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Pessac and Lège revisited: standards, dimensions and failures

Tim Benton. « L'architecture est chose de plastique » (*Vers une architecture*). « A ceux qui, absorbés maintenant dans le problème de la 'machine à habiter' déclaraient : "l'architecture c'est servir", nous avons répondu : "l'architecture, c'est émouvoir". Et nous avons été taxé de 'poète', avec dédain » ("Température à l'occasion de la troisième édition de *Vers une architecture*", 1928).

INTRODUCTION

Behind the absorbing question 'How should Architectural History be done?' lies the more important question 'What is architecture for?' If architecture were simply '*chose de plastique*', its study would consist of the formal analysis of the effects or the means by which the architect achieved these ends. If the most important functions of architecture were to meet practical human needs, then the best methods to evaluate it would be technological, psychological and sociological, studying human behaviour and feelings and testing to see if the needs had been met. But, when an architect designs a house, he is also creating the next chapter in his curriculum vitae, his stylistic evolution, his career. Generating a set of publishable drawings, models and photographs can be as vital for an architect as satisfying the client's needs and earning his fees. Furthermore, every work of architectural design is a step on the path to developing an architect's style - a language of visual expression which both disciplines and amplifies his ideas. Housing brings these questions into sharper focus, since the clients invariably are not the end users. Confronting architectural intention with the experience of the housing dweller is always likely to reveal sharp contrasts.

The sources of primary architectural research mirror these issues. The array of available sources – from architectural drawings, photographs, documents, the archaeological evidence of surviving structures and the witness of inhabitants and visitors -

offer insights into different kinds of enquiry, often with incompatible results.

Doing architectural history usually involves superimposing different narratives, based on incompatible sources, different value systems with possibly conflicting conclusions. More than most arts, architecture confronts artistic intentions with material outcomes that change over time. A common stereotype involves explaining any mismatch between the two, either by blaming idealistic and unrealistic architects or by devaluing practical lived experience by comparison with the loftier and spiritual ambitions of architecture as an Art. It may be more interesting, however, try to see what connects the frequent disillusion of realisation with the imagined outcome. A first step can be to try to understand better what the architects were intending to achieve and what precisely happened to their ambitions.

LÈGE AND PESSAC

The two housing estates designed by Le Corbusier for the Bordeaux industrialist Henri Frugès between December 1923 and 1926 raise these issues in exemplary fashion¹. In many ways these works marked a major maturing of Le Corbusier's architectural style and theory and yet in most measurable ways they were a failure as housing. Long before the houses were inhabited, Le Corbusier had lost interest.

The six houses and a refectory and dormitory (*Cantine*²) for seasonal sawmill workers at Lège – in a pine forest near the sea, North West of Bordeaux – was virtually disowned by Le Corbusier (for reasons which will become apparent) but has recently been restored and developed by the Municipality for summer tourist lettings (*figs. 1-3*).

The second and larger project, the 'Quartiers Modernes Frugès' in the suburb of Pessac (on the road to the seaside resort of Arcachon), consisted of 51 dwellings, of which one was destroyed by bombing in 1942. The original project, however, was much bigger, including 130-134 houses, occupying a site

¹ The standard text remains the two slim volumes produced for the Fondation Le Corbusier: B. B. Taylor, *Le Corbusier et Pessac*, tomes 1 et 2, Fondation Le Corbusier, Paris 1972, to which can now be added the guidebook: M. Ferrand, J. -P. Feugas, B. Le Roy, J. -L. Veyret, *Le Corbusier: Les Quartiers Modernes Frugès/The Quartiers Modernes Frugès*, Birkhauser/Fondation Le Corbusier, Basel, Boston, Berlin 1998. The fundamental work of architectural sociology by Philippe Boudon, *Le Corbusier et Pessac*, Paris 1969, was preceded by his article 'Le Corbusier à Pessac' in *AMC*, 3, January 1968. The English language edition of his book, *Lived-in Architecture; Pessac*



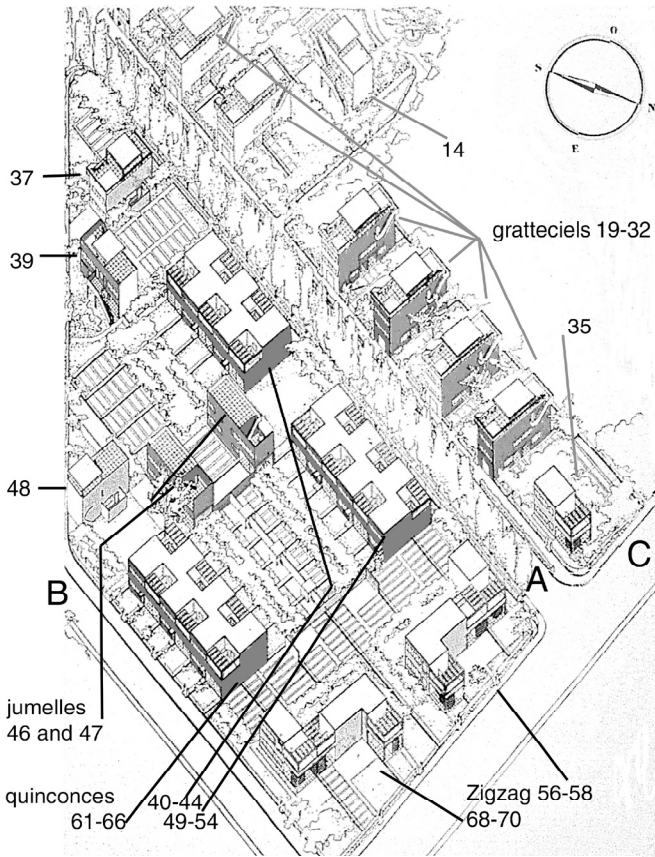
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running from the Bordeaux-Arcachon railway along the South side to the main Arcachon road to the North. Pessac has been the subject of continual controversy from the outset, and the lines of fracture of these debates have usually been along the lines described above. Furthermore, the estate provides visual evidence to this day of two apparently contradictory values:

Modernist formal perfection and messy adaptability to human use (figs. 4-9).

Following the initiative of one of the house owners, William Héraut, No 3 rue des Arcades was listed a Monument Historique on 18 December 1980³. As a consequence, under French law, the whole site (on a 500 metre radius from the house on the rue des Arcades) now benefits from protection. The Commune has bought up and restored examples of each type of house and made one available as a Museum (1983) (figs. 5,8 and 9). Several houses are being restored and occupied by architects and others from the nearby University of Bordeaux (figs. 10-12).

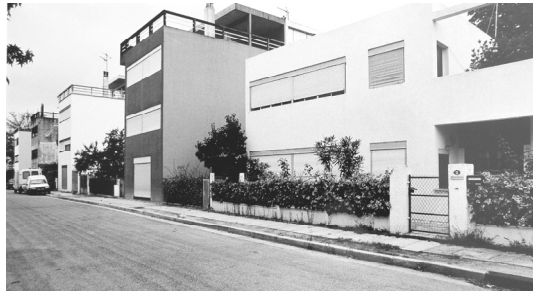
A measure of the delicious post-Modernist irony which currently characterizes Pessac is that a house was recently put on the market with its street façade perfectly restored to the 'adapted' form registered in Philippe Boudon's book of 1969, while the rear façade and next door neighbour's street façade restore Le Corbusier's original intentions (figs. 11-12). Over the years, progressive restoration by individual owners is returning Pessac slowly to something like the intended condition. With this 'improvement' is also being lost a fascinating spectacle of conflicting values and standards of living (figs. 15-16). This narrative of architecture-value versus use-value must sit alongside another narrative of formal architectural exploration, in which Pessac occupies a key place in the development of Le Corbusier's poetic vocabulary. The latter, alongside a history of the later fate of Pessac, will be developed elsewhere. I will not deal here at all with the many designs for unbuilt houses at Pessac, nor the whole planning and design of Sectors A and B.

PART 1: THE DESIGN AND BUILDING OF LÈGE AND PESSAC

I do not propose to trace the detailed design and building history of Lège and Pessac here, but will simply outline the chronological time-line against which the rest of this narrative should be set.

Revisited, Cambridge 1972, includes some revisions and some reflections on the debate caused by his original publication. –2 I will use Le Corbusier's French terms for the names of buildings and internal spaces in Lège and Pessac when these do not translate easily into English. –3 The *classement* of 3 rue des Arcades was completed on 18 December 1980. Pessac has now been constituted a ZPPAU (Zone de Protection du Patrimoine Architectural Urbain). The site had already been *inscrit* on 2 March 1976.

1 Lège Type A house.
 2 Lège Type B house.
 3 Lège Type B house, *fronton de pelote basque* and *Cantine*.
 4 Pessac Axonometric of part of Pessac as proposed in June 1926. Not shown is the rue des Arcades (houses 1-7) or the first two grat-teiels blocks (15-16 and 17-18). House 37 was built but destroyed in the war. Nos 39 and 48 were not built. A: rue Le Corbusier; B: Avenue Frugès; C: rue Xavier Armozan.



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HENRI FRUGÈS AND LÈGE

The Lège-Pessac adventure began well. Henry Frugès was the son of a wealthy industrialist in Bordeaux, whose original wine trade had diversified into a number of businesses, including a large sugar refinery and a carpet business. He was a keen amateur musician, to the point of having his compositions played in public, a lover of art and the exotic⁴. The house he commissioned in Bordeaux is a heady mixture of Art Nouveau and Orientalism. From 1923 until after Le Corbusier's death, Frugès remained an unwavering supporter and admirer of Le Corbusier, although the Lège-Pessac adventure led directly to a breakdown, the collapse of his marriage and in part to the bankruptcy of this well established Bordeaux firm⁵.

LÈGE: A CONFLICT OF TWO APPROACHES

Henry Frugès wrote to Le Corbusier on 3 November 1923, having just read *Vers une architecture*, hoping to contract him to design a small 'cité jardin ouvrière'⁶. Le Corbusier replied on the 15th⁷ and, following a series of meetings and correspondence, prepared a numbered set of plans, elevations and a perspective of Type A and Type B houses⁸ (figs. 17-20). These houses

measured 4.88m wide and 9.50m and 6.05m long, respectively. I will discuss the question of dimensions in detail below. Both types featured minimal living spaces, raised over partially open and partially enclosed areas for storage and outdoor living. The master bedrooms measured c. 2.13 x 2.30m while the bedrooms for two children were 'L' shaped 4.3m wide and between c. 2.2 and c. 3.8m deep. Minimal kitchen-galleys were provided and W.C. and shower. In the Type B houses, an internal transverse staircase led to a third storey with two bedrooms for three children. The plan of the Type B houses was an evolution from that of the workers' cottages at Saintes or the cottages at St Nicolas d'Alhiermont (1917) or Saint Gobain (1920). From the curious Maison Ribot house, which Le Corbusier had exhibited as a model in the Salon d'Automne in 1923, came the open ground floor area and external staircase to the first floor (fig. 21). Le Corbusier must have had in mind vernacular peasant cottages where half the space was given over to storing wood and keeping tools and where you lived over the animals. The only product of this phase, which evolved only slightly between December 1923 and April 1924, was the *maison échantillon* (maison Tonkin), discussed below, which was built between April and September 1924.

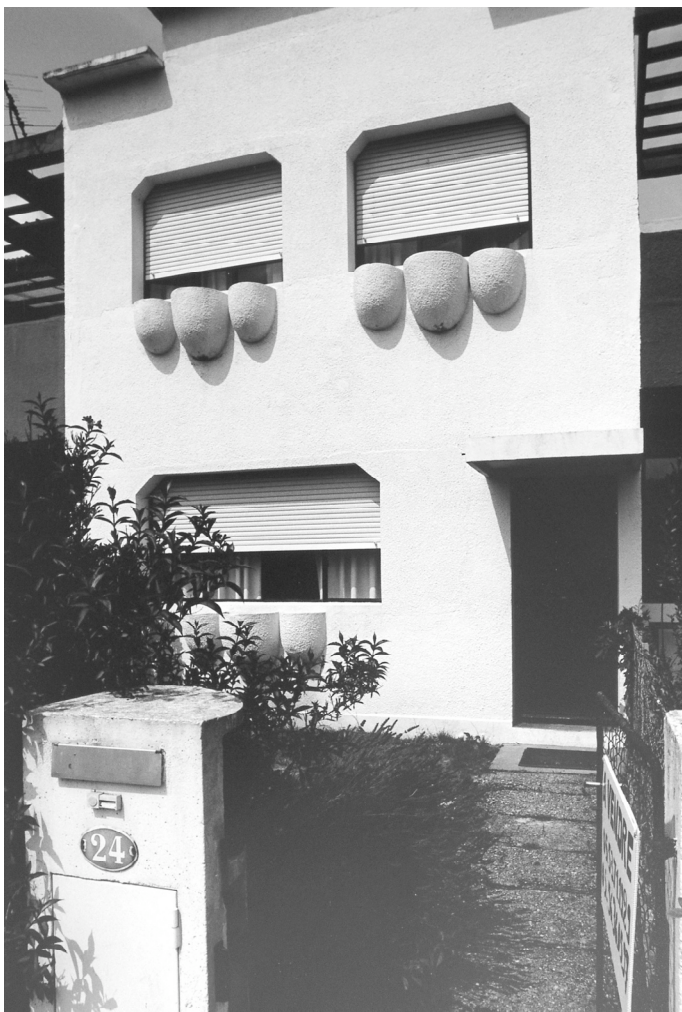
Then, on return from his vacation, Le Corbusier redesigned

–4 For example on 30 March 1925, a symphonic work by Henri Frugès was performed at the *Salle Gaveau*. Le Corbusier attended the concert himself. He explained to the editor of *Comoedia* that Frugès was not a professional musician but that « la vérité vient parfois de gens qui ne sont pas noyés dans les habitudes professionnels' (Le Corbusier to Cogniet, 27/3/1925, H1-20-196). –5 Writing on 23d January 1931, from a clinic in Tunis, Frugès told 'comment je suis tombé d'épuisement, du sur-menage, compliqué de graves préoccupations », how he had been advised to give up business and that he had decided to study agriculture (H1-17-91). In his next letter on 17 March he pronounced himself delighted that, after all their years of collaboration, Le Corbusier could now refer to him as 'mon ami' (H1-17-96). His fortunes subsequently revived, it seems, from a judicious marriage, and he continued to campaign for Pessac and for modern architecture. –6 H1-17-1. –7 H1-17-2.



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- 5 Gratteciels 28-33 and House 35 in 1999. House 32 (centre) was restored by the Municipality and serves as Visitors' Centre and Museum.
- 6 Quinconces houses 61-2 in 1999. No 62 was a furnished demonstration house in June 1926.
- 7 Zigzag houses Nos 58 and 57 on the rue Xavier Arnozan.
- 8 House 14 (Vrinat) restored by the Municipality.
- 9 Arcade houses restored by the Municipality.
- 10 Houses 64-66 in 1993.
- 11 House 65 (for sale in 1999).
- 12 House 66 in 1999.



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—8 FLC 20786, 20782, 20785, 20783, 20784 and its blueprint 19903 numbered 1-4 and 6. One of these plans ('4', FLC 20783) contains details of the system of shuttering used to cast the concrete frame of the buildings. The perspective, numbered '6', shows two Type B houses in a setting of trees which shows that Le Corbusier had not yet visited the site at Lège. Variants of these designs were sent to M. Girardet, Directeur des Établissements Peugeot, 30, rue Danton, Levallois Perret, for 90 houses forming the Cité Audincourt (cf *Œuvre complète*, 1, pp. 69-71 and FLC 20748, H1-20-179). See also Le Corbusier's full description (10 March 1924, I-1-5). Apparently Audincourt was still on the cards in August 1924 (when Le Corbusier tried to persuade Frugès to participate in the development, using the cement cannon, H1-17-125) and on 15 December, when Le Corbusier tried to pressurise the Belgian form Van Hamme to deliver the steel windows for Lège, on the grounds that the major developments for Peugeot and Michelin awaited (H1-19162).



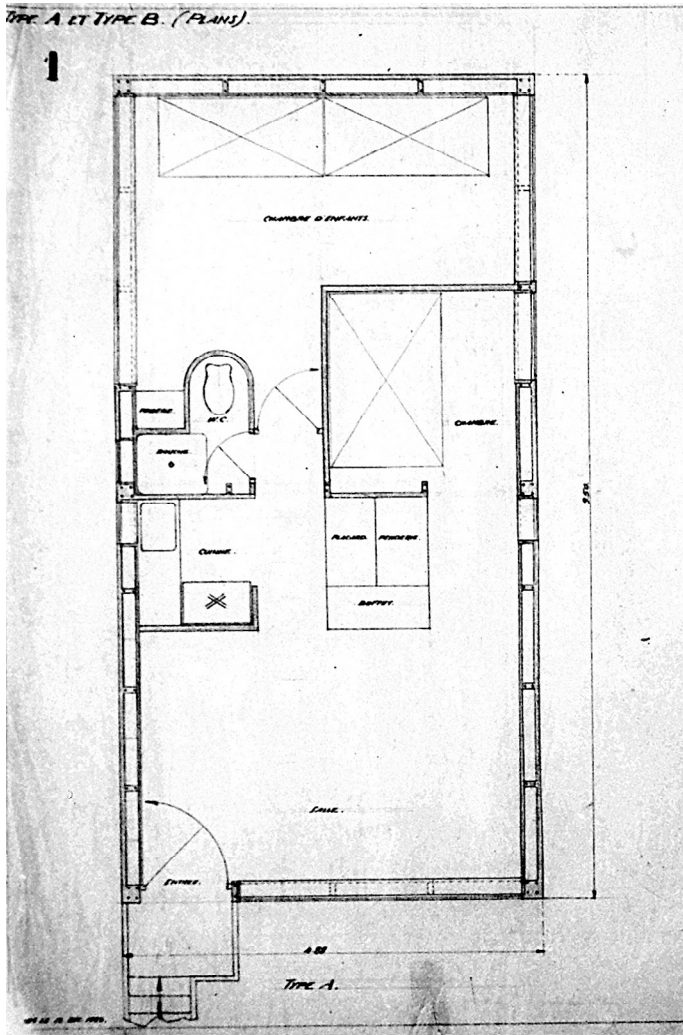
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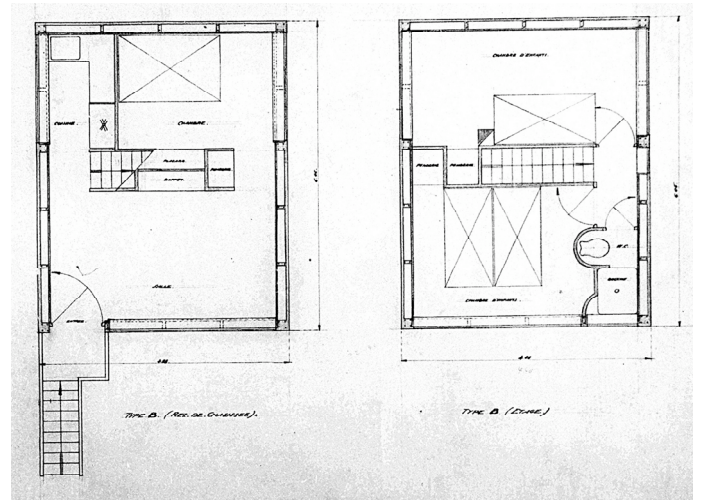
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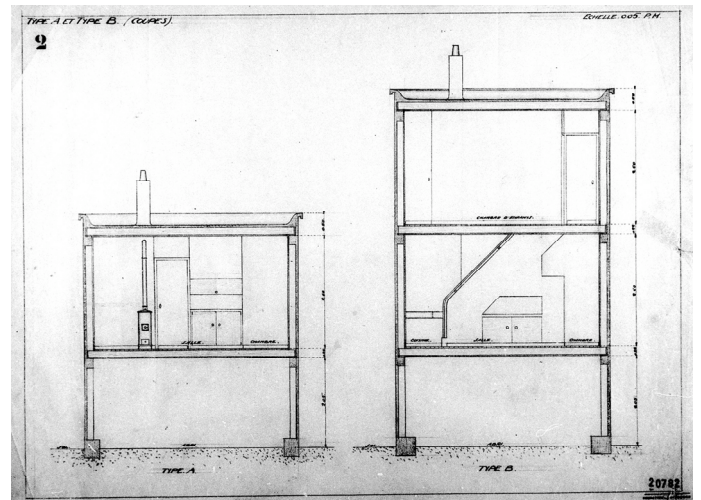
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the Type A and B houses around a 5m unit of measurement⁹ (figs. 22-24). These drawings are dated by Le Corbusier's letter

of 7 August 1924¹⁰, which makes explicit reference to all three drawings and includes a plan of the lotissement (FLC 19910,

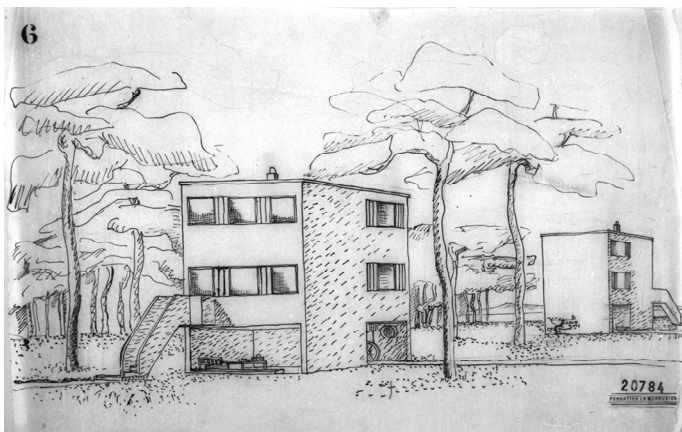
⁹ FLC 20802 ('Type A1L', 10.60mx 5.40m, single storey above ground floor, *sous-sol surélevé*), FLC 20803 ('Type Abis1' 8.10mx 5.40m, single storey above *sous-sol surélevé*) and FLC 20804 ('Type B1L', two storeys with internal stairs over *sous-sol surélevé*). These dimensions derived from combinations of 5.0m and 2.50m with the



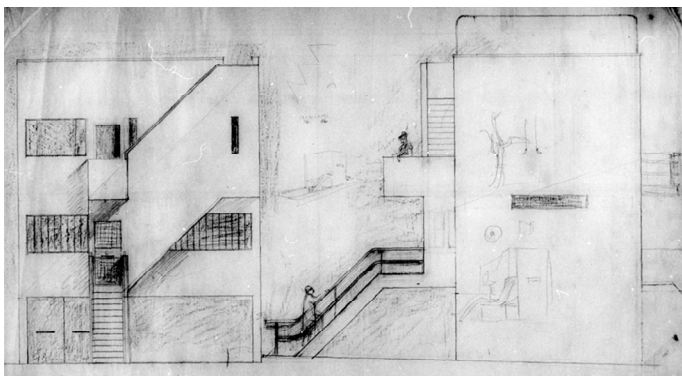
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- 13 Houses 15-16 in 1993.
- 14 Houses 15-16 in 1999.
- 15 House 47 adapted by its owner with parasol roof, reduced windows and 'eyebrow' sun shades, in 1999.
- 16 One of the Zigzag houses (No 58) humanised with applied stone and protected by barbed wire.
- 17 Plan of Type A house, numbered '1' and dated 13 December 1923 (detail from FLC 20786).
- 18 Plans of Type B houses, numbered '1' and dated 13 December 1923 (detail from FLC 20786).
- 19 Sections of Type A and Type B houses, numbered '2' and dated 13 December 1923. Section of

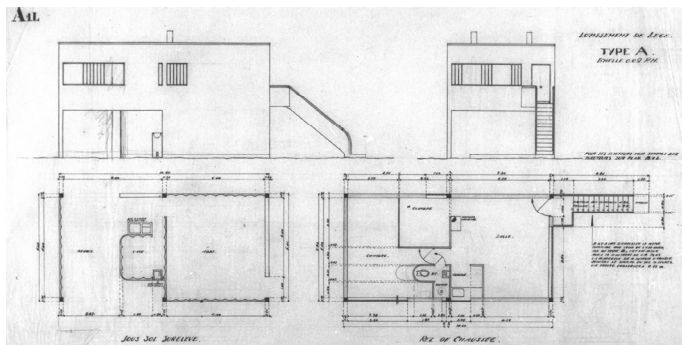
- Type A and Type B houses, 13 December 1923. Note the ground floor height (2.05m) and the stove in the Salle (FLC 20782).
- 20 Perspective of Type B houses in a wooded setting, numbered '6' and dated 13 December 1923 (FLC 20784).
- 21 Design for Maison Ribot, exhibited as a model in the Salon d'Automne in November 1923 (FLC 19126).
- 22 Plans and sections of Type A1L, redesigned around 5 and 2.50m, 7 August 1924 (FLC 20802).
- 23 Plans and sections of Type B1L, redesigned around 5 and 2.50m, 7 August 1923 (FLC 20804).
- 24 Plans and sections of 'new' Type Abis1 for Pessac, 7 August 1924 (FLC 20803).



