4.3. Roof

All the examined houses in this research feature hipped roofs covered with roof tiles. The roofs are intentionally overhanging, a design choice aimed at enhancing protection against wind-driven rain (Figure 4). For accessibility to the rooftop for maintenance purposes and similar activities, Qajar houses employed a specialized roof access hatch known as "Koterkum" in the local dialect of Mazandaran. Typically situated in the middle of the ridge, this equipment facilitated access. The wooden beams and rafters of the roof structure exhibit a cantilevered arrangement, resembling a step-like configuration. In the local dialect, these cantilevered components are referred to as "Shir-sar" translating to "having a head like a lion." The eaves of the roofs could be designed with "one-step," "two-step," or "three-step" overhangs in Qajar houses, with some of these elements featuring paintings.

Table 3. Segmentation and symmetry

Row	Type of the façade	Image	Schematic pattern
1	Twofold façade/ without general symmetry/ symmetrical inside parts	 House No. 4	
2	Threefold façade/ having general symmetry/ symmetrical inside parts	 House No. 28	
3	Threefold façade/ Without general symmetry/ symmetrical inside parts	 House No. 12	
4	Fivefold façade/ having general symmetry/ symmetrical inside parts	 House No. 7	

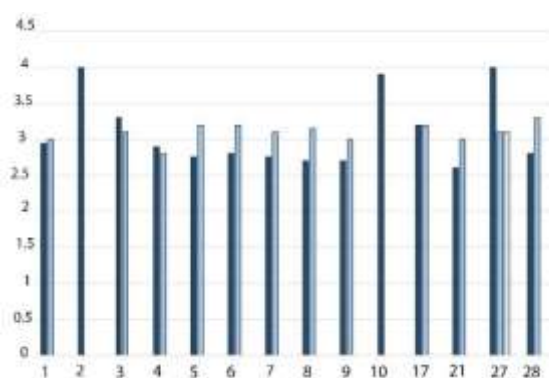


Fig 3. Height of floors in meters. The horizontal axis shows the number of each house. The dark blue column signifies the height of the ground floor, the light blue represents the first floor, and the white column indicates the height of the third floor

4.4. Building materials

The predominant materials employed in the exterior surfaces of the examined historical houses encompassed brick, wood, tile, and plaster. To meticulously investigate the material usage patterns on a house-by-house and city-by-city basis, primary elevation drawings of the sample houses were meticulously crafted. The area covered by each material was quantified, and subsequently, the percentage of each material's area relative to the entire surface area of that elevation was computed. Analyzing the percentage application of diverse

materials enabled the derivation of an overall color scheme for the respective historical district (Figure 5).

4.5. Openings

Analyzing the elevation drawings of the sample houses reveals that openings covered approximately 30 to 50 percent of the surface area of the main façade of houses (Figure 6). Furthermore, there is a discernible pattern indicating that the surface area of openings on the upper floors of the houses tended to be larger compared to those on the lower floors.



Fig 4. top: cantilevered hip roofs in Sari (Fazeli house); below-left: an example of a three-step "Shir-sar" in Hezarjaribi house; below-right: a typical example of a "Koterkum"

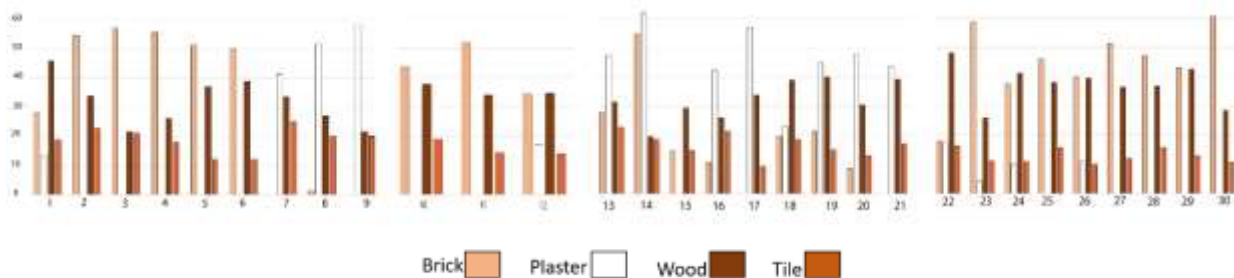


Fig 5. Percentage of using each material in each house's elevation. From left to right: Behshahr (1-9), Babol (10-12), Amol (13-21), and Sari (22-30)

Openings in the local architecture of Mazandaran manifest in various forms, encompassing 'Rojin', 'Jamadar', 'Orosi' or 'Darjibar', and 'Delabcheh'. Notably, 'Orosy' or 'Darjibar' stands out as a distinctive type, characterized by highly ornate sash windows. These windows typically feature two, three, five, or seven movable panels or sashes, with the two- or three-sash variant being the most prevalent.