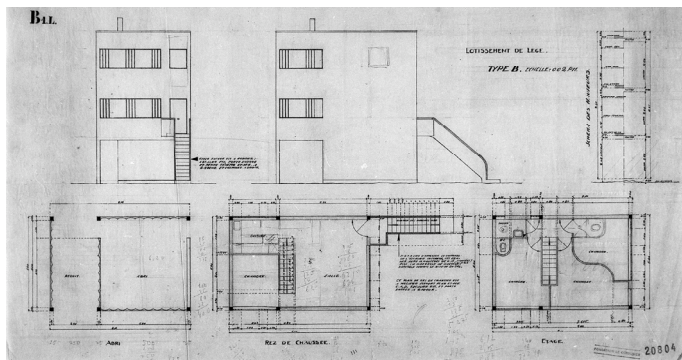
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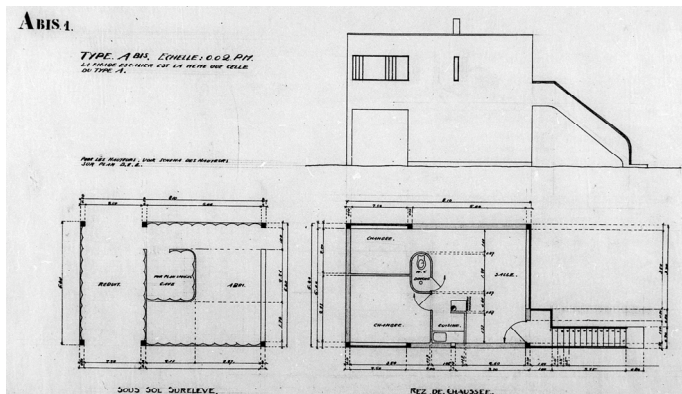
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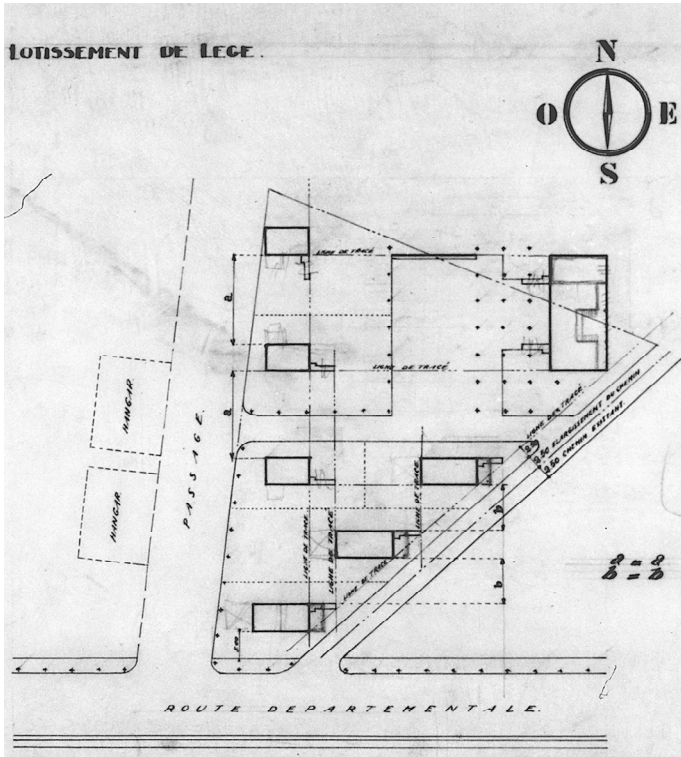
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fig. 25). On the site plan, the external staircases of the Type A houses were on the North side (unlike the *maison échantillon*), whereas those on the Type B houses were transferred to the South. Although the stairs on the Type B1L houses (FLC 20804) are shown on the North side, a note indicates that they are to be transferred. He makes clear that Type Abis1 might be used in Pessac, singly or in pairs (FLC H1-17-125). Elevations for Type Abis 1 can be found on FLC 20801.

addition of three or four wall thicknesses of 0.20m. -10 H1-17-125.

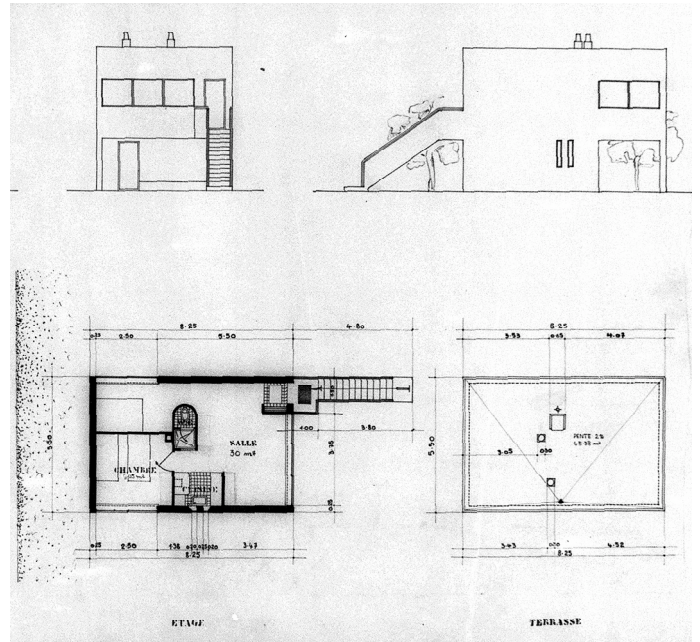


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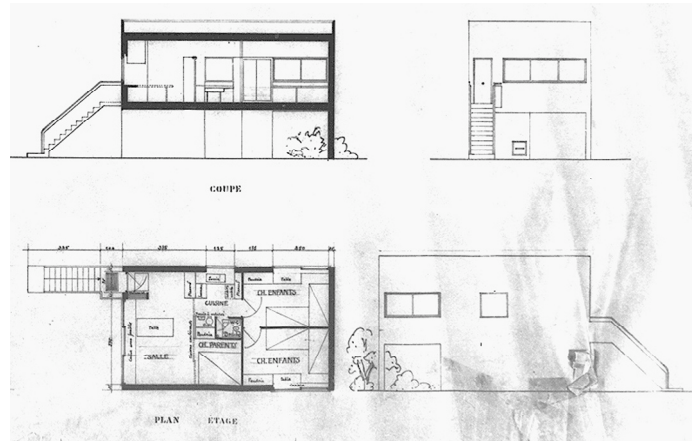
Although nowhere constructed, the Type A1L, Abis1 and B1L had a long history, evolving into the Maisons Minimum, 1926 (eg FLC 20732-6, published in *L'Architecture Vivante*) and later into the Maisons Loucheur, the first designs of which pick up precisely the Maison Minimum drawings¹¹ (figs. 26-27). In 1928, Le Corbusier made a design for the un-built sectors A and B for Pessac using the Maisons Loucheur housing units, prompted by the visit of the Minister Louis Loucheur¹² (fig. 28).

On 9 October Frugès, desperate to make a start on the houses at Lège and unsatisfied by Le Corbusier's house plans, with their wasted space at ground floor level, redesigned the Type A house himself¹³ (figs. 29-32). Frugès's designs (FLC 20798 and 20795) placed the Salon on the ground floor and added a 2m *préau* or porch in front of it, with a corresponding terrace on the first floor, extending the length of the house to 12.80m. Although Frugès followed Le Corbusier's layout of the partitions on the first floor (as to the bathroom and bedrooms), he was able to add another bedroom where the Salle had been and open up access to an 'L' shaped terrace to all three bedrooms. This is what was built, with some small modifications.

A fascinating contrast of approach to the standard is supplied by comparing Frugès's redesigned Type A1L for Lège and Le Corbusier's original. Frugès introduced a host of small compli-



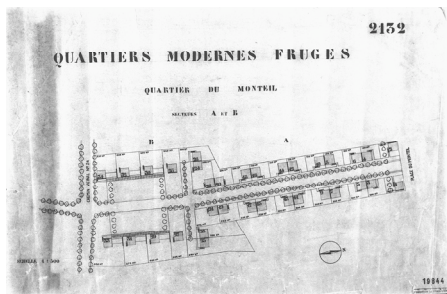
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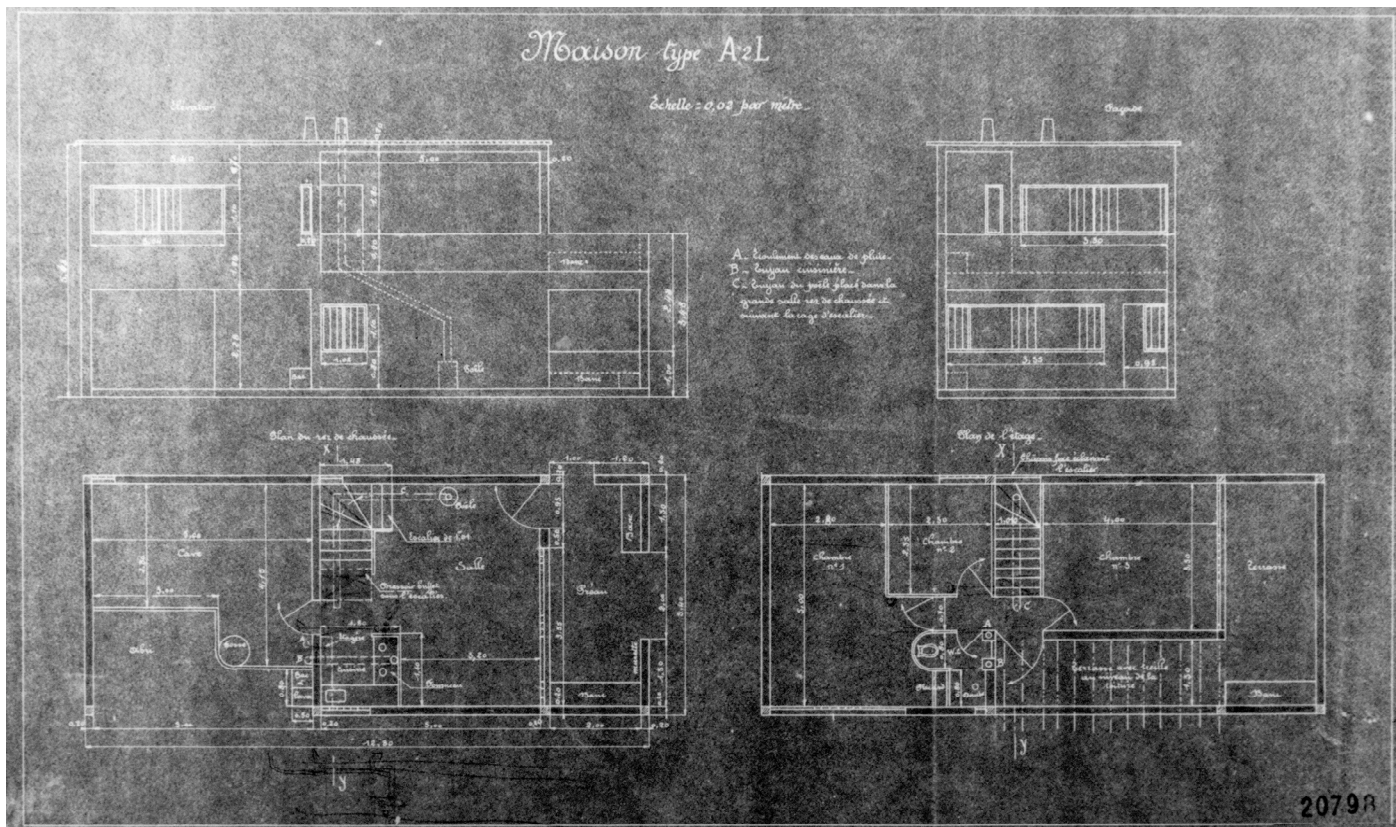
cations and irregularities in the design, from the dog-leg internal staircase to the emaciated pergola and irregular plan forms. The regularity and discipline of Le Corbusier's design was abandoned for use-value. Where Le Corbusier had conceived of the ground floor as 'underneath' the house, to be used for storage, Frugès placed the *Salle*, with a kitchen-niche copied from the one Le Corbusier had designed for the floor above. Where Le Corbusier had placed a small enclosed 'cave' on part of the ground floor plan, Frugès built in a larger 'L' shaped 'cave', leaving only a shallow space open. Part of this was subse-

—11 FLC 19390, 1928. See T. Benton, 'La réponse de Le Corbusier à la loi Loucheur', in J. Lucan, (ed.), *Le Corbusier une encyclopédie*, Centre Pompidou, Paris 1987, pp. 236-239. —12 In July 1928, Le Corbusier and Frugès had serious discussions of using the Loucheur housing law, which was at that time about to become law, not only to build sectors A and B, but also to sell the houses in sectors C and D, not a single one of which had been sold at that time (four rented) (H1-19-5, H1-17-207, 214, 216, 221 etc.). Loucheur visited Pessac for a few minutes only in March 1929. —13 Frugès to Le Corbusier 9 October 1924, H1-19-148. The blueprints of Frugès's design (FLC 20798 and 20795) were sent to Le Corbusier at some point between 9 and 23 October; FLC 20798 bears some corrections by him on it (H1-17-128).

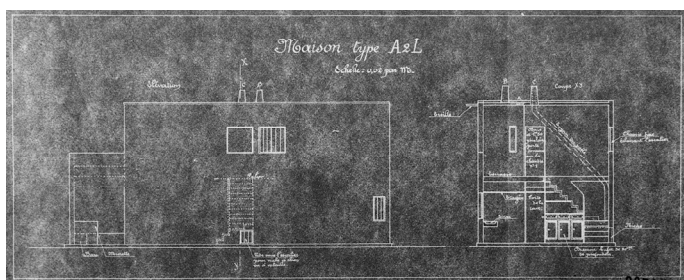


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- 25 Site plan of Lège showing 3 Type A1L and 3 Type B1L houses, a wall or *pelote Basque* and a 21m refectory and lodging house (*Cantine*), with Frugès's smaller 'U' shaped design marked in pencil, 7 August 1924 (FLC 19910).
- 26 Maison Minimum Type 1 1/2 E, 20 October 1926 (FLC 20735).
- 27 Preliminary designs for Maison Loucheur, '2 chambres fixes', 5 December 1928 (FLC 19390).
- 28 Site plan of Pessac, Sectors A and B, laid out with single and twin houses of the Maisons Loucheur type, 1929 (FLC 19844).
- 29 Henri Frugès, redesign of Type A house for construction at Lège, 9 October 1924 (FLC 20798).
- 30 Henri Frugès, redesign of Type A house for construction at Lège, 9 October 1924 (FLC 20795).



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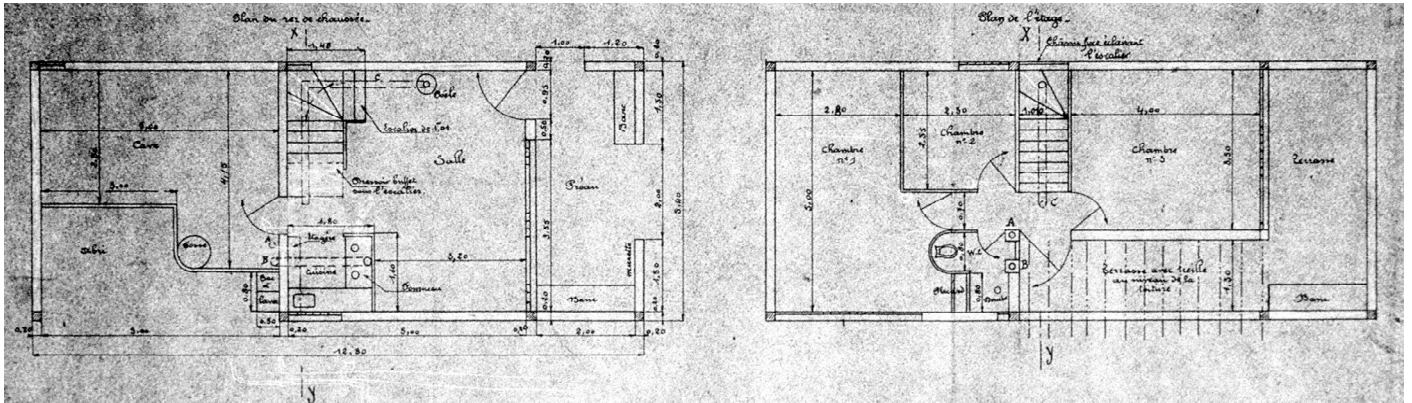


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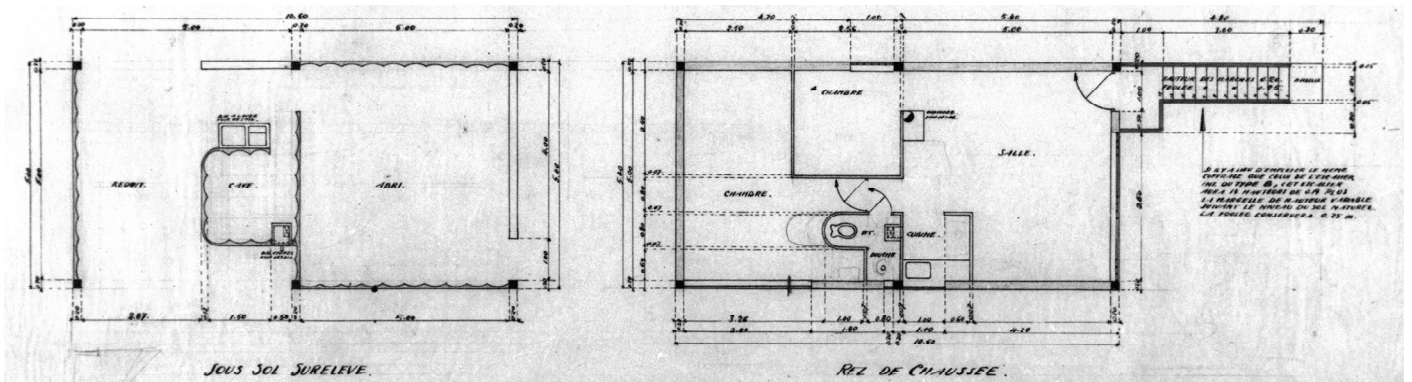
quently filled in during construction. Thus, Frugès had a clear idea of what he considered to be impracticable in Le Corbusier's planning and was prepared to take direct action himself.

On 21 October Le Corbusier and Pierre drew up a revised version of the Type B houses (the *Petit Lège*), numbered 1000 (FLC 20806) (*fig. 33*); No 1001 has been lost; No 1002 (FLC 20799) (a variant of the *Cantine*) and 1003 (FLC 20794) (a mobile coffering system for 5.00 x 2.60m bays). Le Corbusier had to ask Frugès for copies of the plans and details of the Type

- 31 Henri Frugès, ground and first floor plans of redesigned Type A house for Lège (FLC 20798 detail, positive).
 32 Le Corbusier, ground plans of Type A1L, 7 August 1924 (FLC 20802).
 33 Le Corbusier, 'Petit Lège' design, 21 October 1924 (FLC 20806).
 34 Le Corbusier, Type B1L plans, 7 August 1924 (FLC 20804 detail).
 35 Le Corbusier, *Petit Lège* plans, 21 October 1924 (FLC 20806 detail).



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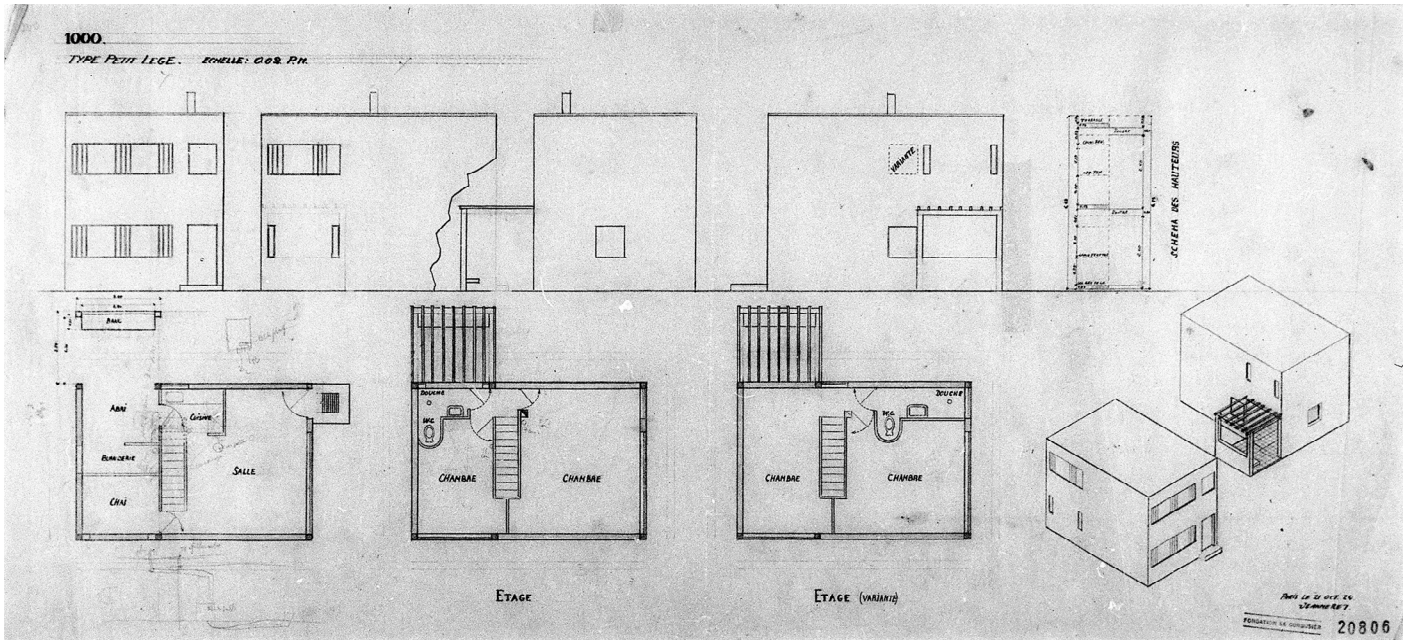


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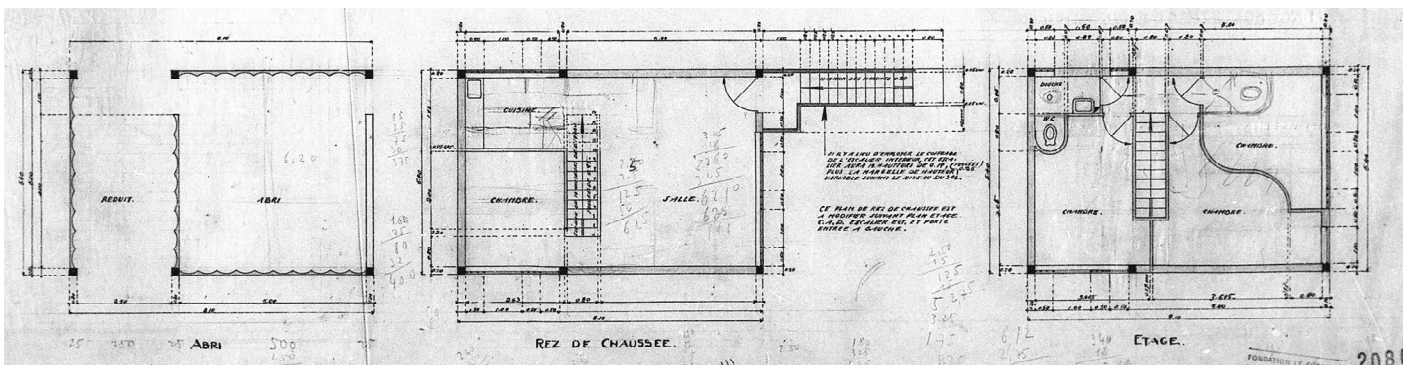
A houses and never did draw up the plans and elevations for the Type A houses as built at Lège¹⁴. The *petit Lège* Type B house was based on the Type B1L of 7 August (FLC 20804), with the ground floor removed (figs. 34-35). Where Type B1L had had a bedroom and kitchen in the 2.50m space beyond the staircase

from the *Salle*, the *petit Lège* had an open *abri*, *buanderie* and *chai*, and the kitchen had to be carved out of the space of the *Salle*¹⁵. On the first floor, corresponding to the second floor of the Type B1L, the curving partition wall, which Frugès had complained of as too complicated, was suppressed, to make a sim-

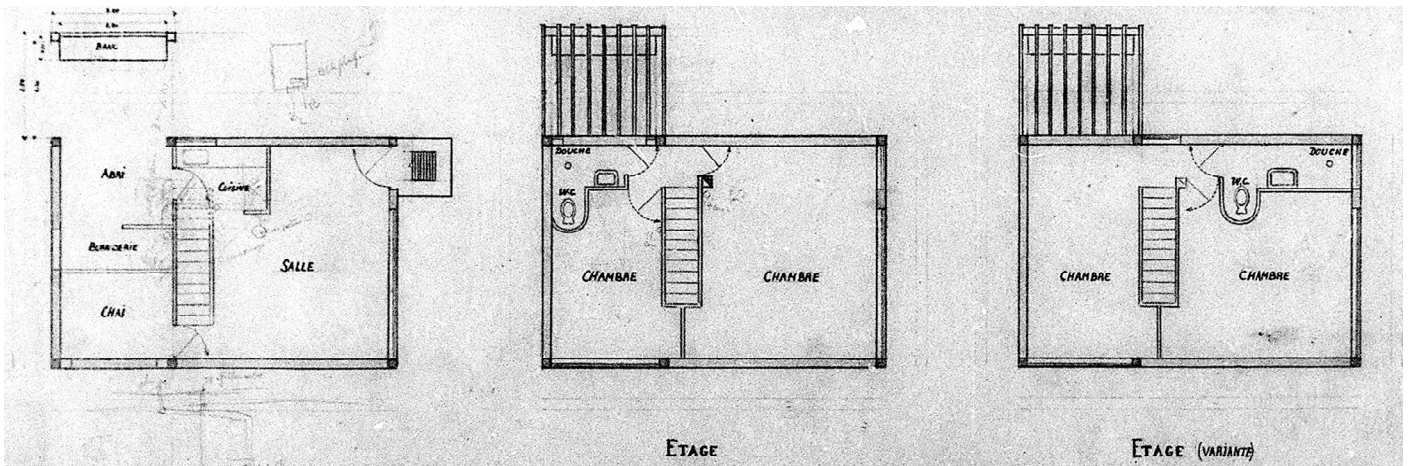
–14 Note in Le Corbusier's handwriting dated 16 October 1924 (H1-17-126). In this note he has to ask where the new *terrasse* in Type A houses is and also for a plan of the *Cantine* at Lège, showing what has already been built. On 1 December 1924, Le Corbusier asked Frugès to send the latest plans of the Lège houses (« qui était resté en suspens ») to the stove manufacturer Odelin Nettey and Bourdon, since he presumably had no revised plans himself (H1-20-257). FLC 20793 is a drawing by Odelin Nettey and Bourdon of the ground plans of the A2L and B2L houses as redesigned by Frugès, marking the hot air heating vents and bearing the for their 'ROBUR' furnaces (20 January 1925). –15 Pencil additions to FLC 20804 show that Pierre had begun to sketch this out on the earlier plan.



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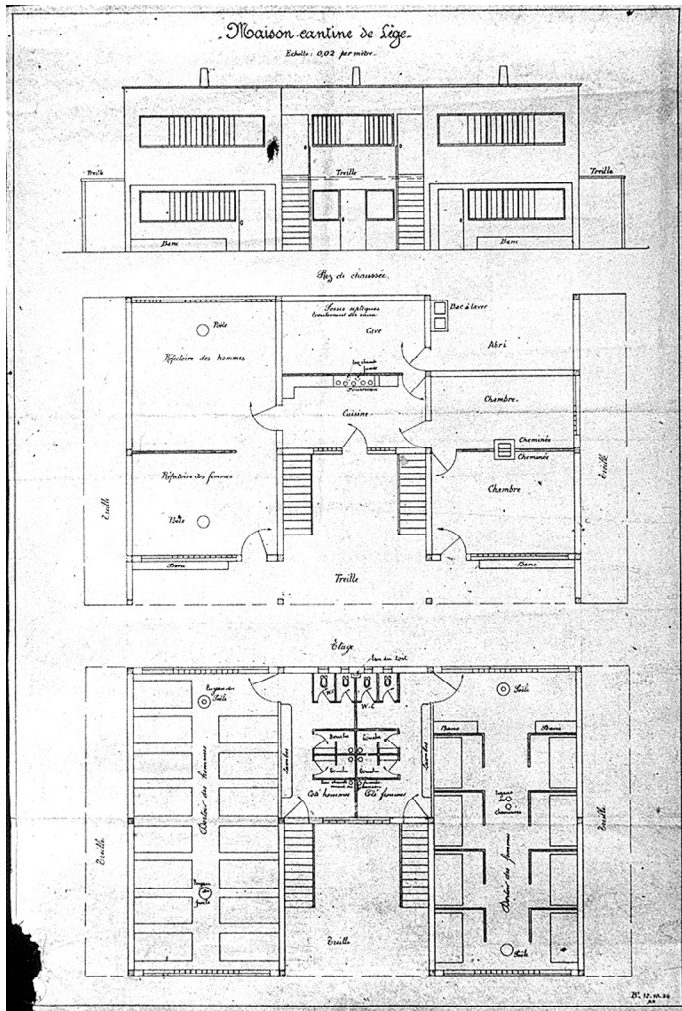


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ple division into large and small bedrooms. The Type B houses at Lège were built more or less according to his design FLC 20806, with many delays and problems, between December 1924 and April 1925¹⁶. They represented a considerable economy over Le Corbusier's Type B1L design.

It was Frugès, therefore, who eliminated the external staircases for both Type A and Type B houses and placed the living room and kitchen of the Type A houses on the ground floor. Only the *maison échantillon* (maison du Tonkin) was built to Le Corbusier's original plans for Lège (that is, FLC 20800, before the change of dimensions).

–16 Confirmed by the plan, which Frugès had sent out to Odélin Nettey and Bourdon FLC 20793. This plan seems to show an opening in the West wall, opposite the *buanderie* and also an insulated treatment of the walls in the part of the ground floor occupied by the *buanderie*, *chai* and *abri*. –17 On 19 September 1924 Le Corbusier told Frugès he was working on the *Cantine* (H1-19-146); he needed to know how many bedrooms to put in. The only elevation of c. 21m which might be for the *Cantine* is FLC 20792 and its partner 20791. No plan corresponds to this and it is unlikely to have been drawn before Frugès's plan and elevations (FLC 20790, dated 12 October 1924). Another elevation with entrance doors left and right, for men and women (FLC 20745) may be an idea for the *Cantine*, sharing the characteristic windows used in Lège. –18 FLC 19893. It shows the South West part of the site, near the railway track, now occupied by Le Corbusier's 'Arcade' houses, as still covered with trees. An additional portion of terrain, to the North East, was not in the event purchased. –19 It is unlikely that this plan was traced from a cadastral survey. Comparing this site plan with later more accurate ones shows that there are mistakes in setting out, notably in the angle of the road at the north end of the site. –20 FLC 19856, lettered by Le Corbusier's office. There is a blueprint FLC 19901, which is identical in the layout of houses but lettered by Frugès's office and including the house numbers and plot areas. Le Corbusier asked Frugès to supply a blueprint with the plot areas on 16 October 1924 (FLC H1-17-126) and Frugès's letter of 24 October sending a new plan

36 Henri Frugès, design for *Cantine*, Lège, 12 October 1924 (FLC 20790).

37 Le Corbusier, redesign of *Cantine*, Lège, labelled '1002', 21 October 1924 (FLC 20799)

38 Henri Frugès, *Cantine*, rear side, showing staircases to the dormitories for men and women

39 Henri Frugès and Le Corbusier, facade of the *Cantine* to the square with the *pelote Basque* wall on the left, showing the façade as redesigned by Le Corbusier. The four thin windows on the upper floor and all the long windows have been wholly or partly blocked up

Le Corbusier had been significantly distracted all summer and autumn by the construction of his parents' house 'Le Lac' at Corseaux. Many of Frugès's requests for plans and information went unanswered in this period. The refectory and dormitory, referred to as the *Cantine*, is a case in point. Although Le Corbusier drew in a 21m rectangle for the *Cantine* onto his site plan of 7 August (FLC 19910) there is no evidence that he prepared a scheme for the *Cantine* before Frugès sent him his design on 12 October 1924 (FLC 20790)¹⁷ (fig. 36). On receipt of this ugly design, with its 'U' shaped plan, c. 15m wide, Le Corbusier seems to have done little except add an element on the North side to arrive at his 21m façade (drawing '1002', FLC 20799) (fig. 37). So the *Cantine* was entirely designed by Frugès (9 October 1924) and only slightly modified by Le Corbusier, expanding it on one side and introducing the Van Hamme windows. It is difficult otherwise to explain this curiously asymmetrical and awkward design. I suspect that FLC 20791-2 were an attempt to improve on the compromise based on Frugès's design, and that this design was ruled out because construction had already started. There appears to be no extant view of the *Cantine* as built. The remains of the *Cantine* provide a fascinating field for the archaeologist (figs. 38-39).

PESSAC: FIRST PLANS

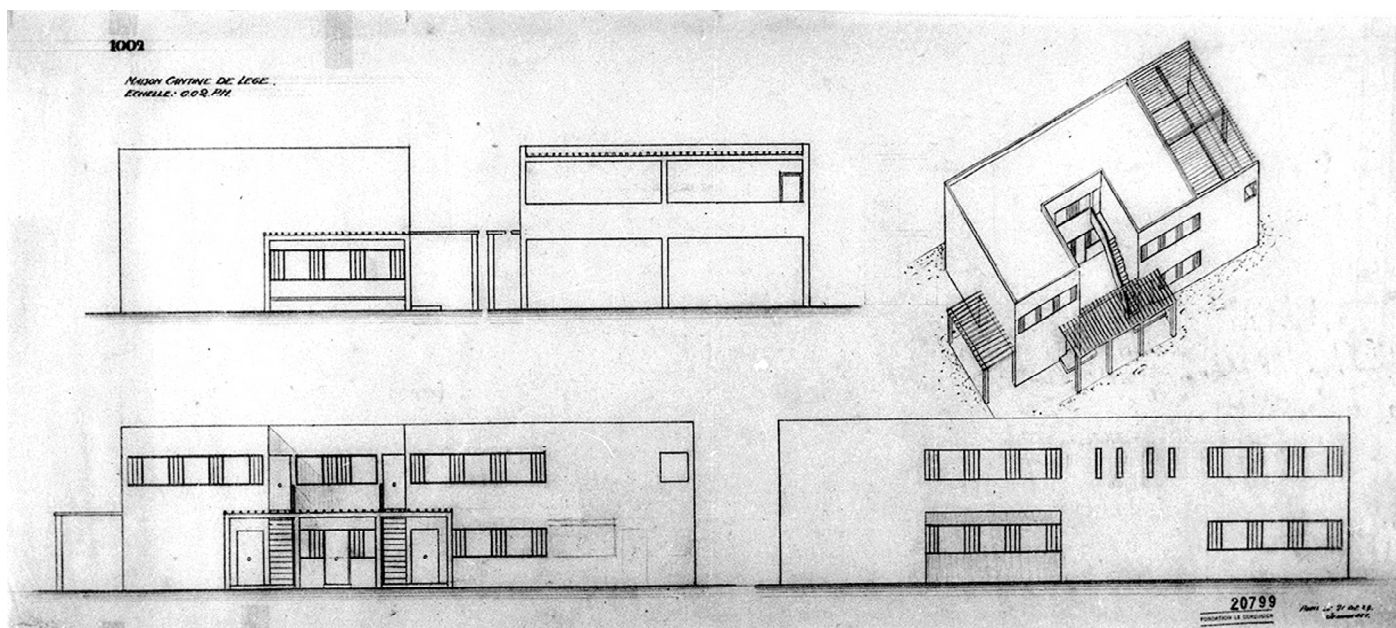
A rough watercolour sketch appears to be the first plan of the site at Pessac¹⁸. The plan carries a 100m rule and is drawn to the scale of 1:500. The drawing seems to have been made by Frugès himself with a wash of water colour indicating the plots he hopes to purchase. We must assume therefore that this plan was drawn before Frugès made his bid for the land and during the preliminary conversations with Le Corbusier at the beginning of 1924¹⁹.



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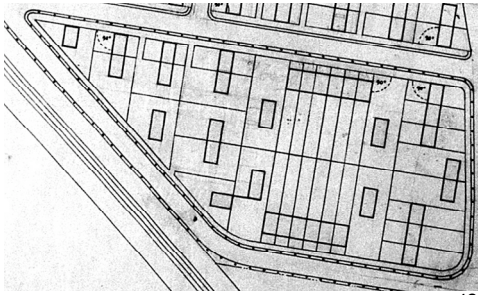
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The earliest site plan to carry a date bears the inscription: "Dressé par Le Corbusier et Pierre Jeanneret, Paris, 27 vii 1924"²⁰ (fig. 40). This drawing also at 1:500 shows a layout of houses quite different from the final plan and apparently based on a standard module of between 7.2m and 7.50m. These little rectangles are formed into terraced rows, sometimes joined by their short side, sometimes by their long side and sometimes as semi-detached houses, with some free-standing houses²¹. In fact, an earlier plan exists, from Le Corbusier's office (FLC 19853). This plan is almost identical in the layout of the site, but

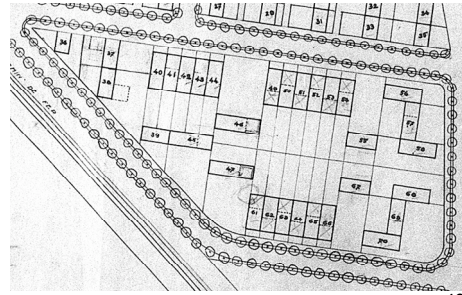
has some differences in the layout of the houses, and some changes in pencil, which point forward to FLC 19856²² (fig. 41). FLC 19583 must have been prepared before April 24, 1924, since Frugès's engineer Poncet refers then to houses 1-13²³. These plans share the peculiarity of aligning three semi-detached houses (like the *gratteciels*) on the east side of the rue Le Corbusier as well as having a different arrangement of the houses which would turn into the six 'Z' types on the North side of Sector C. These anomalies were removed in FLC 19855, by the rue de Sèvres office, in which we can see not only the 'Z'

of Pessac to Le Corbusier (H1-18-2). This blueprint was therefore a copy of 19856, with this additional information added by Poncet. Poncet, who was later blamed for making mistakes in the alignment of one of the streets and in the boundary line probably made the survey plan (lost) on which FLC 19856 was based (cf Frugès to Le Corbusier, 1 October 1925, H1-17-140). Given that there is no other plan with the house numbers on it, and that these numbers were being used in correspondence by April 1924, there must have been some other plan recording these numbers. –21 We have almost no clue what kind of form these standard cells might have taken. No external steps are shown and no indication of height. Although it is tempting to see the semi-detached houses which occupy the place of the present *gratteciels* as being of a similar design, it must be remembered that the design on which the *gratteciels* was based was not made until October 1924. A few days later Le Corbusier's letter of 7 August refers to his short single storey version of the Type A house ('Type Abis1') as a type intended for Pessac and it was probably a Unit of this kind that Le Corbusier had in mind for these combinations. –22 For example, the 12 'Arcade' houses on FLC 19853 become 13 on 19856, and the four southmost *gratteciels* are displaced slightly to the South to allow for a road to be re-aligned slightly to the North. –23 Poncet to Le Corbusier 24 April 1924, H1-17 123.

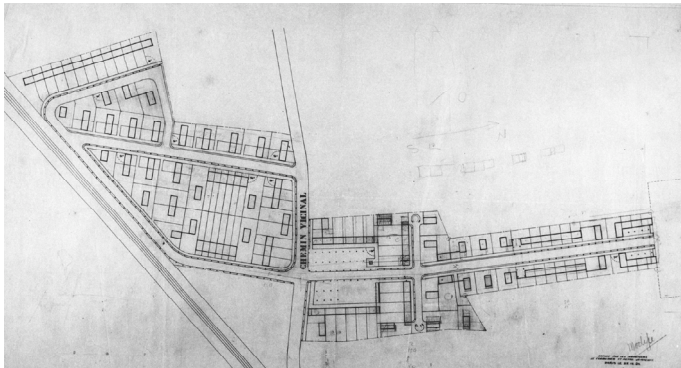
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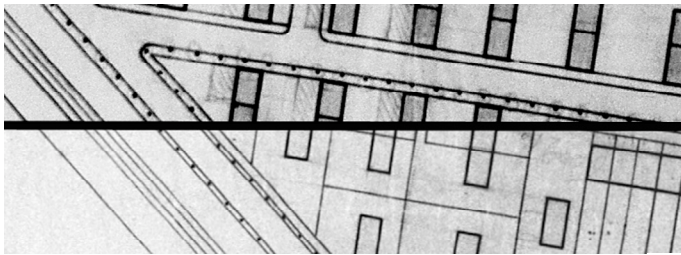
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type houses, but also the *quinconces* with their alternating pattern. This may be the plan given to Frugès on 17 November 1924 and was at any rate completed before that date²⁴. Comparing the treatment of Sector C in these two plans reveals a significant development of complexity. The 7.50m blocks have now been stretched and combined in ingenious ways to create dramatic effects (figs. 42-43). For this plan to have been created, the design of the *quinconces*, zigzag and other houses would have to have been designed, and these must have

followed Frugès's revisions of the Type A houses in October. I am convinced therefore that FLC 19855 was produced between the end of October and 17 November 1924.

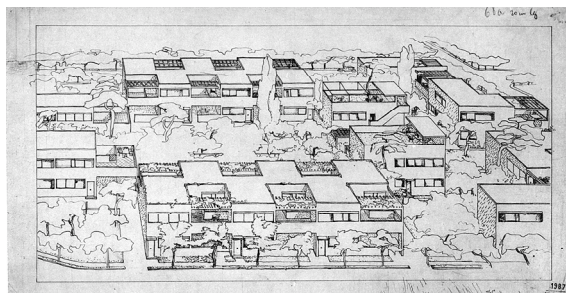
On 1 October 1924 Frugès had submitted a site plan and three plans of house types to the Mayor of Pessac. Unfortunately, these plans have not been conserved in the Pessac Municipal archives²⁵. We may deduce that the plan was based on FLC 19856 but it is a puzzle to know what the house plans were at this point. I believe that the three plans submitted must have been based on the Type A1L, Abis1 and B2L designs of 7 August 1924 (although the lettering would have had to have been changed to remove the reference to Lège)²⁶.

THE FIRST HOUSE PLANS FOR PESSAC

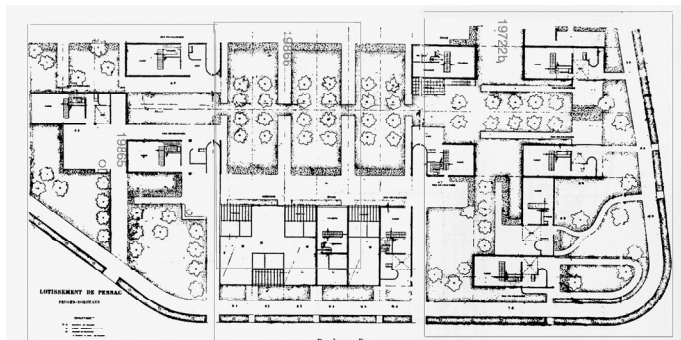
A group of large plans exist (at 1:50), covering the *gratteciels* 26-35, the *quinconces* 49-54 and 61-6, the Zigzag houses 56-58 and 68-70 as well as the *jumelle* houses 46 and 47 (and a third identical house 45)²⁷ (figs. 44 and 47-48). These plans were made to join up to form a large plan measuring c. 2.15m square and are almost certainly the plans (too big to send by post) which Le Corbusier wanted Frugès to pick up on Wednesday 19 November 1924. Part of this large plan (incorporating FLC 19865, 19866, 19722b) was published in the second edition of *Vers une architecture*²⁹ (figs. 45-46). On 1 December Le Corbusier tells Frugès he is sending a perspective of the lotissement ('dont vous avez reçu les premiers plans') and will send a second plan shortly. He informs Frugès that he has all the necessary drawings to complete houses 26-70 (figs. 46-48). The perspective must be FLC 19879 (published in *Vers une architecture*)³⁰. Given the absence of detailed house plans of the project at this stage, we must assume that FLC 30628a, 19877, 30628b, 19722b, 19866 and 19865, were prepared during

-24 Frugès visited Paris and picked up a number of plans and perspectives, which were too big to send by post (Le Corbusier to Frugès, 17 November 1924, H1-17-129). From the Agenda (F3-3-10, finished on 21 November 1924), we know that Le Corbusier cancelled other appointments on Wednesday and Friday of that week to meet Frugès. This confirms what I take to be a major handover of the first plans for houses 26-70. On 24 November Frugès wrote to say that he had given the plans to Poncet who was going to begin serious work (H1-17-130). -25 By contrast, the plan of the streets and drains and the 'plan de Situation', approved by the Préfecture on 24 November 1926 have been preserved -26 The four plans FLC 19840-3 (and the associated drawings 19908 and 19870) – discussed below – might be thought of as candidates for this submission, but this would be to ignore the consequences of Frugès's intervention in October and the elimination of the *sous-sol surélevé* from the designs, leading to the design of the *Petit Lège* model. There is no evidence of any design by Le Corbusier for Lège or Pessac before this date, which does not have the *sous-sol surélevé*. -27 FLC 30628a, 19877, 30628b, 19722b, 19866 and 19865. Unfortunately, the Fondation Le Corbusier has used the same numbers for a number of different drawings, which I have distinguished with the letters 'a' and 'b'. -28 Le Corbusier to Frugès 17 November 1924, FLC H1-17-129. See below for discussion of da-

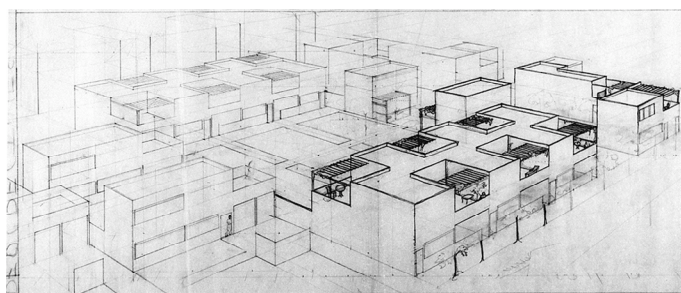
- 40 Site plan of Pessac by Le Corbusier's office, dated 27 vii 1924 (FLC 19856)
 41 Comparison of the layout of blocks on FLC 19856 and 19853, showing pencil changes on 19853 which are incorporated on 19856.
 42 Sector C of the site plan of Pessac, 27 July 1924 (FLC 19856 detail).
 43 Sector C of the site plan of Pessac, November? 1924 (FLC 19855 detail).
 44 Partial plan of sector C published in *Vers une Architecture* (2d edition), December 1924, showing the original documents constituting this plan (FLC 19865, 19866, 19722b).
 45 Bird's eye view showing No3 45-7 (*jumelles*) and the *quinconces* (FLC 19864).
 46 Bird's eye view of the *jumelles* Nos 46-47, *quinconces* Nos 61-66, Nos 55 and 67 and the Zigzag houses, as published in *Vers une Architecture* (2d edition), December 1924 (FLC 19879).
 47 Plan of Zigzag houses 68-70, from FLC 19722b.