Upon scrutinizing the facades of the houses under study, it becomes evident that a set of hierarchical rules dictated the placement and utilization of various types of openings. Consequently, the most intricate and expansive openings were typically reserved for the main elevation of the house, particularly on the upper floors, with special emphasis on the guest room (Figure 7).

4.6. Decorations

Diverse forms of embellishments grace the exterior facades of Qajar houses in Mazandaran. These adornments encompass brick decorations, showcasing an array of brickwork, bonds, arches, and moldings. Mortar joints and plasterwork contribute to the decorative elements, featuring various geometric patterns such as Louzi (rhombus), Haft-Hashti (zigzag), Jenaghi (triangular arches), and intricate plant motifs like the cypress tree (refer to Naderi

Gorzodini, 2016), (Figure 8). Wooden decorations, (Figure 9), and the application of paintings further enrich the decorative repertoire observed in the examined houses.

4.7. Semi-open spaces

Predominantly found in historical houses of Mazandaran, porches, locally referred to as "Refagh", stand out as the most prevalent types of semi-open spaces. Typically situated in the main elevation of the house, these porches may, at times, extend around the building, encompassing up to all four sides (refer to Yousefnia Pasha and Barzegar, 2018) (Figure 10).

4.8. Entrance

In the examined samples, three distinct types of entrance locations on the main facade were identified: an entrance aligned with the main axis of symmetry, an entrance positioned off the axis of symmetry, and two entrances situated on either side of the axis of symmetry (Figure 11). In contrast to classical European architecture, older Qajar houses do not place particular visual emphasis on the entrance from the courtyard side. Instead, the primary focal points of the facade often revolve around 'Orosies' and surface decorations on the upper floors.

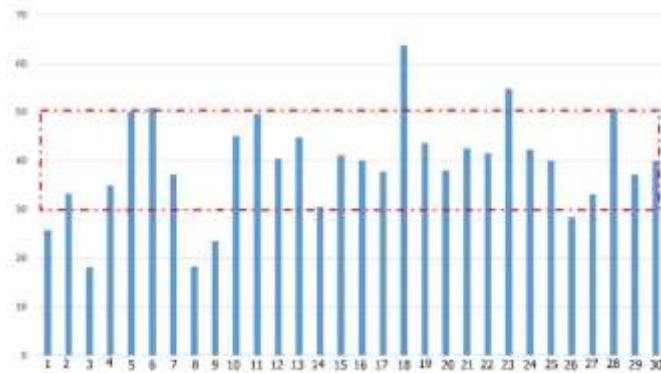


Fig 6. The percentage of opening surfaces to the whole area of the main façade in the sample houses



Fig 7. Examples of 'Orosy', the most exquisite openings were used for the most important rooms of the house. Left: Kolbadi house, right: Shafahi house



Fig 8. Plasterworks. Left: triangular arches and a cypress motif (Ghoreishi house), center: rhombus pattern (Siami house), right: triangular arches and rhombus (Siami house)



Fig 9. Examples of wooden decoration of window sashes, left: Ramedani house, right: Aghajan-nasab house

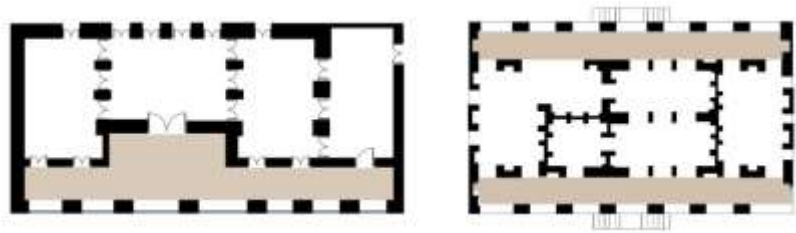


Fig 10. Examples of a one-sided and two-sided porch. Left: the plan of the eastern house of Afghan-nezhad house, right: the plan of Haj Mahdi Sultan House



Fig 11. Types of entrance location in the façade. Left: an entrance on the main axis of symmetry which was usually inspired by the European architecture of the time (Sadeghian house), center: an entrance out of the axis of symmetry (Ghoreishi house), right: two entrances located symmetrically (Kolbadi house).

5. THE PROPOSED FACADE DESIGN RECOMMENDATIONS

After a thorough examination of the character-defining traits of Qajar architecture in Mazandaran and employing the conceptual framework outlined in this article, the following recommendations are proposed for the facade design of new buildings

situated in the vicinity of registered urban historical houses in Mazandaran:

5.1. General visual arrangement

The main facade of the building should follow the general segmentation patterns of traditional facades (Figure 12).