46



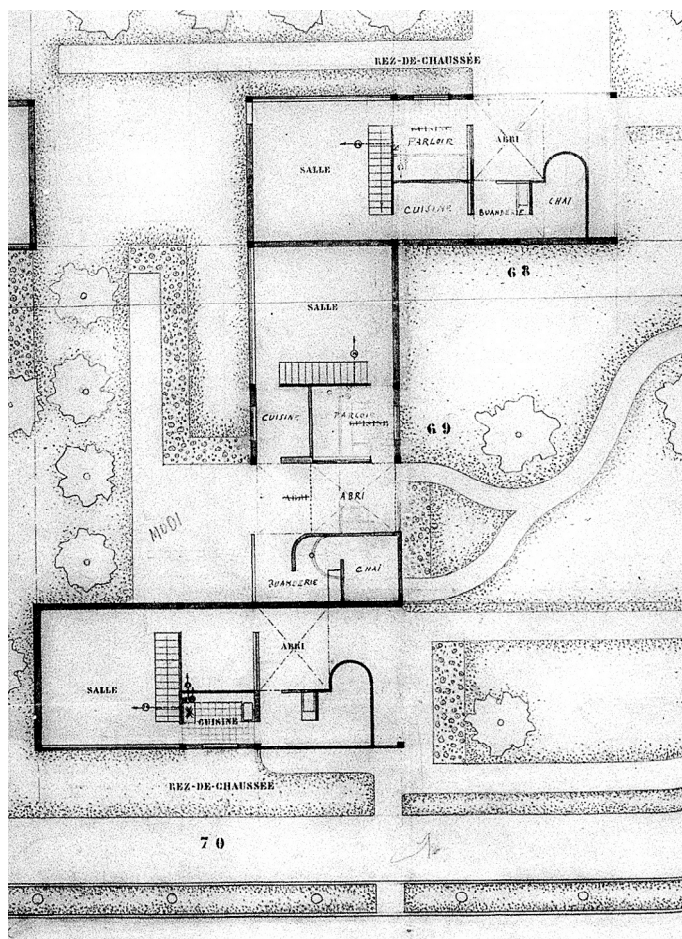
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November and either picked up by Frugès on 19th November or despatched between 24th and soon after 1 December.

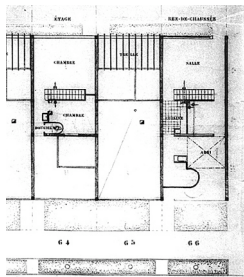
From this meagre evidence, and very little else, we can deduce that the design of the first few houses to be built in Pessac (constructed between December 1924 and May 1925) must date from October to November 1924. This makes sense if we return to the history of Lège, and to Le Corbusier's redesign of the Lège Type A and B houses on a 5m grid. On the two



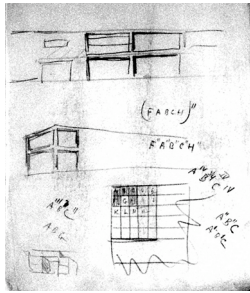
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ting. -29 Le Corbusier's preface for this edition is dated November 1924. He was still working on the illustrations late in November and early December. In his diary he wrote: 'Livre Vers 1 Arch. Affiche coupe voiture Citroen p. Maisons en Serie' (FLC F3-3-11 p. 4). This was the new image heading the chapter 'Maisons en Série' in the second edition. Shortly after, on p.10 Le Corbusier noted 'Photo Frugès perspect Emery triage grand lotissement (?)' (FLC F3-3-11, p. 10). This diary was inscribed by Le Corbusier as beginning on 21 November 1924, so we can assume that this entry must date from the last week of November or the first of December. On 15 January 1925 Le Corbusier received scatter proofs ('premières épreuves') of some of the illustrations added to the second edition. It was in page proof in March 1925 (B2-15-1 letter from Leblanc to Le Corbusier 6/3/1925). Frugès had his copy of the second edition on 3 June 1925 (H1-19-224). -30 These perspectives (including FLC 19994, a preliminary drawing for 19879 and a slightly different view 19864) have the generic windows, which preceded the decision to use the distinctive 2.50m windows manufactured by Decourt in December 1924. We will return to the question of the windows below.

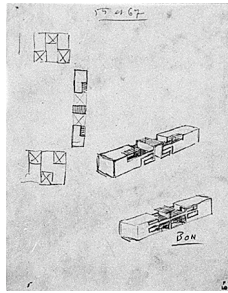
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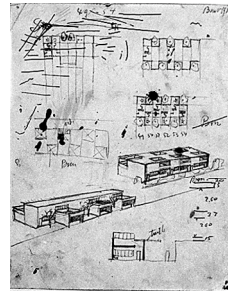
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48 Plan of *quinconces* 65-66, detail from FLC 19866.

49 The *quinconces* as letters of the alphabet, August 1924? (top right sheet from FLC 30522).

50 Sketch of Nos 55 and 67, 13 Nov. 1924 (left hand sheet from FLC 19900).

51 Sketch of *quinconces* arrangements, 13 November 1924 (right hand sheet from FLC 19900).

sheets on the right of FLC 30552, which also includes a sketch (bottom left) of the Type B plan for Lège datable to soon after 7 August 1924 (carrying out corrections indicated on FLC 20800), Le Corbusier plays with a grid of squares, laid out with the letters of the alphabet (ABCDE, FGHIJ, KLMN), from which FABCH are shaded to make a 'U' shaped pattern (fig. 49). Taking this together with a bird's eye view sketch of a terrace of 'L' shaped houses and an elevation sketch showing houses joined by an open balcony/terrace, we might imagine that the 'B' block would be an open balcony, shared between two 'FA' and 'CH' houses (figs. 50-51). On 13 November 1924, two rough sketches on FLC 19900 (fig. 50) toy with the problem of how to make a terrace row of houses interesting. On the left hand sheet are two sketches for Houses 55 and 67, joined by their balconies in a solution which is not taken up later, and two little plans for blocks alternating from front to back. On the right hand sheet, there is a grid, indicating a chequerboard of elements that could be combined in different formations, which can be compared with FLC 30552. We observe a variant with projecting bays on alternate houses and some other variations, of which one is a first solution of the 'maisons à quinconces'. These are numbered unambiguously 49-54. It was these six houses, which were the first to be built, along with the three 'Z' shaped houses 56-58. Houses 55 and 67 went through a large number of variations from November 1924 and June 1925, and the decision to abandon them was only made in October 1925.

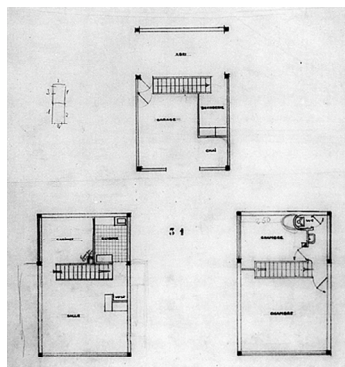
The basis for all these houses was the *Type Petit Lège*. This was transformed into the three storey (plus roof terrace) *gratte-ciel* design on the undated blueprint FLC 19908, which is labelled '31' (one of the *gratteciels*, fig. 52)³¹. Here the *Salle* and kitchen are moved upstairs again, and replaced by a garage and store rooms on the ground floor. On the first floor, separated from the stairs from the *Salle* there is the kitchen and a room with an indeterminate function labelled *cabinet*. The second

floor reproduces the first floor of the *Petit Lège* design precisely, except for the location of the flue from the kitchen range. The *gratteciels* were not among the first houses to be built but I believe they were the first to find their approximate form.

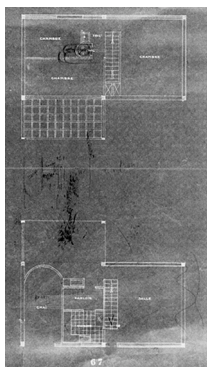
If I am right about this, and about the date of FLC 19908, we can, on stylistic and other grounds associate with it three other plans (and/or their blueprints), drawn and labelled in the same manner and different from all the other plans for Pessac³². FLC 19842 is a plan for the houses 55 and 67 (fig. 53). Here the *Petit Lège* plan is stretched by 2.50m to include a garage at ground level and expanded bedrooms and bathroom above. Like *Petit Lège*, it has a pergola attached on one side³³. FLC 19841 is another blueprint in the same series for the *quinconces* houses. Like the others, it is a blueprint simply drawn and lettered ('62') and has a number of features which disappeared after December: very minimal bathrooms with a combined Turkish WC and shower, no articulation of the windows, no hot air heating (fig. 54). The design takes the *Petit Lège* plan, flips the first floor over, moves the kitchen niche into its own room, next to the *parloir* and then adds a 5 metre bay for *buanderie*, *abri* and *chai*. The *chai* has the bull-nosed plan as in the constructed version, but turned round at right angles (fig. 54). The last of this group is FLC 19870 (and the blueprint 19840), which is for the houses 45, 46 and 47³⁴ (fig. 54). Here the plan expands further. On the ground floor, the staircase is moved outside the 5m bay of the *Salle* into another 5m bay which it shares with the kitchen, *parloir* and *buanderie*. Another 5m bay is given over to garage, *chai* and *abri*. On the first floor, there is room for three bedrooms in the two 5 metre bays on one side, and a terrace on the third bay. This would eventually become the *jumelle* houses 46 and 47.

In plan, the *gratteciels* retain the 8.1 x 5.40m plan (doubled up) of the *Petit Lège* but extended vertically. All the other houses constructed at Pessac took the opposite approach, extending the 1 1/2 Element plan sideways³⁵. A schematic plan,

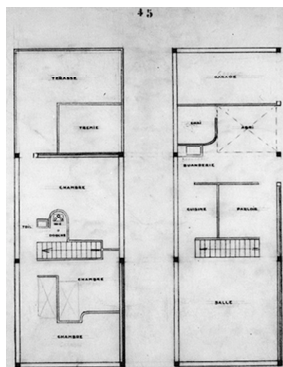
–31 This drawing necessarily precedes the plan of the *gratteciels* 26-33 (FLC 30628b and 19877, which joins on to it), which form part of the group of plans I date to just before 17 November 1924. Compared to FLC 30628b, the stoves are not marked up with the 'bouches d'air' characteristic of the Robur hot air central heating system (see below). Le Corbusier and Frugès were in contact with Odélin-Nettey-Bourdon, the company manufacturing these stoves, from 4 November (H1-19-218), and Frugès had decided to invest in them for all the houses by 24 November (H1-17-130). Furthermore, FLC 19908 does not show the external staircase, which leads from the second storey to the roof (although a pencil line indicates this possibility). This staircase is marked in on FLC 30628b and 19877. –32 FLC 19840-3 are all blueprints, drawn and lettered in the same manner. FLC 19908 and 19870 are original drawings. –33 Associated plans include the sketch by Pierre Jeanneret FLC 19944. A great deal of work went into these houses before they were dropped; the design evolved substantially in the next six months, dropping the rounded end of the garage, rationalising the plan and adding an external staircase to the roof (see FLC 19724 and 19725, March, and a redesign in May and June: FLC 19751, 19749). This was also one of the



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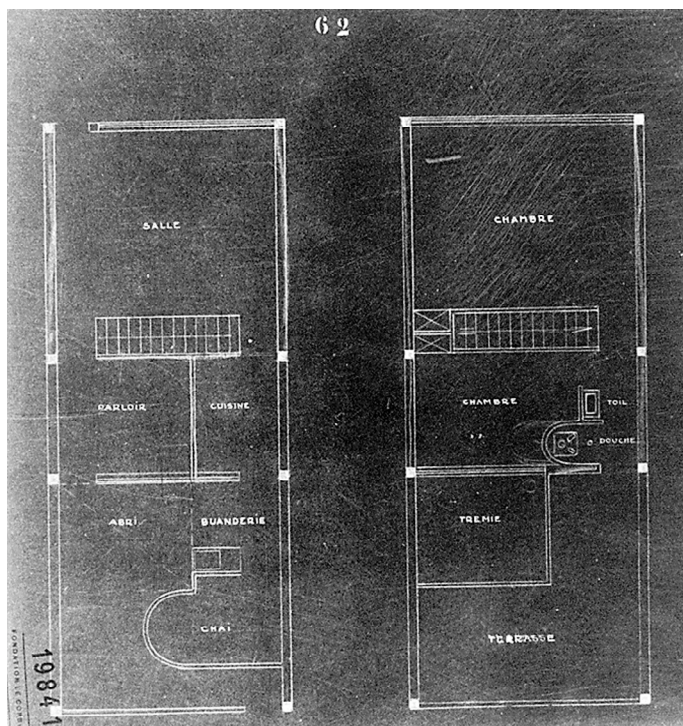
52 Plan of *gratteciel* No 31, October-November 1924 (FLC 19908).

53 Floor plans of No 67 (and 55), October-November 1924 (FLC 19842).

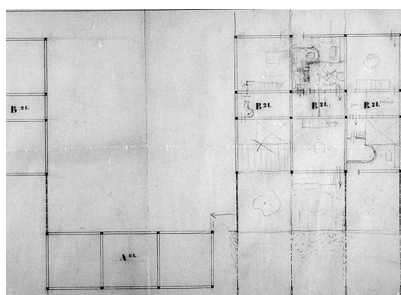
54 Floor plans of preliminary version of No 62 (*quinconce*), October-November 1924 (FLC 19841).

55 Floor plans of House 45 (also 46 and 47), October-November 1924 (FLC 19870).

56 'B2L' (*quinconces* 44 and 49-51) and 'A2L' (*jumelles*, House 46), October-November 1924 (detail from FLC 19878).



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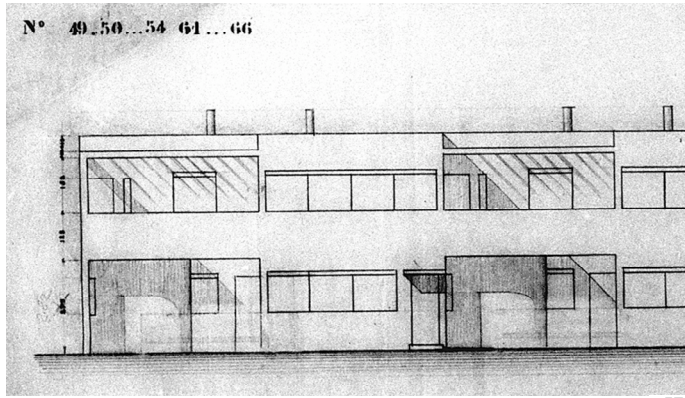
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which is one of the few to use the 'Type' jargon of Lège (FLC 19878) shows the modular structure behind the *quinconces* and houses 45-47 (as shown on the site plan 19855) (fig. 56). In this plan, the 'Type B2L' (2 1/2 Elements) forms the *quinconces* while the A2L (3 Elements) forms the *jumelle* 46 and 47 (as well as 45). The *quinconces* plan creates variety by turning alternate houses round end to end (but keeping the entrances always on the North side), so that every alternate house faces onto the

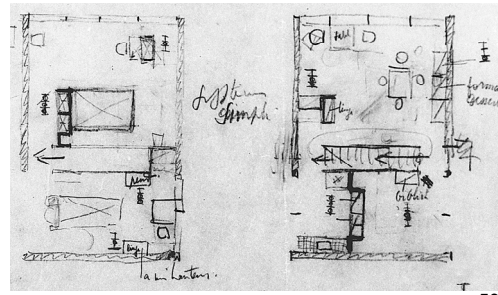
street with its 'rear' front. The 2 1/2 Element plan suited this arrangement, making the central half bay a hinge and spine in the terrace row. Pencil sketches on FLC 19878 indicate the first variant of the *quinconces* scheme. This differs from the finished result in that the *chai* is turned round at right angles (perhaps to make it less obvious when it appears on the street) and has a half-height screening wall (fig. 57). It is this variant, which is drawn up in plan on FLC 19841, in elevation on FLC 19863³⁶ and on the site plans and bird's eye view perspectives published in the second edition of *Vers une architecture*³⁷. The six Zigzag houses were not separately drawn because they replicate the plan of the *quinconces*, with two of the plans being flipped over mirror-fashion.

This concentrated and rushed work, evolving 4 plans from the *Petit Lège* prototype, created many of the problems, which beset the Pessac scheme. Le Corbusier's obsession with open spaces, underneath the houses and on first floor terraces, added enormously to the cost. To an extent, Frugès had contributed to the expense by introducing open terraces and pergolas in his revised Type A1L design. He also encouraged Le Corbusier to provide means of access to the roof³⁸, and Le Corbusier obliged with external staircases for several of the unbuilt designs (as well as the *gratteciels*, the *jumelles* and the

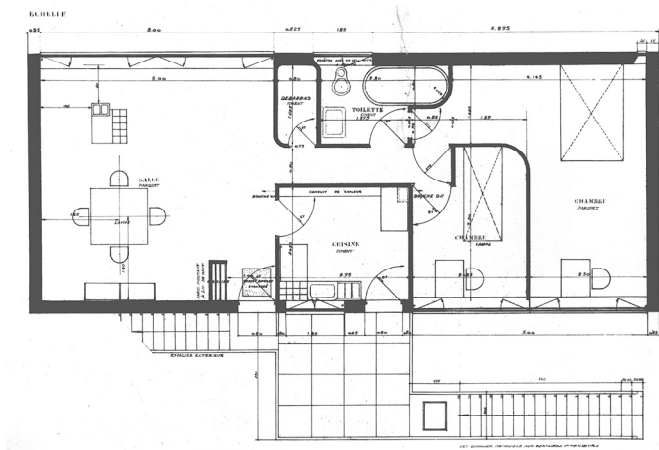
houses where the effect of placing the bulky Stupfel 'fosse septique' cylinder under the WC on the first floor was instrumental in causing changes in the design (see below, and FLC 20018 and 19862). -34 There is a preparatory drawing by Pierre Jeanneret FLC 19998, which shows the first floor in an identical form. Other plans from this stage of the development of Houses 45-7 are FLC 19845 and 19997. -35 All the houses in Pessac are based on 'Elements' of 5 x 5m or 5 x 2.5 m. These measurements are taken inside the wall thicknesses and pilotis, making for external dimensions of 5.40mx 8.10m (1 1/2 E) and so on. -36 There are some differences between FLC 19841 and 19863, for example in the fenestration of the first floor terrace. -37 FLC 19879 and 19865, 19866, 19722b, which make up the plan published in *Vers une architecture*. In this version, the houses are flipped front to back, so that the *chai* points in a different direction when it is at the front compared to the back. -38 On 6 March 1925, Frugès wrote that people liked getting onto the terraces and roofs; where should they place the stairs? (H1-18-7).



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destroyed House 37) which, even if intended to be cast from the same moulds as the internal staircases, created considerable additional expense in the structure and caused innumerable difficulties with expansion and leaks. The modular plan created spaces for which functions were never really defined. The classic case is that of the parloir/cabinet. This space shared the bay next to the *Salle* in many designs. When this occurred on the ground floor, the space was called a 'parloir' and provided a separate entrance and access to the *Salle* from the one through the kitchen. When, on the other hand, the kitchen and *Salle* were located on the first floor (as in the *gratteciels* and House 14), a new function had to be thought up for it (figs. 58-59). In the generous plan of House 14, the space opposite the kitchen was

given over to a bathroom, with a corridor to the two bedrooms. In the *gratteciels*, the parlour was renamed 'Cabinet' and became a redundant cul de sac half-enclosed by the staircase. On an interesting sketch by Le Corbusier showing alternative options for the plan, the *cabinet* space has a *bibliothèque* in it, revealing his penchant for libraries (figs. 60-61). Another notorious case were the semi-circular 'chais', which in their architecturally significant role as façade features marked one of the breakthroughs in the Pessac design, were nevertheless little more than dark broom-cupboards inside. Many tenants introduced little windows or demolished parts of the walls of these structures to make them more useful.

DEVELOPING THE STANDARD TYPES AT PESSAC

In fact, the design work on the Zigzag houses and the *Quinconces* continued until April 1925, while the houses were actually being built³⁹. Design work was also being put into a number of other houses, which were not in the event constructed, for example houses 67 and 55 and Houses 37, 38, 39 and 45, in various combinations. A large number of rather vague elevations studies and sketches for plans exist from this period. A snapshot of an intermediary stage of this development can be seen from a series of large plans and some perspectives, two of which were published in the second edition of *Vers une architecture* (see FLC 19864 and 19879, figs. 45 and 46).

As we have seen, Le Corbusier's Preface to this edition was dated November 1924 and at any rate, the book was with the publishers before January 1925⁴⁰. There is other evidence to suggest that these drawings must date from around November

–39 On 2 February, the raised concrete bases for houses 47 and 48, the Zigzag houses (56-8 and 68-70) and two groups of *quinconces* houses (49-54 and 61-66), H1-18-24. The shuttering for the Zigzag houses 56-8 was to be completed that evening. Frugès urgently wanted elevations for these houses, since they would be the first to be built. He claimed he was about to begin the *gratteciels* 26-35 (although in the end 35-5 was not built, see below). On 21 February, Frugès wrote requiring corrected plans and sections of the Zigzag houses, because he wanted to make models of them, which suggests that they had not progressed very far in the three weeks since the 2d. By 1 April, the *ossatures* for houses 56-8 were complete and that of the *quinconces* 49-54 complete up to the first floor (H1-19-234). Revised plans and details for these houses were sent off on 4 April (H1-17-138). –40 See Note 29 above, for the dating of the work of preparation for this edition. –41 «...contraires à toutes les règles et constituent un état de choses absolument menaçant et dangereux», H1-18-107. –42 The engineer Elie Guénu of 50, rue Philippe de Girard, visited Le Corbusier with his report on 1 May 1925 (H1-18-126). Guénu had made a 'deplorable' impression on Le Corbusier. Guénu's written report (dated the following day) was delivered to Frugès on 4 May (H1-18-134) and to Le Corbusier on 12th (H1-18-191). It was critical of aspects of the construction, pointing out that some of the beams had flexed excessively, there was insufficient reinforcement and some of the walls were not straight. But he was of the opinion that the calculations were sound and that the defects could be easily repaired (H1-18-10). Summer claimed that Poncet's concrete sections and steel reinforcement was seven times lighter than the ministerial recommendations (the Ministerial circular dated from 1908!) (H1-18-132). –43 One suggestion was that Summer's team should concentrate only on the *quinconces* 61-66 and a comparison of costs and quality be made before committing further. On 4 May Frugès commissioned a second opinion from a M. Rodin, engineer of the Ponts et Chaussées



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57 Elevation of preliminary version of *quinconces* houses, October–November 1924 (detail from FLC 19863).

58 First floor plan of House 14 (Vrinat), showing arrangement of kitchen and bathroom, 20 January 1926 (FLC 19803b).

59 Le Corbusier, Sketch plans of first and second floors of *gratteciels* (detail from FLC 19928).

60 *Cabinet* in the *gratteciel* No 32 (Musée Le Corbusier) viewed from the staircase.

61 View from the *Cabinet* towards the *Salle* in *gratteciel* No 32.

1924. We will see later that it was in November that Pierre drew up a series of specifications for standard windows, which he put out to tender with a number of firms. The 2.50m version of these standard windows had a distinctive form, with a central fixed pane flanked by two opening panes. Drawings featuring these windows can safely be dated after November 1924, and the many designs, that show different windows are probably previous to this date. The bird's eye view perspectives associated with the plan and perspective published in *Vers une architecture* do not have the standard Pessac window form.

These views present evidence, characteristic of Le Corbusier's practice, of rushing through the creation of presentation drawings before the designs have been completed. The 'maisons à quinconces' are represented with different treatments of their 'second' front, with a half-height screening wall and the chair turned round so as to disguise its rounded front. Similarly, the Zigzag houses were also represented with their 'chais' turned round. In fact, we know that the first three Zigzag houses were actually built with their *chais* in this form and had to be changed later.

The design activity of October to November 1924 is one of the engine rooms for the construction of Le Corbusier's architectural language. To grasp what was at stake here involves an analysis encompassing all the design projects in the atelier at this time, and cannot be attempted here. What is important to understand here is that the rich and varied effects achieved at Pessac, at the expense of the compactness of the *Petit Lège* design was on the one hand a veritable game of dominos with the standard plan (the metaphor used by Le Corbusier) allied to the creation of new design elements (such as the rounded *chais*,

the cantilevered external staircases and the concrete pergolas).

THE BUILDING OF PESSAC

The subsequent building history of Pessac is a long and tortuous story. The main highlight was a spectacular rupture between Le Corbusier and Frugès's engineer M. Poncet, following Le Corbusier's visit to the sites of Lège and Pessac on 7 April 1925. When Le Corbusier saw the workmanship on the Lège houses and the first Pessac houses in construction, he demanded that his trusted builder Georges Summer be called in. Describing Poncet's work as 'contrary to sound practice and constituting an extremely precarious and dangerous situation'⁴¹. He proposed that all work should be halted immediately and professional advice obtained from a qualified engineer. When this report appeared to partially exonerate Poncet, Le Corbusier furiously denounced him as a 'friend' of Poncet and therefore unreliable⁴². Accusations flew back and forth while Frugès tried to find a compromise, but eventually, Summer's team was installed, at great expense⁴³. In May 1925, they began serious work on the completion of the estate. Frugès was obliged to employ a foreman and eight skilled craftsmen from Georges Summer's Parisian firm, whose wages and expenses he had to meet for the next eight months⁴⁴.

With Summer's team came an experienced and well-disciplined crew who, as Le Corbusier never tired of pointing out to Frugès, 'saved' Pessac. But out went any pretence at industrialised building methods. The cement gun was banished to make garden walls and some of the rounded *chais* in the 'maisons à quinconces'. All the visible house walls were made of breeze

(H1-18-135). This report seemed to confirm Summer's calculations rather than those of Poncet and Guénu. On 15 May Poncet visited the rue de Sèvres and met Le Corbusier and Summer. Le Corbusier's conclusion was that 'il n'y a rien à sortir d'utile entre nous et lui'. Summer opined that he was not prepared to send a team to Bordeaux if the attitude he saw in Poncet persisted. Poncet retorted that if Summer's team arrived, he would leave (Le Corbusier to Frugès, 15 May 1925 H1-18-193). According to Le Corbusier, Poncet was finally shown up in tests made on Friday 19 June, which Le Corbusier referred to as « preuves écrasantes ». He was only sorry that Frugès hadn't 'étayé le plancher essayé au dessous de 50 cm; l'éroulement de la construction se serait opéré » (Le Corbusier to Frugès, 22 June 1924 H1-18-193). When the staircase of house 56, constructed by Poncet, was stripped of its shuttering, it collapsed (Frugès to Le Corbusier 1 September 1925 H1-18-32). Summer's team had arrived on 27 May but the foreman Jean Perrucchionni took to his bed sick for ten days (Frugès to Le Corbusier, 28 May 1925, H1-18-143). —⁴⁴ Jean Perrucchionni the foreman was paid 1,600 frs per month, was given free accommodation, the construction of a canteen and refectory, and Summer was given a fee of 30,000 francs for the use of his patent PIMA flooring system (on the basis of 1.50frs per m²) (FLC H1-18-114, Summer letter of agreement with Frugès, 22/4/1925). A factory had to be set up to manufacture the precast beams and the breeze-block bricks Summer used in his system. Summer built most of the villas in Paris for Le Corbusier in the 1920s (La Roche-Jeanneret, Cook, Stein-de Monzie, Church as well as the Esprit Nouveau Pavilion and the de Beistegui apartment, see Tim Benton, *The Villas of Le Corbusier*, London and New Haven 1987, p. 220).

62 *Gratteciels* in construction in February 1926 using Summer's patented PIMA system and with walls of breeze blocks manufactured on site. (FLC L2-15-46 detail).

63 Georges Summer's plan showing the addition of four *pilotis* and four beams, to reinforce the *quinconces* houses 49-54, May 1925 (FLC 19875).

64 View of the *Salle* of the *quinconce* No 54, in 1999, showing the two vertical supports added by Summer in May 1925.

65 Type A house, Lège, showing Poncet's *voutains* supporting the terrace.

66 Photo of building site in February 1926, taken from one of the *gratteciels*, showing the *quinconces* 40-44 and 49-54 on the left and House 47 and the *quinconces* 61-66 on the right, March 1926 (FLC L2-15-42).

blocks manufactured on the site and cement rendered by Summer's men by hand ('à la taloche'), in order to give that high precision, machine-made look which Le Corbusier required. Summer's patented P.I.M.A. system of floor slabs provided strength and simplicity of construction, without the need for expensive and complicated shuttering⁴⁵ (fig. 62). Summer prepared drawings for reinforcing the houses Poncet had constructed (56-8 and 49-54), adding slim *pilotis* (10cm square) carrying reinforcing beams buried in the slab and hiding Poncet's *voutains* (the system of precast shallow vaults onto which gunnite was sprayed)⁴⁶ (figs. 63-64). Poncet's *voutains* floor slabs can be seen at Lège and in the exposed soffits of the terraces in the first nine houses to be constructed at Pessac (fig. 65).

Work proceeded on the Zigzag houses and *maisons à quinconces* through 1925⁴⁷, with the first *gratteciels* (Nos 26-33) apparently begun in December⁴⁸, the Arcades houses a little later⁴⁹, along with the 'maisons jumelles' (Nos 46 and 47)⁵⁰. On 27 October 1925 Frugès wrote that unless the plans for the Arcade houses 1-7, Nos 37, 39 46 and 47 did not arrive soon, the workmen would be left 'bras croisés', which suggests that building work on the *quinconces* 61-6 was nearly complete⁵¹ (figs. 66-67). A snapshot of the site in March 1926 can be seen from a series of photographs taken by a M. Le Maillot⁵². One of these was published in *Almanach d'Architecture Moderne* (p.114). These show all the *quinconces* and the Zigzag houses complete, with the windows and shutters mostly installed, and the first of the *gratteciels* complete to the roof terraces. Nos 46 and 47 were in a more incomplete state and the first four Arcade houses still emerging from their shuttering. The walls are clear-

ly shown as made of breeze block (e.g. *gratteciel*) or brick (e.g. terrace walls of houses 46 and 47). Railway lines for distributing materials and many huts required for manufacturing the bricks and storing components can also be seen.

House No 14, often referred to as the maison Vrinat (after one of Frugès's employees who later inhabited it) was designed at the beginning of 1926 and completed by May⁵³ as was House 37⁵⁴. Unbuilt in May 1926 were No 39 (similar to No 14) and No 48 (similar to 37). Although these were later suppressed, Henri Frugès included them in his model of the estate (on view in the Musée Le Corbusier in *gratteciel* and they seem to be an accepted part of the overall composition.

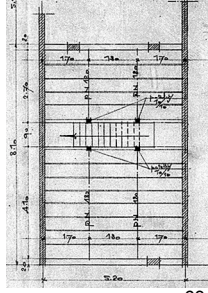
Meanwhile, other cuts were being made in the plan agreed in October 1924 (FLC 19855). As late as 1 September 1925, Le Corbusier was being asked for plans of houses 55 and 67, 39 and 45, and it seems that the status quo of FLC 19855 was still then in place. But on 1 October Frugès sent Le Corbusier three very critical expert reports commissioned by the Municipality⁵⁵.

Frugès noted that the North most *gratteciel* was found to conflict with the pavement of the *route vicinale*, and he suggested that this *gratteciel* be suppressed (eventually to be replaced by House No 35, which is a copy of the Zigzag houses)⁵⁶. He suggested cutting houses 55 and 67, taking into account the *agent voyeur's* views about density. These changes can be seen on plans FLC 19905a and 19905b (copies of FLC 19855 marked up with hand written corrections), including a suggestion of moving the road from the rue des Arcades away from the boundary, so that it came out between 21-2 and 23-4 (fig. 68). On FLC 19905b, 22-3 and 21-2 are displaced to make room for this road, but eventually, the four *gratteciels* (Nos 17-24) would

-45 Summer's plans for the shuttering of several houses exist, e.g. FLC 30973, of the second batch of *quinconces* houses to be built (61-66). -46 FLC 19875, 19849, 30968 are Summer's drawings for repairs to the *quinconces*. FLC 30967 (Summer's number 318 No 9) is the plan for the repair of the three Zigzag houses. Ironically, the only FLC drawing to show Poncet's system of 'voutains' is Summer's 318 No 8 (FLC 30968). -47 By 4 July, the first of the *quinconces* houses (49-54) were still being repaired and altered (the *chais* turned round), the second group of *quinconces* (4-44) had their walls in place and some beams in place. A start had been made on the third set, houses 61-6. By 1 September, the shuttering for the Zigzag houses had only just been removed (causing the staircase cast by Poncet to collapse), while the *quinconces* had made better progress: 61-6 (begun by Summer in June): walls being plastered and the exterior rendering done, the Stupfel 'fosse septique' being installed and the roof asphalted; 40-44 (the third batch, begun by Summer): the windows being installed and rendering 'à la taloche', 49-50 (begun in February by Poncet): repairs done to Poncet's floor slabs and the terraces cast. The brick factory installed and ready to go, producing 3,500 breeze block bricks. (Frugès to Le Corbusier, 1 September 1925, H1-18-32). -48 There are dated plans of the *gratteciels* in July 1925 (FLC 19755 and 19757-60, 29 July 1925), with details in October (FLC 19874-6). On September 1 Frugès was asking for drawings of the *gratteciels* 17-35. Progress on 34-5 cannot have been extensive by November, since Blocks 15-22 were re-sited after November 1925 and Block 23-4 eliminated in 1926. -49 One dated design exists (FLC 19787, 30 October 1925). The houses are shown in construction, working down from No 1 rue des Arcades, in a photograph probably taken in February 1926 (FLC L2-15-51). -50 A first set of designs for houses 46 and 47, as well as an identical house 45 dated



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from March 1925 (FLC 19732-3, 12-13 March 1924), but the version constructed was not designed until October and November (see FLC 30632 12 October 1925, on which the suppression of No 45 is noted; also FLC 19783 and other associated drawings). Summer's construction drawings date from 10 November and 1 December 1925. **-51** H1-17-142. **-52** Frugès sent Le Corbusier a set of photographs by a M. Le Maillot on 5 February 1926 (H1-20-172). These were needed for an article Le Corbusier was to write for the *Sud-Ouest Economique* (H1-20-71). I presume that the photographs in the FLC Phototèque with wintery trees must be from this group. Frugès had some photographs taken by a 'professional photographer' in March 1925, but there is no sign of these among the documents at the Fondation Le Corbusier (H1-17-137 and H1-20-32). **-53** The drawings date from 20-30 January 1926 (FLC 19803, 19813, 19809, 19814). **-54** The drawings date from 28-9 January 1926 (FLC 19800, 19811, 19799, 19812). This house was bombed in the war and has been replaced by a different building in a vernacular style. **-55** There were three reports from the *Agent Voyeur* of the Prefecture de la Gironde, by M. Bouny (1 September 1925), M. Ballan (4 September) and M. Lefebvre (12 September) (Pessac Mairie, doc.104 3, and FLC H1-17-139). Bouny's report, as well as criticising the plan and the state of the roads, insisted on the widening of the road between *gratteciels* 24 and 25, and noted: « D'une façon générale, les terrains occupés par les constructions paraissent présenter une surface trop importante par rapport à l'ensemble du lotissement, surtout si l'on considère que le Quartier Fruges se trouve à 8 kilomètres du centre de Bordeaux ». M. Ballan backed this up, also noting that it was regrettable to build a 'cité ouvrière' with lots of 80-100m², when it would be expected, on this location, to provide much bigger gardens. **-56** Frugès to Le Corbusier, 1 October 1925, H1-17-140.

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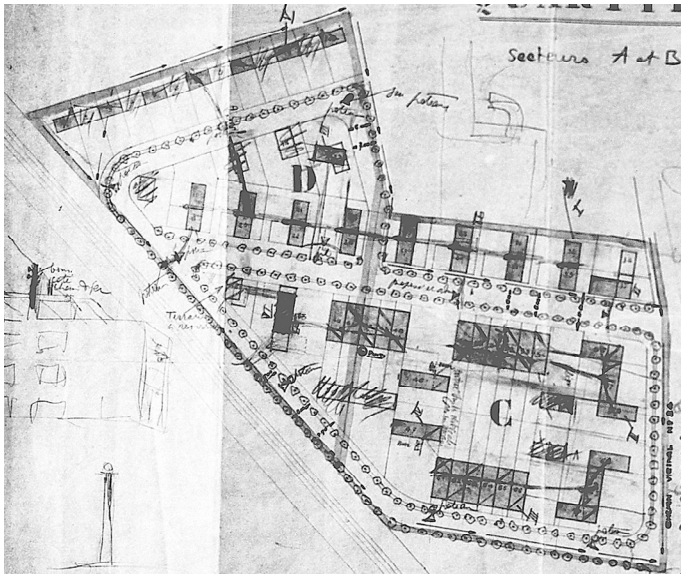
67 Photo of building site, with House 47, showing quinconce House 61 in background, March 1926 (FLC L2-15-39).

68 Detail of site plan, based on FLC 19855, marked up to show changes prompted by the *agent voyeur's* report, October 1925 (detail from FLC 19905a).

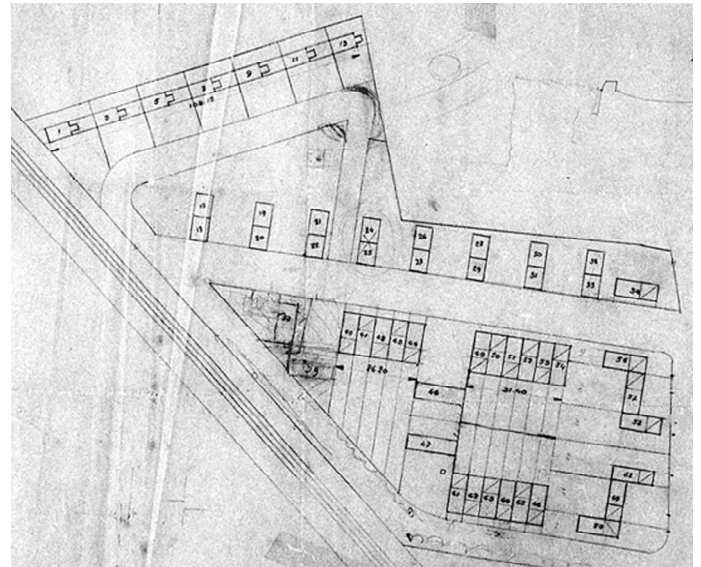
69 Revised site plan of Pessac, 24 November 1925 (detail from FLC 19792).

70 Pessac on June 13 1926, during the visit of Anatole de Monzie, showing the Zigzag houses 68-70 (FLC L2-15-92).

71 Pessac in June 1926, showing House 37 in the foreground (destroyed in the war) and the *gratteciels* 15-16 and 17-18 in the background (FLC L2-15-68).



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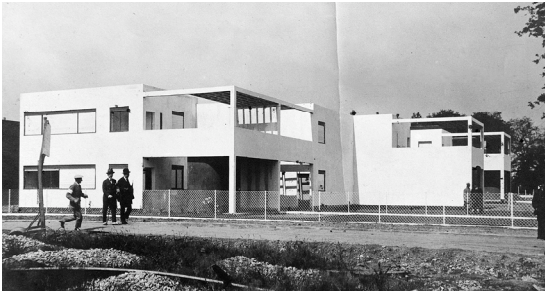
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be moved to the South, with one placed on the other side of the road next to the railway. Paradoxically, the road linking the rue des Arcades to the rue Le Corbusier – the cause of these problems – was eventually replaced by a path, but the *gratteciels* had already been built, leaving an unsightly and unexplained gap. Later, Le Corbusier made the best of this gap as a frame for his house No 14 (see perspective FLC 19859).

On FLC 19905a and 19905b a number of other changes are

proposed, most of them confirmed on two dated site plans FLC 19788a (12 November 1925) and FLC 19792 (24 November 1925)⁵⁷ (fig. 69). The 13 Arcade houses were reduced to 7, with an open vaulted space in between every other house⁵⁸. The three houses 14, 15 and 23, forming a group on the other side of the rue des Arcades, were scrapped and the first thoughts for No 14 sketched in. The small houses No 16 and No 36 were also abandoned and the Zigzag double house 37 and 38 replaced by

–57 FLC 19878a and 19792 do not incorporate No 14 (apart from some rubbed out traces) but there is a first indication of the final solution for No 37 and 39. No 48 is not yet located on the plan. –58 On 23 October 1925, Frugès asks for the plans of the revised Arcade houses (1-7). On the 30th, an elevation drawing of the fronts and backs of the houses was duly sent off, similar to the definitive scheme but with a straight rather than curved vault joining the houses (FLC 19787). –59 On FLC 19905b, the following houses in sectors A and B were marked for suppression: 71, 78, 85, 81, 89, 93, 101, 107, 114, 119, 121, 123 and a line drawn at the houses 95 and 125, separating the *immeuble portique* and the eight adjacent houses from the rest. On FLC 19792, these changes were all confirmed, and the plan breaks off before houses 95 and 125. –60 P. Boudon, *Le Corbusier et Pessac*, cit., p. 63. See also P. Boudon, 'Le Corbusier à Pessac', cit. Boudon also cited an article in *Le Nouveau Siècle* by Le Corbusier's friend Pierre Winter, one of the circle around the French Fascist movement, pp. 22-6 (also in the FLC H1-20-70). –61 In 'Un standart (sic) ne résout pas un problème d'architecture', *Almanach d'Architecture Moderne*, cit, p. 114-5. –62 On 16 February 1931, however, Le Corbusier wrote to Frugès declaring that 'Pessac vit, et la victoire est à nous' (FLC H1-17-92). –63 On 15 November 1928, Frugès reckoned his overall costs (using the formula of the Loi Loucheur) at 5,483,734 frs, adding that even at this figure he would not cover his costs (H1-17-282). This would have made the value of each house between 87,000 frs and 127,000 (H1-17-257), whereas Frugès was unable to sell them even at 20,000 frs. Discussion of Frugès's costs were complicated by wrangles about the architects' fees. Le Corbusier and Frugès agreed rather lower costs in calculating fees, at between 2.4 and 2.6 million frs (H1-17-252-4 and H1-17-256 (28/3/1929)) with the cost of each house (including land) coming out at between 56,600 frs and 74,500 frs. –64 A succession of Pessac Mayors conspired to obstruct the approval of the 'dossier' incorporating the suburb into the municipal roads and sewers system, which in turn led to the water company refusing to provide a supply without charge, against future water rates. As a result, Frugès



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House 37. Thus Sectors C and D shank from an original 70 houses to 54 houses. Later, the suppressed double house 39 and 45 would be replaced by the single house 48, turned round to align with the quinconces and making the 53 houses which was the definitive plan for Sectors C and D (although 48 and 39 were not in the end built). A similar process of pruning was going on in sectors A and B, removing 28 houses in the course of November 1925⁵⁹. The design of Sectors A and B is a story to be told elsewhere.

When, on June 13 1926, Anatole de Monzie arrived for the inauguration of Pessac, with his private carriage full of invited guests, the completed houses had been spruced up and painted in Purist colours (*figs 70-71*). The material history of Pessac, however, had barely begun. For the next ten years, interminable wrangles with the Mairie prevented the estate from having any running water or drains, or obtaining permission for street paving and lighting. By July 1928, not a single house had been sold, with only four occupied for rental, despite the employment of an expensive Parisian firm of estate agents and a continual dropping of the asking price. This agonising and well documented saga is another story.

PART 2: HOUSING AND ARCHITECTURE

THE FAILURE OF LÈGE AND PESSAC

The word most commonly used to describe Pessac is 'failure'. Philippe Boudon addressed the question of the 'failure of

Pessac' directly, giving this as a sub-heading of his fifth chapter and associating it with a statement by one of his interviewees likening architects to fascists because 'they impose their will on others'⁶⁰. Le Corbusier himself used the word '*faillite*'⁶¹, and almost every commentator and historian has agreed⁶². In almost every material sense Pessac was a disaster, running spectacularly over budget and contributing to the bankruptcy of its patron⁶³, stimulating powerful opposition from local architects and politicians⁶⁴, failing in all the usual technical ways (drains, windows, terraces, roofs), failing to attract buyers or tenants at the intended prices and rents and later failing even to attract the close scrutiny from scholars which it deserves. But, as Boudon pointed out, the fact that the owners of the Pessac houses went on to make substantial individualistic changes to their houses itself demonstrates the flexibility of the plans and construction. And Maurice Besset (himself the author of many books on Le Corbusier) wrote to Boudon suggesting that Le Corbusier was delighted with the changes the owners had made⁶⁵.

In 1972 Brian Brace Taylor published two slim booklets on Le Corbusier's early housing projects in Paris, based on a first survey of the drawings and documents in the Fondation Le Boudon which helped to correct some of the mistakes in Boudon's book, without directly confronting the arguments in it⁶⁶. Recently, a team of architects and a historian has published a booklet in the series of guidebooks published by the Fondation Le Corbusier⁶⁷. Neither of these publications drew out the significant role Pessac played in the development of Le Corbusier's architectural style and theory.

had to pay a bill of 100,000 frs for the connection (H1-19-260, 25 February 1927). —**65** Besset quoted Le Corbusier as saying, « Ce qu'ils ont fait, c'est épatant ». In a letter to Boudon of 28 September 1966, Besset tells the story of showing Le Corbusier an article by a young architect about Pessac including photos of changes and Le Corbusier saying: « Vous savez, c'est toujours la vie qui a raison, l'architecte qui a tort ». When the question of classification came up, Le Corbusier insisted that it should be in its current condition and that the 'usagers' should not be obliged to convert the houses to their original state. See P. Boudon, *Le Corbusier's Pessac Revisited*, Cambridge 1972. But he also said: « Quand même, ça ne tient pas mal le coup' (FLC H1-20-137). And when Le Corbusier visited Pessac in June 1931, he wrote a furious letter to M. Vrinat, who lived in No 14, pronouncing himself horrified at how Vrinat's house looked and at the state of Pessac 'qui a pris l'allure de l'architecture la plus goujeate des villes d'eau en pseudo moderne ». Vrinat had allowed the owners to fill in under the vaults of the Arcades, 'et peindre de glycines les quinconces. C'est une horreur véritable et une façon de Tarasconnade bien peu séduisante' (Le Corbusier to Vrinat, 16 June 1931 H1-20-120). —**66** B. B. Taylor, *op. cit.* The drawings illustrated in volume 2 were as yet uncatalogued and unnumbered, as were the documents. Taylor nevertheless offers the only competent history of the project, contextualised in the history of Le Corbusier's early housing projects. —**67** M. Ferrand, J. -P. Feugas, B. Le Roy, J. -L. Veyret, *Le Corbusier: Les Quartiers Modernes Frugès/The Quartiers Modernes Frugès*, cit. This bilingual booklet has some reasonable descriptions of the buildings, some good modern photographs of Lège and Pessac and a useful account of the Bordelais context, as well as an account of the restoration of both projects (explained in greater depth in their report *Pessac Le Corbusier Sauvegarde et réhabilitation des Quartiers Modernes Frugès*, Paris 1985). The authors have made no attempt to deepen an understanding of the history of the project or its meanings.