Maintaining an uninterrupted vertical alignment of load-bearing walls, extending from the highest floor to the lowest, is imperative. In the design of the facade, it is essential to avoid placing the piers of the upper floors directly onto any openings present in the lower floors (Figure 13).

A suggestion is made to arrange the primary piers of the facade symmetrically around the central vertical axis of the building (Figure 14). In instances where achieving complete symmetry may be challenging, it is advisable to employ partial symmetry as a viable alternative.

5.2. General façade dimensions

The height level of the ground floor should be considered between 0.6 and 1 meter higher than the level of the adjoining yard.

In one-story buildings, the ground floor height should be considered between 3.5 and 4.5 meters (Figure 15).

In buildings with more than one floor, the height of each floor should be between 2.5 and 3.5 meters (Figure 16). The upper floors should not be shorter than the ground floor.

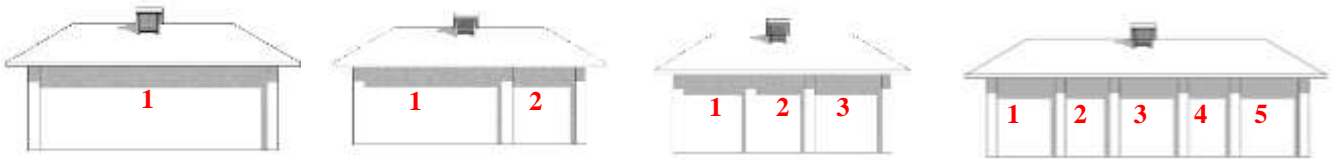


Fig 12. Examples of acceptable façade segmentation

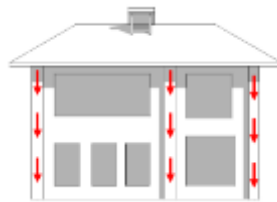


Fig 13. The vertical direction of power flow paths

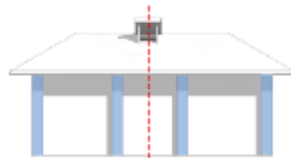
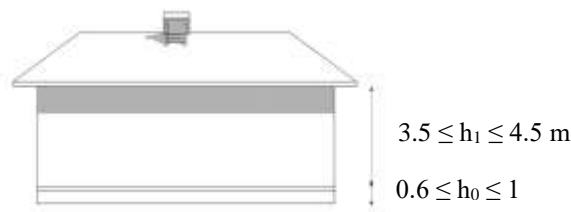


Fig 14. An example of symmetrical placement of main piers



$$3.5 \leq h_1 \leq 4.5 \text{ m}$$

$$0.6 \leq h_0 \leq 1$$

Fig 15. Acceptable floor height in one-floor buildings



$$2.5 < h_2 < 3.5$$

$$2.5 < h_1 <$$

$$0.6 < h_0 < 1$$

Fig 16. Acceptable floor height in buildings with more than one floor

5.3. Roof

Roof should be hipped and covered with roof tiles in harmony with traditional local patterns (Figure 17). In accordance with local "Koterkum" patterns, it is essential to incorporate a roof access hatch as a necessary provision (Figure 17).

The inclusion of a roof projection, resembling either a "one-step" or "multiple-stepped" overhang, is required to align with local architectural patterns (Figure 18).

5.4. Building material

The primary recommendation is to utilize brick, local plasters, wood, and roof tiles as the principal building materials for exterior finishes (figure 19).

The recommended approach involves ensuring that the allocation of surface area for each primary material of the facade aligns harmoniously with the established local patterns of the respective city.

5.5. Openings

A suggested guideline is to ensure that the percentage of surface allocated to openings in the main facade of the building is in accordance with the established local patterns of the architecture specific to the relevant city.

The area dedicated to the openings in the upper floors should be larger than the lower floors.

When selecting the type of openings, it is advisable to preserve similarity with traditional local openings such as Rojin, Dalabcheh, Orosi, Jamidar, Do-dari, Se-dari, Panj-dari, and others.

When siting openings, it is crucial to adhere to the hierarchy of importance and grading prevalent in local architecture.

5.6. Decorations

In enhancing the facade of the building, it is advised to incorporate local decoration patterns, encompassing various forms of brickwork, plasterwork, bonds, arches, and wooden decorations.

5.7. Semi-open spaces

It is recommended to use semi-open spaces in the facade of the building in harmony with local patterns (Figure 20).

5.8. Entrance

The installation of the entrance in the main facade of the building is advised to be in accordance with local architectural patterns. This encompasses various types, including: 1. An entrance in the main symmetry axis of the facade (Figure 21, left); 2. An entrance outside the main symmetry axis of the facade (Figure 21, middle); 3. Two symmetrical entrances on both sides of the facade (Figure 21, right).