The estate at Pessac today presents fascinating contrasts of decay and conservation, of adaptation to satisfy owners' needs and tastes (flexibility or vandalism?) or upholding of the architect's vision (keeping the faith or sterile formalism?). Lège offers a different image, that of an artificially restored original. And yet the six houses restored and modernised to provide holiday homes form a stark contrast with the refectory left in an almost unrecognisable state.

It is impossible to visit either site without engaging in the polemics of Modernism. Is it a success because Le Corbusier's Modernist vision is now finally being vindicated? Or is it more successful as a demonstration of the ability of Modernism to respond flexibly to popular taste and individual needs? Was it a victory for standardisation or for individualisation?

For Le Corbusier, high points in the 'success' of the project were its well publicised inauguration by the Minister for Public Works Anatole de Monzie on 13 June 1926⁶⁸, publication in the lavishly illustrated journal *L'Architecture Vivante* (autumn 1927) edited by his friend Jean Badovici and the more hurried visit of the Minister of Housing Louis Loucheur in February 1929⁶⁹. On 14 May 1926 he was able to tell his mother 'Bordeaux-Pessac est un poème méditerranéen, une éclosion athénienne'⁷⁰. A journalist describing the visit of Anatole de Monzie, Minister of Public Works, to the Pessac site on 13 June 1926, began his piece as follows:

Il était une fois un architecte féru d'idées neuves, nourri à la substantifique moelle du cubisme, et professant cet axiome moderne, en matière d'architecture, tout au moins 'le sentiment arrête le progrès'. Le Corbusier élaborait donc un projet fort intéressant de constructions nouvelles privé de sentiment mais adapté au tempérament humain du moment, et susceptible de satisfaire les grands renouvelés de la clien-

tèle moderne'. En ces temps de 'struggle for life' (sic) exaspéré, le 'home' se devait de prendre une allure bien spéciale.⁷¹

By 1926, other more impressive modern housing schemes in Holland, Belgium and Germany had been published in the international architectural press, and Le Corbusier's interest in Pessac rapidly waned⁷². In fact 1926 was Le Corbusier's *annus mirabilis*: on 26 January the 13 large drawings for the Palais des Nations were despatched, by July he had private clients coming to see him 'every day'⁷³. The designs for Meyer, Cook and Stein de Monzie show the full flowering of Le Corbusier's style, a long way removed from the beginning of the Lège-Pessac designs in December 1923.

Between them, Lège and Pessac present formidable problems for the researcher. Over 450 drawings survive (few of them dated) and over 775 documents in the Fondation Le Corbusier, as well as some plans and several hundred documents in the Archive of the Pessac Town Hall. Much more work remains to be done on this fascinating project which significantly changed Le Corbusier's approach to housing and to architecture. I propose to contextualise some themes that turn out to be critical to the undertaking.

THE STANDARD: CHANGING MENTALITIES

Within the ideological framework of the modern movement, a dominant idea was that architecture should contribute to the radical reform of society and that indeed the task of architecture was properly defined by this agenda. Le Corbusier appeared to declare his interests categorically in the chapter 'Architecture ou Révolution' in *Vers une architecture*⁷⁴. And he was aware that the reform of housing could only be achieved by changing atti-

–68 Well reported in the national press (eg *L'Intransigeant*, 25 June 1926, FLC H1-20-75) and the local press, eg *Sud-Ouest Economique*, 23 June 1926 (FLC H1-20-17). –69 By this time, Henri Frugès was nearly bankrupt and was in a clinic suffering from a breakdown. His wife had organised things for Loucheur's visit to Bordeaux, but the Minister had only spent a few minutes in Pessac (FLC H1-17-230, 'mardi gras' 1929). –70 FLC R1 06-123. –71 'Max G', Press cutting, c. 14/6/1926 (H1-20-14). –72 For example, J. J. P. Oud's estates in Rotterdam, the work of Ernst May's architects in Frankfurt and the many Siedlungen in Berlin had all been successfully launched and publicised before a single paying customer bought or rented a house in Pessac. –73 « Quant à moi, c'est maintenant la cour du roi. C'est bientôt un client par jour et de partout. 1 pour Allemagne, 1 pour Buenos Ayres, 1 pour le Brésil, 1 qui revient des Etats Unis Bergerac, un Hongrois, etc. Polignac, Stein, Cook, Planeix, Anvers, marchent actuellement. De Monzie, qui va peut-être être ministre la semaine prochaine désire me voir samedi prochain pour des projets à lui'. Letter to his mother, 20 July 1926, FLC R1-06-130. –74 Le Corbusier, *Vers une architecture*, 2d edition, Crès, Paris 1925, p. 225ff. –75 « L'architecture a pour premier devoir, dans une époque de renouvellement, d'opérer la révision des valeurs, la révision des éléments constitutifs de la maison... Il faut créer l'état d'esprit de la série, L'état d'esprit de construire des maisons en série, L'état d'esprit d'habiter des maisons en série, L'état d'esprit de concevoir des maisons en série (Le Corbusier, *Vers une architecture*, cit., p.

tudes:

The first duty of architecture, in a period of renewal, is to bring about a change of values, a revision of the components of the house...

We must create a spirit of mass production.

The spirit of building mass produced houses.

The spirit of living in mass produced houses.

The spirit of designing mass produced houses.⁷⁵

Modern industrial techniques such as standardisation seemed to offer the key to modern architecture. In fact, Le Corbusier believed that industrialisation and standardisation would create the modern style:

Bit by bit, building sites will become industrialised; the introduction of machines into building will lead to the development of 'type-elements'; even the plan of the dwelling will be transformed and a new economy will take over; the 'type-elements' will deliver unity of detail, and unity of detail is an indispensable condition of architectural beauty. Cities will lose that chaotic aspect, which makes them whither today. Order will be the rule and the layout of new roads, wider and richer in architectural possibilities, will offer our eyes some magnificent views.⁷⁶

The requirements of industrialised building would not only determine new kinds of living based on standardised housing elements, they would generate the language of modern architecture, in the poetic, stylistic sense.

Thanks to the machine, thanks to the type, thanks to selection, thanks to the standard, a style will emerge. Once again, that order, which the poet seeks behind him, in past eras, will reassert itself today. Let the poet look to his front. Holding in his hand a polished steel sphere, symbol of a now realisable perfection, let him call for order, let him transpose his desire

for harmony into the new order of things. New relationships will be established: the style of our age.⁷⁷

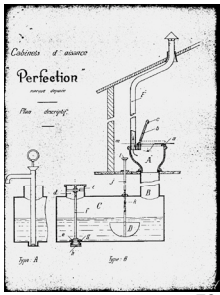
And this is the real story of Lège and Pessac; in parallel with a narrative of housing within strict economic constraints is the narrative of an evolving style, a style in which the aesthetic emerged from the grappling with the discipline of standardisation.

STANDARDISATION AT LÈGE AND PESSAC

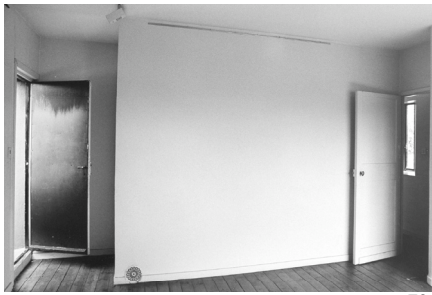
It is of course true that most of Le Corbusier's designs of the 1920s were for individual clients. These villas were made by hand and, in the event, so were the 51 houses at Pessac. But he had been toying with different ways of introducing industrial methods into architecture since the Dom-ino project of 1915-77⁸. By 1923-4, he was beginning to experiment seriously with standard fittings (especially windows and doors) and industrial methods of construction⁷⁹. And in Pessac and the Esprit Nouveau Pavilion, these experiments were taken further. At Pessac, he used standard, prefabricated metal windows, standard roller blinds, standard doors, standard staircases inside and out, standard fittings (window and door handles, locks, etc), an innovative chemical septic tank (the 'Perfection', manufactured by Stupfel), Odélin-Nettey-Bourdon's range of Robur combined kitchen stove and hot air heating system and, notionally at least, a standard plan and the use of the famous cement cannon manufactured by Ingersoll-Rand (figs. 72-74). But, as Le Corbusier wryly commented in an article entitled 'A standard fails to resolve an architectural problem'⁸⁰:

Each of these houses, each of the groups of houses, needed scrupulous study on the drawing board at 1:20. This was minute, difficult and delicate work. All the more minute, deli-

187). -76 « ...petit à petit les chantiers de construction s'industrialiseront ; l'introduction des machines dans le bâtiment conduira à l'établissement d'éléments-types ; le plan du logis lui-même sera transformé, une économie nouvelle y régnera ; les éléments-types y apporteront l'unité de détail, et l'unité de détail est une condition indispensable, de la beauté architecturale. Les villes alors perdront l'aspect chaotique qui les flétrit aujourd'hui. L'ordre régnera et des tracés de rues nouveaux, plus vastes, plus riches en solutions architecturales, offriront à nos yeux des spectacles magnifiques ». Le Corbusier, 'Construire en Série', *Almanach d'Architecture Moderne*, cit., p. 81. -77 « Grâce à la machine, grâce au type, grâce à la sélection, grâce au standart, un style s'affirmera. De nouveau, cet ordre y régnera que le poète cherche derrière lui, dans les époques passées. Que le poète regarde devant lui ; tenant dans sa main une sphère d'acier poli, symbole de la perfection désormais réalisable, qu'il exhorte à l'ordre, qu'il transporte dans l'ordre de choses nouveau son esprit désireux d'harmonie. Des rapports nouveaux s'établiront : le style de notre époque', *Ibid.* -78 Gregh, E., 'The Dom-ino Idea', *Oppositions*, 15/16, pp. 61-87. -79 For example, Le Corbusier used a single batch of Roneo metal doors for five houses in Paris: La Roche-Jeanneret houses, the Lipschitz and Mietschaninof studios, the Ternisian house and studio. -80 'Un standart (sic) ne résout pas un problème d'architecture', Le Corbusier, *Almanach de l'Architecture Moderne*, cit., p. 114.



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cate and difficult because at Pessac we were working only with standard elements: the same window everywhere, the same staircase the same door, the same heating system, the same concrete cell of 5 x 5 and 2 1/2 x 5 metres, the same equipment for kitchens, washrooms and bathrooms.⁸¹ He went on to explain that these standard elements in a standard plan could not, as Henry Frugès supposed, be handed over to the *chef de chantier* to execute.

A work will not carry emotion or touch my affective self unless real intentions have determined the form. To this intention, Mister 'X' (this person unknown to you or me, who will become the owner of one of these houses) will not respond unless we have put it there. It's the care we will have put into seducing him onto a little corner of land by giving him all the light he needs, sheltering him from the annoying prevailing winds, siting his flowers and fruit trees in the sun, his kitchen in just the right spot, his door where he would expect it on arrival, his window with a good view, his resting place out of sight of his neighbour etc., etc. If we didn't insert into every house a benevolent intention, we would be nothing more than jerrybuilders ('ferions du coron'), and the series, the standard, would indeed fail because the dwelling would be uninhabitable. Standards are letters of the alphabet. With these letters we must in a certain sense write the names of the future inhabitants.⁸²

And in fact, as we have seen, at an early point in the design of the *Quinconce* houses at Pessac, Le Corbusier actually used the letters of the alphabet as a code for working the permuta-

tions of his house plans. And later, the idea of 'cells' or 'elements' would take centre stage in the debates between architect and client surrounding an appropriate form of calculation for their fees.

So, on the face of it, the standardisation project was compromised from the start by the needs of the poet/architect to provide an individually tailored home for each individual dweller. This tension, which contributed to the complexity and expense of the project, lies at the heart of the Pessac story.

The idea of designing a dwelling in the abstract, for some unknown person ('Mr X'), touches on a sensitive spot in the paranoia of Modernism. Is the normative person of the architect's imagination little more than a collection of normative needs ('besoins types') and behavioural characteristics? If so, can these needs be met once and for all by specifying standards of space and light, based on optimised dimensions? Le Corbusier sometimes polemicised as if he believed these propositions. His slogan 'la maison est une machine à habiter' juxtaposed the human and the mechanical in a way, which never fails to shock.

It is common to imagine that it took the transformations of Le Corbusier's houses by the owners, and Boudon's 1960s reassessment of Le Corbusier's Modernism to bring the issue of habitability to the fore. But a study of the voluminous correspondence between Le Corbusier and Henri Frugès demonstrates that this was a central topic of conversation between architect and client and led to a number of changes in the design. On 13

—81 « Chacune des maisons, chacun des groupes de maisons a nécessité une étude minutieuse à cinq centimètres par mètre sur la planche à dessin. Minutieuse et difficile, délicate. D'autant plus minutieuse, délicate et difficile qu'à Pessac, nous ne travaillons qu'avec des éléments standards (sic) : la même fenêtre partout, le même escalier partout, la même porte, le même chauffage, la même cellule de béton de 5 x 5 et 2 1/2 x 5 mètres, le même équipement de cuisine, de laverie, le même cabinet de toilette », Le Corbusier, *Almanach de l'Architecture Moderne*, cit., p. 114-5. The difficulty of working with standard elements, and of finding the new architectural standards was given as a reason for raising the architects' fees: 'Etablir les standards, mais c'est un problème accablant, éreintant. Il faut sans cesse remettre sur le métier » (letter to Frugès, 19 February 1926, in which he argued for raising the fees from 100 frs per 'Element' (5 x 5 x 3m of constructed cube) to 175 frs (47,000 frs instead of 31,050) (H1-17-24). —82 « Une œuvre n'est porteuse d'émotion et ne touche notre moi sensible que si des intentions véritables en ont dicté la forme. A cette intention, ce M. X (inconnu de vous et de nous, qui deviendra le propriétaire de l'une des maisons) ne sera sensible que si nous l'y avons mis. C'est le souci que nous aurons pris de le cajoler sur un petit bout de terrain, en lui donnant toute la bonne lumière qu'il faut, en lui évitant les vents pénibles, en mettant ses fleurs et ses arbres fruitiers au soleil, sa cuisine à bon escient, sa porte normalement à son chemin d'accès, sa fenêtre en belle vue, le lieu de son repos à l'abri des regards du voisin, etc. Si nous ne mettons pas dans chaque maison une intention bienveillante, nous ferions du "coron" et la série, le standart feraient faillite, parce que le logis serait mal habitable. Les standards sont des lettres. Avec ces lettres il faut d'une certaine manière écrire les noms propres de vos futurs propriétaires », Le Corbusier, *Almanach d'Architecture Moderne*, cit., pp. 114-5. —83 A stove is drawn in on the section of the Type A house in FLC 20782 (although not marked on the plan FLC 20786 and in subsequent plans before August 1924, the lack of a fireplace indicates that a stove was assumed) and the first appearance of a fireplace is on one of the sketches on FLC 30552, which represents a correction of FLC 20804 (7 Aug. 1924). Ironically, Frugès includes a stove in his own design of the Type A house (FLC 20798 and 20795). —84 « De nom-

- 72 Stupfel 'Perfection' septic tank system, adopted in Pessac.
 73 Hot air vent (bottom left in bedroom wall) providing heat from the Robur kitchen stoves, second floor of *gratteciel* 32. The door on the left leads to the external staircase to the roof.
 74 Standard bathrooms, attributed to Henri Frugès, *gratteciels* No 32, with separate shower and WC.
 75 Fireplace in the first floor Salle, *gratteciel* No 32.

January 1925 Frugès wrote a long letter drawing conclusions on the experience of the *maison échantillon* and Lège and requiring changes for Pessac. The 20x20cm treads of the staircases at Lège were too narrow; Le Corbusier was to make them 25x20cm at Pessac. The front doors were tucked away under the overhang or leading off the store-room; was this advisable? Le Corbusier addressed this problem in some at least of the Pessac houses. The kitchen alcoves at Lège were much criticised; make them separate rooms. Le Corbusier did so. About the fireplaces, Frugès was particularly interesting. Le Corbusier had specified cast iron stoves in the first designs for Lège⁸³.

There are many requests for fireplaces; people just can't understand a house without a hearth. It's no use telling them about central heating; they want at least one fireplace, to have the pleasure of a crackling fire... I have to add that, personally, I couldn't live in a house, however well heated, if I couldn't take pleasure from some blazing logs."⁸⁴ (fig. 75)

On 16 December, 1924, he reported on the experience of the foreman living in the *maison Tonkin*; there had been a cold spell and the internal temperatures had dropped to as low as 2 1/2 degrees above zero. By contrast, in the summer the *Salle* became an oven: 'The conclusion would appear to be to have fewer windows and not to forget to add external shutters'⁸⁵. Later, on 6 January 1926, Frugès passed on some criticisms of the first Pessac houses to be built⁸⁶. These included a shortage of cupboards and store-rooms, the semi-circular store-rooms (the *chais*) were too small and there was a shortage of garages.

This was a terrible time for Le Corbusier; his father was dying (he died on 11 January 1926) and Le Corbusier was travelling back and forth to Vevey. At any rate, he was not very receptive to these criticisms, many of which continued to be voiced about Pessac.

On 20 June 1928, Frugès commented on the observations of visitors to a group of houses recently furnished. The narrowness of the stairs made it almost impossible to bring in furniture; there were insufficient cupboards ('and housewives like to have lots of these in a home'); kitchens were badly arranged and too small; windows and doors were unprotected from rain and sun, causing unsightly stains; blockage of the terrace drains caused flooding⁸⁷. On 3 March 1926 Frugès commented that it was embarrassing trying to put furniture into the houses⁸⁸. The kitchens were full up with only one piece. Frugès even commissioned a questionnaire of potential buyers to try to find out why the houses weren't selling. Many visitors criticised the absence of vestibules, 'People are suffocated coming straight into their dining room from the street. This is a disagreeable deflation of their petit bourgeois pride'⁸⁹. According to Frugès, this factor alone may have lost 20-25% of potential sales⁹⁰. On the other hand, the distance from Bordeaux (8km) counts for even more (60%). Interestingly, Frugès went on, 'Contrary to what one might expect, the architectural form of the houses accounts for only a small percentage'.

It is quite clear that Le Corbusier was not deprived of a vigorous discussion of the likely impact of his houses on the future owners. It can easily be shown that he tried to incorporate some

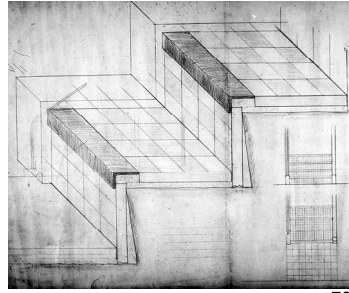
breuses demandes de cheminées nous sont faites ; les gens ne peuvent pas comprendre une Maison sans foyer ; on a beau leur expliquer qu'il y aura le chauffage central, ils aimeraient avoir au moins une cheminée, pour avoir le plaisir de voir pétiller le feu. Je crois qu'il serait facile de prévoir une petite cheminée dans la pièce qui serait le moins chauffée par le chauffage. Il serait incontestablement plus gai de pouvoir mettre cette cheminée dans la salle commune. Je dois ajouter que personnellement je ne pourrais pas vivre dans une maison si bien chauffée soit-elle, si je ne pouvais avoir le plaisir de voir flamber quelques bûches », Frugès to Le Corbusier, 13 Jan. 1925, H1-17-131. —**85** « La conclusion semble donc être de mettre moins de vitrages, et de ne pas négliger de mettre des fermetures », Henri Frugès to Le Corbusier, 16 December 1924, H1-19 166. —**86** Henri Frugès to Le Corbusier, 6 January 1926, H1-17-190. —**87** H1-19-309. —**88** H1-19-296. —**89** « Les gens sont suffoqués d'entrer directement de la rue dans la Salle à manger. Cela chatouille désagréablement leur petit orgueil bourgeois », although Frugès was persuaded that people would soon come round to the plans (Frugès to Le Corbusier, 10 May 1928, H1-17-237). Other criticisms were the shortage of garages (again) and the close proximity of some houses. —**90** Boudon provides interesting evidence of the local penchant for plans organised around corridors; this was the feature of a local plan-type, which he calls the 'lean-to' house (Boudon, *op. cit.*, pp. 91-93, Figs 16-17). And Boudon convincingly demonstrated that many of the owners' changes to Le Corbusier's houses involved adding corridors in imitation of the 'lean-to' house type (Boudon, *op. cit.*, p. 121). It is quite clear from the documents that Frugès was well aware of this taste for separating domestic spaces and creating discreet spaces by the provision of vestibules and corridors. —**91** Among the changes prompted directly by Frugès were: the use of the ground floor for living rooms and kitchen in all but the *gratteciels* and No 14 houses, fireplaces in the living rooms, proper separation of the kitchen from the living room, proper separation of the master bedroom (designed as a bed alcove in the first Lège designs), the use of decorative wallpaper, the provision of hen-coops and rabbit hutches in the gardens of the *quinconce* houses, the addition of garages and so on.



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of Frugès's comments⁹¹. An intriguing and bizarre example of Le Corbusier's attempts to adapt to popular taste emerged in the autumn of 1925, as the first houses were being finished and decorated. It was decided that the interiors needed livening up (no doubt compounded by stains in the plaster blamed on the breeze block walls⁹²) and Le Corbusier undertook to select wallpapers manufactured by a Parisian firm, Maison Heibel⁹³ (fig. 76). All the papers selected were facsimiles of natural materials, which Le Corbusier no doubt considered less suspect than ornamental designs⁹⁴. Summer's foreman was expecting to apply wallpaper to the houses in December⁹⁵ and the green marble wallpaper can be seen in well known illustrations⁹⁶. Unfortunately, this dark green wallpaper was not popular with clients either. One of the criticisms passed on by Frugès on 6 January 1926 was the green marble wallpaper on the staircase of House 62 (one of the *quinconces*), which 'darkened dreadfully the staircase'⁹⁷. Another element of decoration about which there was considerable discussion was the use of tiles for the stairs. Eventually, these were eliminated, for reasons of economy, being replaced by painted concrete, but the first houses to be constructed had little chequer-board tiles on the stairs (figs. 77-78).

THE FAILURE OF THE STANDARD

The first problem in imposing standardisation was to find manufacturers who could deliver what they wanted at the right price. Le Corbusier reported on his experiences at Lège and Pessac in his spread 'Appel aux Industriels' in *Almanach d'Architecture Moderne*, published in the spring of 1926 but handed over to the printers in January or February. Here he names dismissively the

firms he approached for the standard windows, shutters and doors for Pessac: Ronéo, La Menuiserie Métallique du Sud Est de Grenoble, Van Hamme of Brussels, Raoul Decourt.

It is also true that, one by one, the elements of standardisation themselves failed. The cement cannon was quickly abandoned, despite its exorbitant price. It turned out that the difficulty, cost and poor results of spraying cement onto shuttering was much more expensive than Summer's patented P.I.M.A. system, in which precast concrete beams were used. Le Corbusier admitted as much in his captions in *L'Architecture Vivante* No 1 (1927) but claimed that the cement cannon had been re-deployed at the end of the construction process (presumably on the Maisons Arcades). A precious example of the cement cannon in action can be seen in the remains of the *Cantine* at Lège (fig. 100). The chemical septic tanks gave off an unpleasant odour and were eventually all replaced (as well as being condemned by the Municipality), the standard windows and doors invariably created problems of installation in the concrete frames.

From a point in February 1924 when client and architect agreed that the design of both projects should be rationalised around standard components, industrialised building methods and a correspondingly austere visual aspect governed by the harsh laws of economy, events moved inexorably towards a particularised, artistic, expensive and hand-finished practice. For example, Le Corbusier persuaded Henry Frugès to use the Ingersoll-Rand Cement gun as early as February 1924⁹⁸ and they both spent much of this year trying to strike bulk deals with industrialists for large orders of standard doors, windows,

–92 Frugès to Le Corbusier, 1 September 1925, H1-18-32. –93 Maison Heibel, of 29 rue Bonaparte, Paris (H1-19-333, 25/10/1925, and H1-19-327, 20/11/1925. –94 Order of 20 November 1925: Paper 89461 (brown granite, 12 rolls), 89753 (green marble 48 rolls), 89713 (white marble, 48 rolls (H1-19-326). –95 H1-19-255. –96 *Œuvre complète*, 1, p. 80, top left, an illustration which has bemused many Le Corbusier aficionados. –97 H1-17-190. –98 Le Corbusier to Frugès, 8 February 1924, FLC H1-18-208. –99 By November 1924 it had been agreed that the windows and doors should be standardised (eg correspondence with Roneo from 30 July 1924 (H1-19-142) and with Van Hamme from 23 October 1924 (H1-19-151), that standard kitchen equipment should be used (Odelin-Nettey-Bourdon's range of Robur kitchen ranges mentioned in a letter from Frugès to Le Corbusier of 4 November 1924 (H1-19-218). The 'Perfection' chemical septic tanks manufactured by Stupffel had been ordered by 5 December 1924 (H1-18-202). For example, Frugès bought nearly 1,000 steel windows (598 chassis of 2.50mx 1.05m; 213 chassis of 1.25mx 1.05m; 52 chassis of 0.20m x 1.05m) from the industrialist Raoul Decourt for Pessac, which arrived late, frequently to the wrong specification and remained in large quantities unused (H1-19-175, 6 March 1925). Two large 'baraques' were kept full of windows, doors and stoves left unused after the decision was taken to abandon sectors A and B. On 22 April 1927, Frugès complained that he was unable to sell any of the unused frames (H1-17-233) and in September grumbled that they took up a great deal of space (H1-19-16). –100 For example, Frugès bought nearly 1,000 steel windows (598 chassis of 2.50 x 1.05; 213 chassis de 1.35 x 1.05; 52 chassis of 0.20 x 1.05) from the industrialist Raoul Decourt for Pessac, which arrived late, frequently to the wrong specification and remained in large quantities unused (FLC H1-19-175, 6 March 1925). Two large 'baraques' were kept full of windows, doors and stoves left unused after the decision was taken to abandon sectors A and B. On 22 April 1927, Frugués complained that he was unable to sell any of the unused frames (FLC H1-17-233) and in September grumbled that they took up a great deal of space (FLC H1-19-16). –101 The phrase 'La maison est

76 Interior of *quinconce* house No 62, c. January 1926, with furniture and wallpaper selected by Le Corbusier (FLC L2-15180).

77 Original tiles on the stairs of *quinconce* house No 49.

78 Detail of the tiles to be used on the stairs (FLC 19906).

stoves⁹⁹. Each of these deals required Frugès to spend large sums in advance of construction¹⁰⁰. But the romance of reducing unit costs by bulk purchase, or by reducing building costs by using industrialised methods soon evaporated.

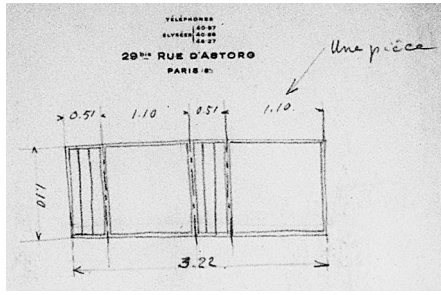
LÈGE AND THE QUESTION OF DIMENSIONS

The question of dimensions demonstrates how the standard housing cell of Le Corbusier's imagination stood at an intersection between men and machines, for the benefits of industrialised production and standardisation could only be achieved if the elements of the dwelling were adapted to the machine. Thus, a dwelling dimension might be thought of either as responding to the needs of men and women, or to the demands of the building industry. In this sense, too, the 'house is a machine for living in'¹⁰¹.

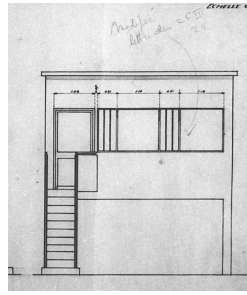
The development of the Lège projects shows that the main factor in determining dimensions became the size of the metal windows. The first project (13 December 1923, FLC 20786) had overall external dimensions of 9.50m x 4.88m for the two storey Type A houses and 6.06 x 4.88m for the three storey Type B houses. The main windows were c. 3.30m long and 1.10m high - they were composed of two fixed panes and two opening casements consisting three strips¹⁰². As Pierre worked on these dimensions, they changed to produce a window of 3.22 x 1.10m (e.g. FLC 30558 which includes, top right, a sheet specifying the window of the first Type A scheme). This window then effectively caused a revision to the dimensions of the building, reducing its width from 4.88 to 4.76m (fig. 79). This distinctive window arrangement of panes (1.10m) and strips (3 x 0.17m = 0.51m)

appears nowhere else in Le Corbusier's built work¹⁰³. In the ensuing drawings, the dimensions of the Type A house changed slightly to 9.32 x 4.76m and in the version built as the *maison échantillon* (also referred to as the *Maison Tonkin*) the dimensions appear to be around 9.40 x 4.72m¹⁰⁴. Little really distinguishes these variants except the size and disposition of the windows, whose dimensions are carefully noted on all the drawings (figs. 80-82). It must be assumed that Frugès had a stock of available wired and hammered glass (suitable for houses which would be left unoccupied for part of the year). Evidence for this comes from a letter of 7 August 1924, when Le Corbusier refers to the 'dalles de verre armé' in Frugès's possession, which were to be reused, despite the change of bay width to 5 metres¹⁰⁵. The quality of the glass can be seen in the photograph of the *maison échantillon*¹⁰⁶. For some reason, while the opening panes remain fixed at three strips of 17cm (0.51m), the fixed panes of glass oscillate in width between 1.01, 1.02 and 1.10m, from one version to another, and in height between 1.10 and 1.15m, producing window sizes, which vary in length from 3.06 to 3.22m. These window lengths, in turn, slightly modified the width and length of the house and also the section. In what seems to be the final drawing of the Type A house constructed as the *maison échantillon* (*maison du Tonkin*), the windows shown as 3.22m (based on 1.02m panes but with an additional strip of 0.16m added to make up the width) which with the door frame at 1.03m and an intervening strut of 7cm, allows 20cm each end for the concrete frame¹⁰⁷. Now, it seems that the panes of glass measured 1.02 or 1.01 in width and possibly only 0.97 in height, which explains the addition of the 0.16m strip at the right hand end. A sketch shows a very odd arrangement where

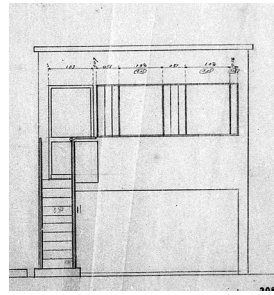
une machine à habiter', appears as a the heading for the chapter 'Des yeux que ne voient pas : les avions' but refers to the less shocking proposition « Une maison est faite pour être habitée » (*Vers une architecture*, 2d edition, p. 94). -102 The dimensions are confirmed in a document (FLC H1 17 259) in which the horizontal and vertical surfaces and volumes are estimated (probably for costing the use of the Ingersoll-Rand cement gun). -103 Among the unexecuted projects are the few sketches for Audincourt (eg *Œuvre Complète*, 1, p. 72b) the sketches, which may relate to the Royan housing project (FLC 19983) and two intriguing elevation drawings (FLC 20744 and 20745), which might be related to the *Cantine* and dormitory for Lège. Le Corbusier had used vertical strip panes as opening windows in a number of projects before, including Citrohan I (FLC 31178, 31180 etc) but never in this particular configuration. -104 As we have seen, the first set (FLC 20786 ('1'), 20782 ('2'), 20785 ('3'), 20783 ('4'), 20784 ('6') and blueprint (19903)) was dated 13-14/12/1923, to which can be associated the structural sketch 20754. A sheet of plans (20805), elevations (19872) and sections (20797 and 20812) marks a reduction of the first project to 4.73 x 9.32m. 20812 and 19872 bear an annotation by Pierre Jeanneret 'modifié lettre de 25/3/24' with an arrow pointing to the window. Although this letter has not survived, it's clear that the change indicated matches the note on FLC 20805. -105 FLC H1-17-125. -106 In the event, it seems that Frugès's glass was not used, since window frames were ordered from a Belgian company Van Hamme. On 13 January 1924, these windows had still not arrived, although the six houses were nearly finished (Frugès to Le Corbusier, 13 Jan. 1925, H1-17-131). On 2d Feb., the six houses were still stalled, for lack of the Van Hamme windows (H1-18-24). -107 FLC 20800. Note, however, that the fixed panes are marked in pencil 1.01 (on both the front and side windows). -108 FLC 30554 inscribed « lettre et plan expédié Frugès 25.3.1924 » and also « 4.4.24 ». The distance between the structural supports embedded in the walls.



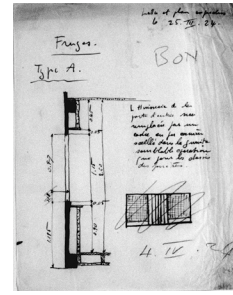
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a strip would be added along the bottom¹⁰⁸ (fig. 82). The *bricolage* aspect of this reuse of existing industrial quality materials makes a significant impact on the design of the Lège houses.

Comparing the dimensions of the preliminary projects for Lège provides food for thought:

FLC	Date	Width	Length	Height	Interval ¹⁰⁹	Window elements ¹¹⁰
First project Lège ¹¹¹ (20786, 20785...)	13/12/1923	4.88	9.50 (A) 6.06 (B)	5.37-5.40	4.46	3.30, 2.00, 1.00; 0.51
Revised project Lège ¹¹² (20805, 20812, 19872...)	12-25/3/1924	4.76	9.32	5.25	4.36	3.22, 1.10 ¹¹³ ; 0.51
Maison Tonkin ¹¹⁴ (20800, 30554)	04-12/4/1924	4.72	c. 9.28	5.20	4.34	3.22 (3.06 +0.16), 1.02/1.01, 0.51; 0.20 ¹¹⁵
Type A1L Lège (20802, 30579?)	c. 7/8/1924	5.40	10.60	c. 5.80	5.00	3.0, 1.0, 3.50, 0.20
Type B1L Lège ¹¹⁶ (20804, 20803)	c. 7/8/1924	5.40	8.10	c.8.50	5.00	2.50, 0.20, 3.50
Type A 2L, by Frugès (20798, 20795)	9-23/10/24	5.40	12.80	c.5.80	5.00	3.55, 3.30, 3.0, 1.0, 0.50,
Type <i>Petit Lège</i>	21/10/1924	5.40	8.10	c.6.03	5.0	3.50, 2.50, 1.0, 0.20

All this uncertainty over small dimensions was to be resolved once the decision had been made to use standard frames of 2.50m (which could be doubled to make 5.0m), 1.25m and 0.20m. The Pessac drawings divide into those before

or after this decision, which can be dated around January 1925.

When Le Corbusier decided to change the grid to 5 metres (between the supports), in August 1924, a process began which

–109 The distance between the structural supports embedded in the walls. –110 Most of the windows in the Lège designs are composed of fixed wired glass panes either 1.10m or 1.15m high and either 1.02m or 1.10m wide, in combination with opening casements 0.51m wide, consisting of three 0.17m panes. –111 I include in this 'first' project 20786, 20782, 20785, 20783, 20784, 19903, 20754. They have in common the overall dimensions of 4.88m wide and 6.05m (Type B) or 9.50m (Type A) and the fenestration pattern. –112 In the second project, I count 30639, 20805, 20812, 20797, 19872. This project is slightly reduced in size, has a slightly different window unit and other small differences from the first. The window dimensions are derived from FLC 19872. –113 On FLC 20812, the 1.10m window marked as « modifié lettre du 5.3.24 ». –114 FLC 20800, 30558 B (second drawing on the sheet), 30554. This is all that exists of the 'maison échantillon' or maison Tonkin. The sketch on 30554 dated 25 March 1924 has the same dimensions in the section of the upper floor but experiments with a 0.95m pane of glass, requiring a horizontal strip to make up the height. –115 On FLC 20800 there are two calculations comparing dimensions for the Type A house using 1.10m or 1.01m panes of glass which add to 4.72 and 4.88m respectively, the widths of the first two projects. In this project, however, an extra strip next to the door has been added to make up the width. –116 In FLC 20803, the external stairs are turned round to the 'left' side (viewed from the front), following pencil note proposing this change on FLC 20804. –117 Some time in December 1924 Pierre sent out a set of drawings of windows, based on the dimensions 1.25m, 2.50m and 5.0m, which should be able to be combined both horizontally and vertically, to be sliding or casement, and to have built-in roller blinds (either vertical or horizontal). Van Hamme, Lacour, Decourt, Jacquemet et Mesnet, Baumann and the Menuiserie Métallique de Sud Ouest de Grenoble replied. On 26 Jan. 1925, Dousse of Decourt sent in a bill for 700 frames for 389,400frs at an estimated cost of 195frs/ m² (H1-18-182). On 19 Jan., a rival and apparently cheaper, proposal was made by the Menuiserie Métallique du Sud Est de Grenoble including a blueprint (FLC 30966) but the decision went to Decourt. Decourt could provide the window frames but not the shutters. On 22 Jan. Jacquemet et Mesnet sent in their proposal for combined windows and roller shutters and these were then combined with the Decourt windows. –118 Despite the revision, in Aug. 1924, of the Lège Type A and B plans around an interval of 5 and 2.50m, the old style of windows with their opening panes made of three strips of 17cm glass, continued to be used, rationalised to fit the new dimensions (see letter of 7/8/24 where Le Corbusier refers to the 'new dimensions we agreed', but retaining the reinforced glass panes. H1-17-125). –119 For example, on 5 Feb. 1925, following a meeting between Le Corbusier, Pierre Jeanneret and Henri Frugès, it was agreed that the architects' fees would be paid on the basis of 100frs per 5x5x3m 'element', including the pergolas, terraces and overhangs (« y compris toute treille, ou *chai* ou *abri* dont l'ossature est coulée avec ou sans dalle ») (H1-17-15). On 26 January 1926, the elements were agreed as being 272, not counting Lège (H1-19-103). This figure would be endlessly contested afterwards. –120 The dimensions can be checked on FLC 20800 (basically, the *maison échantillon* Tonkin house), where a section of the upper floor confirms that there was little more than 1.95m left underneath the floor

79 Sheet of writing paper with measurements for Type A window, Lège, December 1923 (detail from FLC 30558).

80 Detail of elevation of second variant of Lège houses, based on window panes of 1.10m, inscribed 'modifié lettre de 25 iii 1924' (detail of FLC 19872).

81 Detail of revised version of Lège Type, as built in the Tonkin factory (*maison échantillon*), based on window panes of 1.02m (revised to 1.01) (detail of FLC 20800).

82 Right hand sketch showing a section and plan of the window for the *maison du Tonkin*, based on panes 0.97m high and probably 1.02m wide (detail of FLC 30554).

led to the standard window sizes of 1.25m, 2.50m and 5.0m (consisting of two 2.50m windows), using expensive plate glass panes, and these became the standard for Pessac¹¹⁷. Or, to be more precise, it was the search for standard components, dimensioned in sub-multiples of 5m, which led to the re-dimensioning of the Lège and Pessac houses¹¹⁸. Evidence of this comes from the fact that the 5 metre measurement was not an intercolumniation (from centre to centre of the pilotis) but an interval. In the event, the 5x5 metre 'unit' became, conceptually, the building block of Pessac, to the point where Le Corbusier and Frugès considered using a method of calculating the architects' fees based on 5x5x3m 'elements'. It is striking that Le Corbusier was to be paid as much for the 'empty' parts of his houses (terraces and *abris*) as for the enclosed parts¹¹⁹. It is clear from this thinking that what began as a concern for dimensioning windows around 'as found' parts becomes a Cartesian grid of elements from which the different houses would be composed.

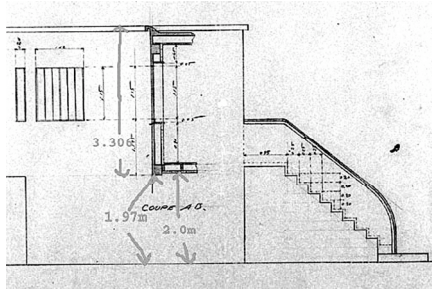
By contrast, it seems that the width of the Lège houses (from 4.72 to 4.88m) was determined by the transverse internal staircases of the Type B houses which, rising 2.60m (plus the 0.20m floor beam), were only 2.80m wide. Allowing a minimal landing of 0.75 and wall thicknesses of 0.20m, this gives a width of

4.80m for the houses.

An idea governing the standardisation of the site was that the same shuttering could be used for the internal stairs as the external ones, despite the fact that, in the Lège designs, the sous-pilotis area was only 2.0m high¹²⁰ (*fig. 83*). One of Frugès's criticisms of the *maison échantillon* and Lège houses, which he passed on to Le Corbusier in January 1925, concerned the stairs, which with their 20cm treads and 20cm risers were too steep and narrow for comfort and safety¹²¹. Even with the 5m width of the Lège Type A1L, B1L and Type Abis1 houses and the Pessac houses, the stairs, now lengthened to 25cm by the provision of a rebate, cut into the landings¹²². The staircase became a dominant design component at Pessac, where the dimensions of the internal and external stairs were indeed almost identical¹²³. In Le Corbusier's mind, the staircase became a compositional component, which could be applied to outside walls (*gratciels* and Nos 14, 37 and 39) or to terraces (Nos 46 and 47).

As built, the *maison échantillon* the windows were detailed 1.15m high, with fixed panes 1.01m wide (corrected from 1.02m) and opening sections consisting of three strips of 0.17m. A drawing of 4 April 1924 records these changes¹²⁴ (*fig. 81*). The one surviving original photograph of this house only shows the façade, with a window detailed as in FLC 20800 (that is, with an

slab. The photograph of the Maison Tonkin is further confirmation of the small scale of the *abri*. –**121** It is notable that Le Corbusier lengthened the treads of the external stairs to the maison Tonkin in FLC 20800, making the steps 3.25m long (plus the extension of the base) by 2.0m high, whereas the external steps on the earlier drawings were 2.0m high by 2.0m long (e.g. FLC 19872, inscribed « modifié lettre de 25.3.24 »). –**122** Frugès to Le Corbusier (13 Jan. 1925), including a long list of criticisms and asking for the 20 x 20cm stairs to be replaced by treads of 25 cm in the Pessac houses (H1-17-131). This was repeated on 23 Jan. 1925 (H1-20-29). In fact, Le Corbusier had already resolved this when he enlarged the Lège designs in August 1924. On the Type A1L, B1L and Abis1 designs for Lège (7/8/1924), based on the 5m grid, the external steps consist of 12 treads of 0.25x0.20m, plus the base for a height of 2.60m, and there is a note saying that if the same moulds were to be used as for the internal stairs, there would be 14 steps of 0.19m plus a base which would vary to suit the natural terrain. The Type B2L house (FLC 20804) internal steps included 14 risers of 0.19m and 13 treads of 0.25m, leaving 1.0m on the side of the kitchen and 0.75m giving access to the bedroom. Even on the maison Tonkin (FLC 20800), the external stairs had been lengthened by the inclusion of 0.25m treads. Frugès's criticism would only make sense if the Lège houses had been built to the same measurements as the Tonkin house, but we know this to be wrong, since Frugès's re-design of the Type A1L incorporates the 5m grid dimensions (FLC 20798). On 24 Jan. 1925, Le Corbusier asks for the exact height dimension between the floors, and calculates a staircase width of 3.25m, on the basis of 12 risers and 13 treads, which would allow only 0.75m for the doors on the staircase landings (H1-17-135). By 24 April 1925, as part of the revisions after the first group of houses at Pessac had been built, Le Corbusier further adapts the stairs, inserting 16 steps with 0.18125m (sic) risers (for a floor height now of 2.90m and a width of 3.40m), treads of 0.226m and a rebate of 0.0233m, giving 0.25m in total to the tread (FLC 19743). Dimensions to three or four places of decimals, derived from dividing fixed intervals, characterise the Pessac plans and bear witness to the struggle Le Corbusier's draughtsmen had to adapt to prefabricated components. –**123** On FLC 20804 (7 Aug. 1924, of Type B1L), a note records the proposal to reuse the formwork for the internal staircase for the external staircase (although the heights were quite different). –**124** FLC 20800, dated in pencil bottom left and inscribed: 'Type A ce plan de façade annule les précédents'. The house must have measured c. 9.28 x 4.70m, confirmed by calculations along the right margin which would have given a width of 4.70m. A sketch on a sheet of paper also dated 4 April 1924 (FLC 30554) records 'lettre et plan expédié 25 mars 1924'. Similar handwritten notes can be found on the section FLC 20812 and the elevations FLC 19872, both drawn to the earlier dimensions, with 3.22m windows with 1.10m panes. On FLC 19872, horizontal lines in pencil along the bottom of the windows are explained on FLC 30554 as a proposal to subdivide the panes into a big pane of 0.97m and a strip of 0.18m (erased on the sketch). This sketch clearly shows the wired glass along the bottom.



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84

additional strip on the right)¹²⁵. The photograph shows how low the ground floor area was, barely 2.0m clearance in the *abri*. In a document of 2 August 1924, Le Corbusier specified a colour scheme for the *maison échantillon* and some other corrections of the earlier drawings¹²⁶. By 30 September Le Corbusier had received two photographs of the *maison échantillon* and replied to Frugès criticising the standard of construction and criticising the lack of rigour in following the dimensions precisely¹²⁷

The Maison du Tonkin survived until recently, and photographs of the front and sides show that the house was built according to the elevations in FLC 20800 (dated 4 April 1924) (figs. 85-86). A shadow is clearly visible where the front door and *abri* have been filled in and the external stairs removed. The window has been substituted by one of the 2.50m windows manufactured by Decourt and used in the Pessac houses (fig. 91). Figure 87 illustrates the slit window illuminating the shower and a 1.25m Decourt window where the original 1.02m opening casements ventilating the kitchen had been (see FLC 20800). Where the 3.04m window in the master bedroom was (on the right), another 1.25m Decourt window has been substituted. The cornice, visible in the drawings and in the original photograph, has gone, replaced by a parapet all round the roof.

In the drawings for Type A1L, B1L and Abis1, a process of purification around standardised window components can be seen to be at work, whose consequence would be the standard 2.50 and 5.00m windows used in Pessac. For example, the side window on the Type A1L house was drawn as 3.00m (two 1.00m panes and two 0.50m opening casements). But in elevation and in plan, this window was marked up to be reduced to 2.50m. The

reason for this emerges from the Type B1L, where the plan was based on one bay of 5m and one of 2.50m, producing windows in the side elevation constrained by two concrete piers 2.50m apart. The Type A1L house was therefore made to match the window sizes of Type B1L. The six Lège houses were built around these dimensions, although the window sizes quickly multiplied for the two house types and the *Cantine*¹²⁸.

Having arrived at standard dimensions of 2.50 and 5.00m, however, Le Corbusier moved on to the next step, of trying to meet all the illumination needs of Pessac with a standard 2.50m window (featuring one fixed pane and two smaller opening casements) which could be used on its own or joined together to make a 5m window. A 1.25m window could also be used on its own or joined with the 2.50m one to make a window with room for a front door within a 5.40m façade. Finally, a 'meurtrière' (gun slit) window for lighting narrow spaces was also available.