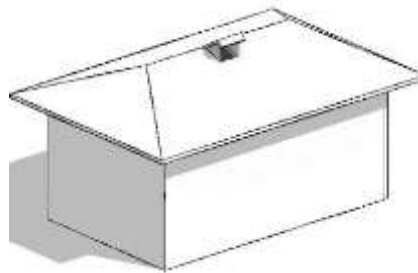


Fig 17. An example of an acceptable roof design



Fig 18. Examples of acceptable roof overhang design



Fig 19. Recommended color palette

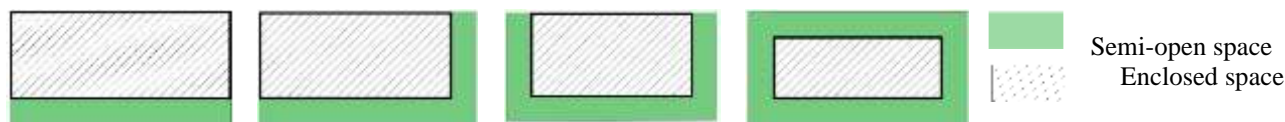


Fig 20. Examples of acceptable combinations of open and semi-open spaces in floor plans

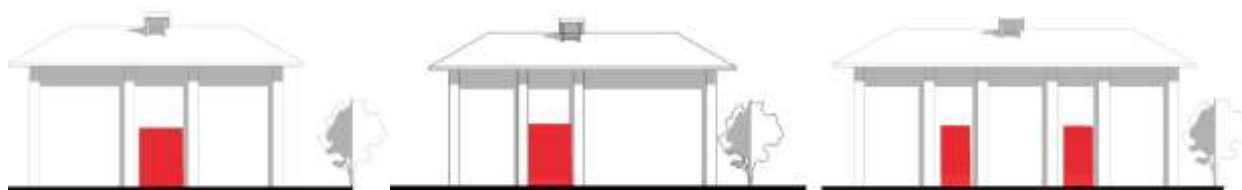


Fig 21. Examples of acceptable positions of the entrance in the façade

6. CONCLUSION

This article endeavors to offer facade design recommendations aimed at achieving visual harmony between new infill buildings and neighboring cherished Qajar houses within the historical context of the cities of Mazandaran province.

Addressing the initial sub-question necessitates a focused consideration of the character-defining features within facade design. These encompass elements such as 'general visual arrangement', 'general facade dimensions', 'roof', 'building materials', 'openings', 'decorations', 'semi-open spaces', and 'entrance'. To attain the desired level of continuity and coherence between new and old architecture in this historical context, meticulous attention to these features is crucial. The response to the second sub-question is elaborated in the section titled 'vernacular rules and patterns for facade design'.

To address the third sub-question, an examination of the realities within the development control system in Mazandaran is undertaken. The acceptable design approach, or approaches, for each facade design element is determined, primarily encompassing literal replication and invention within the same or a related style. These approaches are permissible for the macro-level elements shaping the facade, namely 'general visual arrangement', 'general facade dimensions', and 'roof'. However, for the micro-level elements, including 'building materials', 'openings', 'decorations', 'semi-open spaces', and 'entrance', the use of the abstract reference approach is also allowed.

It is crucial to note that the intentional opposition approach is deemed unacceptable in any case.

Addressing the main question of the research, the conceptual framework and typological studies conducted on the facade design tradition of valuable Qajar houses in Mazandaran province have led to the formulation of specific design recommendations for each facade element. The guidance provided in the preceding section of the paper should be adhered to in new infill constructions to ensure the attainment of visual compatibility.

Undoubtedly, the implementation of these design recommendations does not negate the necessity for expert 'judgment' (Oc, Heath & Tiesdell, 2010, 58), and the guide alone is not inherently adequate to ensure the desired 'continuity and coherence' (Brolin, 1980) between new constructions and the old listed monuments. However, it can serve as an effective tool to enhance the conservation status of Mazandaran province.

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¹ For example, see: (Cerlet, 1999) for an account of the French and (Punter, 1999) for an account of the British building control system for the historical contexts.

² See: (Pour Ahmadi, 2020; Pour Ahmadi, 2019; Pour Ahmadi & Dolatkah, 2020).

³ Some good examples include: (Kropf, 1996; Samuels, 1999; Samuels and Pattacini, 1997).

⁴ For some good examples, see: (Oc, Heath and Tiesdell, 2010, 68; Carmona, Heath, Oc and Tiesdell, 2003, 154; and Davies, 2003).

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