Pierre drew a number of drawings as models for the tenders from the manufacturing firms¹²⁹ (figs. 90-91). These emphasised horizontally sliding windows with roller shutters also sliding horizontally. The window elements were to be drilled to accept bolts allowing them to be combined in any sequence, both vertically and horizontally. This was the preferred form stressed in 'Appel aux Industriels' in *Almanach d'Architecture Moderne*. The manufacturing companies rejected the horizontal shutters as impractical and were not able to offer reasonable prices for sliding windows. The company Menuiserie Métallique du Sud Est de Grenoble (manufacturing fittings patented by A. Dousse in Alfortville) made a simple design for the 2.50m window, with a fixed central section and two opening casements, which was

–125 A lost pen sketch published by J. Petit in *Le Corbusier par lui-même* shows a version of the *maison échantillon* including part of the side view. An interesting detail is the horizontal cylinder visible under the '*abri*' on the left. This was the Stupffel patent 'Perfection' chemical septic cylinder, which was used at Lège and Pessac but which still hadn't been delivered by 5 December 1924 (H1-18-202). We must assume that, if the sketch is accurate, the *fosse septique* was added after the *maison échantillon* had been completed. –126 « Facades and *abri*: terre de sienne brûlée ; grande Salle : vert anglais ; alcove des parents 3 murs (and children's bedroom) : ocre rouge » (H1-19-328, 2 August 1924). He also sent drawings for « le réservoir d'eau, la laverie, système de poubelle, la cave à installer dans le hangar agricole ». These appear on the revised plans for the Type A1L and Abis1 made five days later (FLC 20802 and 20803). The *cave* appears in both and the 'système de poubelle' (a rubbish chute from the kitchen to the cave) appears only in 20802. The *cave* can be seen in the pen sketch illustrated by J. Petit but not the *système de poubelle*. –127 « Cette maison fait-elle bonne impression? En ce qui nous concerne nous croyons que le parti que vous avez tiré du *sous-sol surélevé* doit séduire la clientèle, mais il sera évidemment indispensable lors de l'exécution sur une grande échelle d'arriver à suivre rigoureusement les profils, les cotes et les dimensions, faute de quoi nous arriverons à un aspect bâtarde qui peut être très préjudiciable à cette sorte d'architecture qui nécessite une plus grande rigueur ; c'est évidemment là une question de mise au point et d'habitude de la part des contremaîtres » (H1-20-27, Le Corbusier to Frugès, 30 Sept. 1924). –128 E.g. FLC 19852, where 10 different windows were illustrated (A-J), varying in size from 0.20m to 4.97m. This blueprint may have accompanied the tender by Van Hamme of Brussels for the steel windows at Lège. –129 E.g. FLC 30582 and 30562. –130 Frugès reported on this reasonable proposal on 13 January 1925 (H1-17-135). The Menuiserie Métallique failed to deliver on the right terms, so Pierre persuaded Decourt to make a prototype along the same lines. The first design by Decourt was in soft steel and considered too fragile. The second design weighted twice

83 Detail of side elevation and partial section of *maison échantillon* (Tonkin), showing heights (detail from FLC 20800).

84 Photo of *maison échantillon* (Tonkin) constructed by September 1924 (*Œuvre complète*, 1).

preferred to the others and was at a reasonable price¹³⁰. After three months of haggling with various companies, Frugès eventually ordered a very large number of these metal windows from the Parisian company Decourt¹³¹. Although Decourt tendered for the job, the shutters were provided by a different firm, Jacquemet et Mesnet (*figs. 92-93*).

The standard windows created innumerable difficulties. Not only did the windows often turn out to be the wrong size¹³², it was impossible to fit the two 2.50m windows into the 5.00m space in the concrete frame. Frugès proposed that some of the frames be used in as yet unbuilt houses, in which the space

could be enlarged, and Pierre then ordered a set of windows with reduced dimensions from Decourt¹³³. The local engineer Guénu was concerned that the steel frames would create expansion problems unless a wooden sub-frame or mastic was used, and he turned out to be right, although Le Corbusier mocked his timidity¹³⁴ (*fig. 94*).

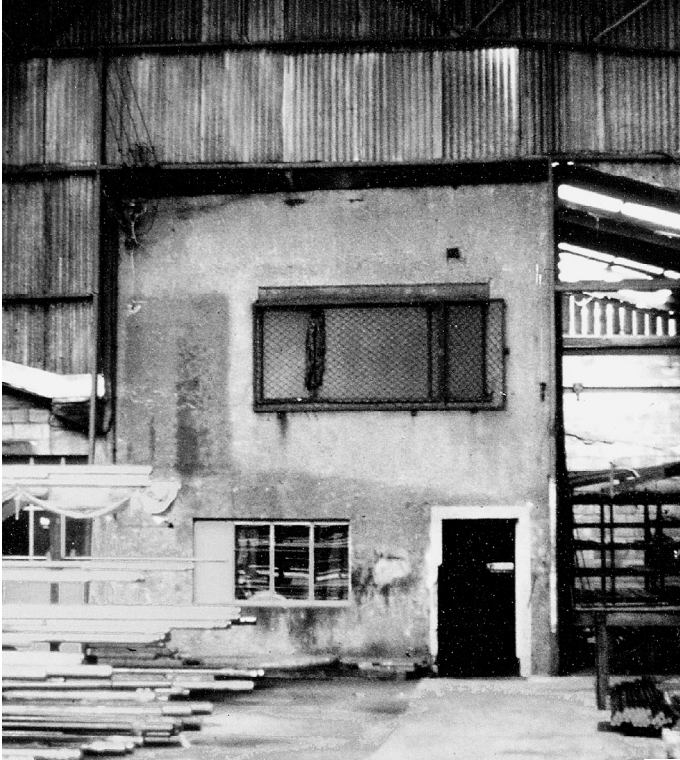
The use of prefabricated steel windows at Pessac was nevertheless a significant achievement in the settling of a modular design process. Tabulating the use of the window types and the 5x5m 'Elements' gives a measure of the standardisation aimed at.

Type and numbers as built	No of houses	2.50	1.25	0.20	Elements	Oriented
<i>Gratteciels</i> (15-22, 26-32)	16	7/8 (front or back) [120]	-	3/2 [40]	80	E/W
<i>Quinconces</i> (40-44, 49-54, 61-66)	17	3 [51]	4 [68]	-	85	E/W
<i>Maisons en 'Z'</i> (56-58, 68-70)	6	3 [18]	5 [30]	1[6]	30	N/S, E/W,S/N
35	1	4	3	2	5	
<i>Jumelles</i> (46 and 47)	2	7 [14]	-	1 [2]	10	N/S
<i>Arcades</i> (1-13)	7	7 [49]	4 [28]	2 [14]	42 (inc. 'jardin')	NW/SE
Type Vrinat (14 and 39)	1 (+1)	5 [10]	2 [4]	1 [2]	10	N/S
Type 37 and 48	1 (+1)	7[14]	1 [2]	2 [4]	10	EW
Including 39 and 48	51(53)	280 (divided into left and right opening)	135	70	272	

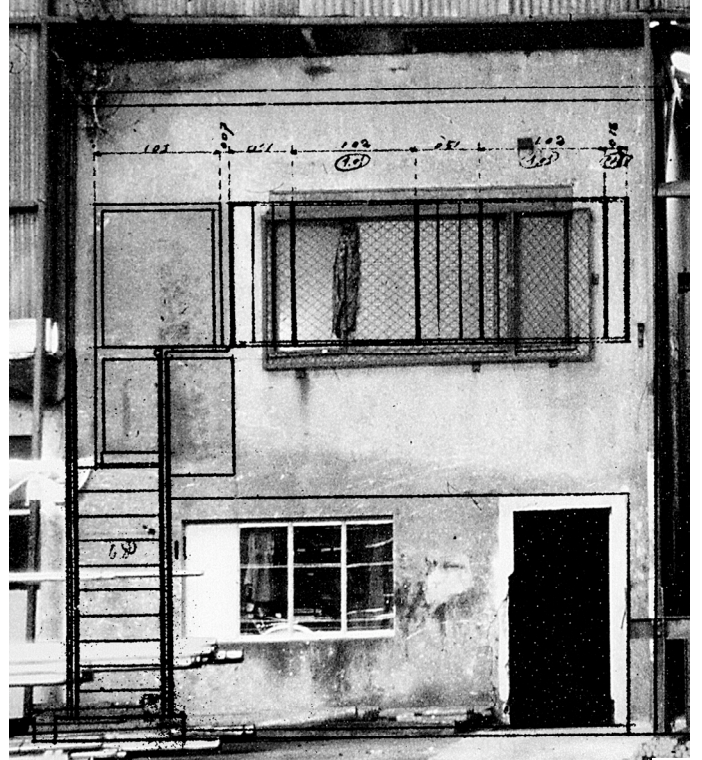
as much, was more expensive but more robust. On 21 February 1925, Pierre reported on this second design, which seems to have been the one selected (H1-19-169).—131 On 6 March 1925, Frugès seems to have ordered nearly 1,000 steel windows (598 chassis of 2.50mx 1.05; 213 chassis of 1.25mx 1.05; 52 chassis of 0.20mx 1.05m) (H1-19-175). A list of windows ordered to date 18 March 1925 included 236 windows. All the 2.50m1.25m windows were to be handed left or right to allow the functioning of the roller blind strap (H1-19-108). Although some of the windows had already been ordered and installed, it was found that they could not easily be fitted into the space between the concrete piers; on 10 March 1925, Le Corbusier adjusted the dimensions (2.50m became 2.48 and 1.25m became 1.24) (H1-19-148). Later, it seems that a further large order of Decourt windows was made, for the whole site, since Frugès complained of having to store these. Two large 'baragues' were kept full of windows, doors and stoves left unused after the decision was taken to abandon sectors A and B. On 22 April 1927, Frugès complained that he was unable to sell any of the unused frames (H1-17-233) and in September grumbled that they took up a great deal of space (H1-19-16).—132 The first batch of Decourt's window frames were 6cm too high. Frugès wondered if the difference could be taken out of the upstand underneath the window, or else they could be used in later buildings (Frugès to Le Corbusier 8 July 1925, H1-19-185). Decourt also delivered a batch of the 1.25m windows with only one side opening (Pierre Jeanneret to Decourt 22 April 1925 H1-19-183). In the end it was agreed to make half the 1.25m windows with one opening casement and half with two opening panes (Le Corbusier to Decourt, 6 July 1925 H1-19-191). Another problem was that the 2.50m windows, with their wooden roller blinds supplied by Jacquemet et Mesnet, had to be re-specified as left- or right-handed.—133 The revised dimensions were 2.48 and 1.24 (the 0.20m slit windows remained the same) (Pierre Jeanneret to Decourt 10 March 1925 H1-19-178). Some of Summer's construction plans show modified dimensions of 5.04m between the piers (e.g. FLC 30793 for the quinconces houses Summer's design 318.1). Frugès noted

- 85 Photograph of the façade of the *maison échantillon* in the 1970s (photo Patrick Aubry).
- 86 Photograph of the *maison échantillon* compared with the elevation in FLC 20800.
- 87 Photograph of the side of the *maison échantillon* (Photo Patrick Aubry)
- 88, Le Corbusier, sketch of *maison échantillon* as built, showing the 'Perfection' septic tank suspended underneath the WC in the abri (Jean Petit, *Le Corbusier lui-même*).
- 89 Detail of FLC 20800, showing the side of the *maison échantillon* as built, confirmed by Patrick Aubry's photograph (detail of FLC 20800).
- 90 Detail of one of Pierre Jeanneret's drawings sent out to window manufacturers (Ronéo, Van Hamme, Menuiserie Métallique du Sud Est de Grenoble, Decourt

- etc.) in December 1924 (detail of FLC 30582).
- 91 Metal window proposed by Menuiserie Métallique du Sud Est de Grenoble, c. 13th January 1925 and later copied by Decourt (FLC 30589).
- 92 Steel windows by Decourt and roller shutters by Jacquemet and Mesnet perfectly conserved on the gratteciel No 28 in 1999).
- 93 Roller shutters by Jacquemet et Mesnet on the inside of House 46 (*jumelle*).
- 94 Construction photograph of *quinconces* houses 65 and 66 in March 1926, showing the Decourt window chassis installed on the first floor (2 x 2.50m), but not on the ground floor (2.50m + 1.25m) (FLC L2-15-28).



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STRUCTURE: THE INGERSOLL-RAND CEMENT CANNON

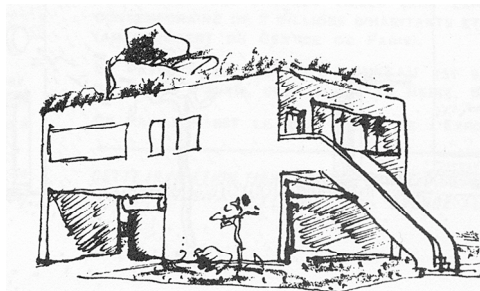
The first set of drawings for the Type A and Type B houses for Lège, produced between 13 and 14 December 1923, were submitted to the French representative of the American Ingersoll-Rand company for costing for construction using their cement guns. The Ingersoll-Rand Cement Gun was extremely expensive: the compressor cost 58,200 frs, each cement cannon attachment cost 19,500 frs (Frugès used two at once), and the attachments all added up (water tank 2,200 frs, spare pipes

1,050 frs each). On top of this, a specialist engineer had to be employed, at 50frs a day plus expenses, to train local labour¹³⁵. The representative of the Ingersoll-Rand Company, M. Petitjean, calculated the manual labour to build the Lège houses as around 45 man-days (including only 2 days of a five man crew for the concrete projection), plus 3,050 frs in materials (excluding any foundations, woodwork, glazing and painting)¹³⁶. In April, Petitjean proposed a more detailed set of figures, including a system of cavity walls using plaster squares, which would give a figure of between 5,000 and 6,000 frs for the raw construction¹³⁷. Based on these figures for the 'gros œuvre', we

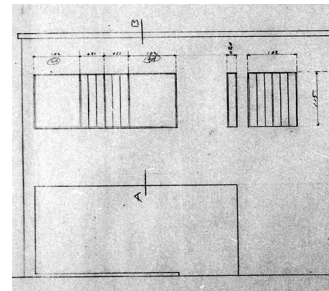
that the spaces left for the 5.0m window frames in the completed houses varied from 4.99 to 5.01m and asked whether they might not insert single 2.50m windows, instead of the two 2.50m chassis, filling the 1.25m spaces on either side, which would add to rigidity. There is no record of Le Corbusier's response to this outlandish suggestion (Frugès to Le Corbusier, 9/3/1925 H1-19-106). The Decourt windows were used in the Pavillon de l'Esprit Nouveau, and indeed a set of the ones paid for by Frugès were used and not returned. —134 Le Corbusier informed Frugès that Guénu had telephoned Decourt to ask him about the coefficient of expansion of the steel window frames. Le Corbusier believed that this puerile mentality would take discussion back to the ABC of building ('des discussions alexandrines'). Guénu had produced a structural report on the first houses built at Pessac which Le Corbusier considered to be '...d'une insipidité stupéfiante, il est vraiment dommage qu'un homme de métier se dérange



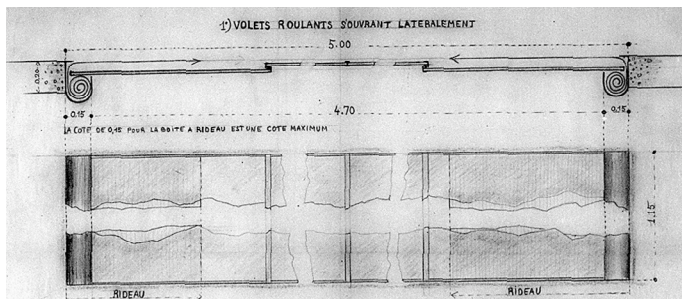
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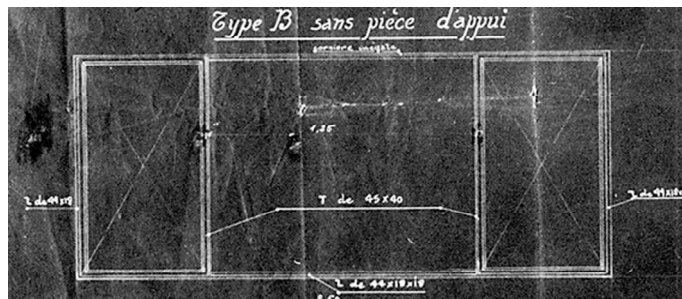
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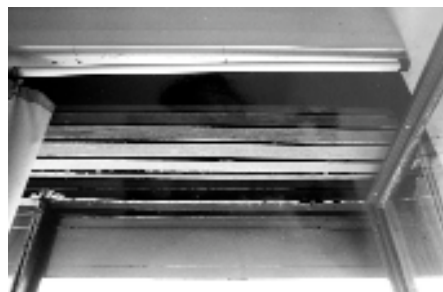
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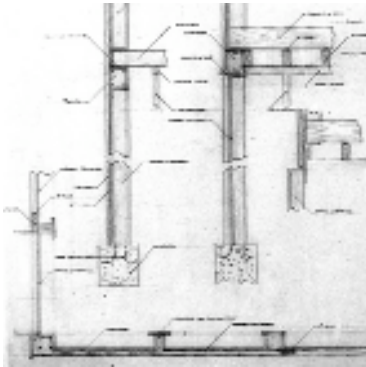
might expect a figure of around double (10,000-12,000frs) for a completed house, given the most efficient methods and very cheap land values. This is the figure used by Le Corbusier in promoting his work at Pessac to others¹³⁸. An outlay of over 100,000 frs on equipment would demand many hundred houses to pay its way. No wonder that Le Corbusier constantly tried to persuade Frugès that his cement cannon could be rented out or put to work on contracts in the Bordeaux region (Royan), or projects he claimed to have in the bag, such as a Cooperative housing association *La Pipe St Claude* in the Jura and Audincourt¹³⁹.

The first set of plans produced by Le Corbusier for Lège, which were the ones sent to Ingersoll-Rand for costing, included one set of details for the shuttering¹⁴⁰ (fig. 95). In this system, wooden shuttering inside the house would support a metal grill for reinforcement, onto which the concrete would be sprayed from the outside. Thin (6 cm) reinforcing buttresses on 1.14m

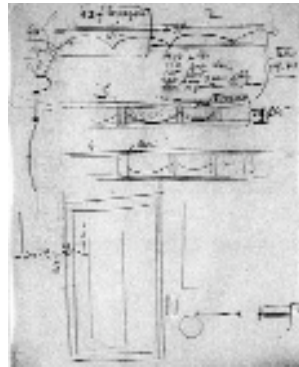
centres were cast in, in between the main 20cm pilotis. The complicated profile of the cornice moulding would also be cast directly with the cement cannon. A lining of some material would finish the interior walls, creating cavities of c. 13cm. It is not clear how the floors would have been constructed, probably of concrete beams faced on the top with floor boards and underneath with plaster board. This system can be seen also in FLC 20805, 20812 and 20797 and on a sketch dated 4 April 1924 (FLC 30554).

On the same sheet as the sketch dated 4 April 1924 (FLC 30554) is the first indication of the next system of construction to be used (fig. 96). A rough sketch compares three floor systems: wood planks on beams, terrazolite on thin beams interspersed with sprayed concrete, and the system of *voutains* used in Lège and the first nine Pessac houses. This system of spraying concrete onto external shuttering to create a scalloped effect would

pour aboutir à de telles inutilités' (letter to Frugès, 12 May 1925 H1-18-191). -135 Petitjean, of Ingersoll-Rand, to Le Corbusier, estimate of costs, 23 January 1924, FLC H118-159-166, 23 January 1923. -136 Petitjean to Le Corbusier, letter, 23 January 1924, FLC H1-18-167. -137 Copy of Petitjean letter to Office Public des Habitations à Bon Marché, Valenciennes, 7 April 1924, FLC H1-18-175. -138 Le Corbusier to M. Girardet, Managing director of Etablissements Peugeot, sending a plan for Audincourt and boasting that the houses at Lège and Pessac were already in construction at an astonishing price of 10,000 frs per house. H1-20-179. In the event the houses cost three to four times this sum. -139 Le Corbusier to Frugès, 7 December 1923, H1-18-155. -140 FLC 20783.



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be used on vertical and horizontal surfaces alike. The system of precast voutains sprayed with gunnite can be seen on the drawings of August 1924 and on subsequent drawings and is visible in the Lège Type A houses on the underside of the terraces, on the *Cantine*, and also in houses 49-54 and 56-58 at Pessac. Unfortunately, there appears to be only one extant photograph of Poncet's system in use, and this shows a 1 1/2 element house which might be the North side of a Type B house at Lège, but lacking the kitchen window (figs. 97-98).

They had trouble from the start with the reusable shuttering used at Lège and soon abandoned it¹⁴¹. Although it seems that the cement cannon was used on the six houses and the *Cantine* at Lège, on the maison du Tonkin, and possibly on the first nine houses at Pessac, it was dropped in April 1925 except for minor work on the curved store-rooms (the *chais*) and the garden walls. It was difficult to control the gunnite cement and achieve the thin, perfectly flat surfaces required. The garden walls, and part of the *Cantine* show that thicknesses of several centimetres were used, in several layers, creating inevitable difficulties of slippage, as well as the time needed for curing (fig. 100). One problem was that the cement cannon required the use of pre-cast isolating panels to achieve simplicity and economy. On 24 October Le Corbusier wrote to M. Tschayef, Director of the com-

pany Solomite¹⁴². He was already in contact with Tschayeff over the Esprit Nouveau Pavilion, where Solomite panels (of compressed straw) would be used. On 27 October he told Frugès that Tschayef had agreed to send Frugès a panel of 2.60x5m, explaining that the gunnite would form a surface rendering, with the Solomite as a 'coffrage perdu'¹⁴³. On 5 December, Frugès reported that the Solomite slabs had arrived but that they measured only 2.0m instead of 2.60m, with two additional bits to make up the height. In this form, they collapsed under their own weight¹⁴⁴. On 8 January, Tschayef reported that Frugès's workmen had set the slabs badly (horizontally rather than vertically) and that, in his opinion, Frugès 'was a very busy person without good collaborators'¹⁴⁵. Several of the details for roller blinds and windows, drawn as late as March 1925, included sections of wall consisting of straw 'Paille', faced directly with plaster on the inside and gunnite sprayed concrete on the outside¹⁴⁶. None of the early plans and sections for Pessac unambiguously show the use of Solomite, although a marginal sketch on a plan for one of the *quinconces* houses does specify Solomite and sprayed gunnite¹⁴⁷. In the end, Solomite was abandoned at Pessac and reserved for use in the Pavillon de l'Esprit Nouveau.

-141 As early as 19 May 1924, Frugès had written, 'Nous avons été très retardés par les coffrages dont certains éléments ont du être recommencés jusqu'à trois fois ! Je n'ose plus vous dire quand j'espère commencer', H1-17-124. -142 H1-18-199. -143 H1-18-200. In the event, Tschayef sent 3 panels of 1.50 x 2.60m and another of 0.50 x 2.60m, to make up the 5m, Tschayef to Le Corbusier, 29 November 1924, H1-18-201. -144 H1-18-202. -145 H1-18-204. -146 For example, detail of section and plan of window, 23 April 1925, FLC 19741. On this plan are shown the gunnite exterior surfaces, plaster inside and 'paille' in between. -147 FLC 19976. This drawing was

95 Detail of sheet showing system of construction for Type A and B houses, numbered '4', and dated 13 December 1923 (FLC 20783)-

96 Sheet of sketches of alternative floor systems, with Poncet's *voutains* at the top and a system of precast beams below (detail of left hand sheet from FLC 30554).

97 Poncet's system of construction in use, showing the precast *voutains* and the use of the cement cannon on the external walls (FLC L1-12-98).

98 Henri Frugès and Le Corbusier, South side of the *Cantine*, showing the side entrance to the refectories. The *voutains* system of vaulting devised by Poncet can be seen, as well as a piloti added by Georges Summer in May 1925.

99 Poncet's *voutains* in Zigzag house 57.

100 Detail of one of the blocked up windows on the ground floor of the *Cantine*, showing successive layers of Gunite projected by the Ingersoll-Rand cement cannon.



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100

Standardisation and industrialisation may have failed as a practical tactic at Pessac, but they embedded themselves as an ideological necessity in Modern Architecture. In another study I will look at the impact of these ideas on the design process and will also consider a number of the technical innovations at Pessac (Stupfel 'Perfection' septic tanks, Robur hot air heating systems and others) and their fate.

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made after December 1925, because it shows the Robur stoves and hot air ducts and is fairly close to the numbered drawings of April 1925 (FLC 19744 and 19743, Le Corbusier number 526-7, 24 April 1925). The section which goes with this group FLC 19747 (LC num 530, 20 May 1925), however, shows clearly Summer's patented flooring system. The walls are drawn with an 11cm infill, but even if this was intended to have been Solomite, we know from the construction photos that Summer used breeze blocks for the walls.