# Rhythms, Metrics, and Industrial Roof in Alejandro de la Sota's Clesa Dairy Plant

Rafael García García

The important question of an architectural grid and regularity in Alejandro de la Sota's work has been affirmed on different occasions by scholars. In the words of Teresa Couceiro, "Alejandro de la Sota always establishes an order on the structure, that is, a grid of invisible lines that arranges, and that he always uses as the basis for the beginning of the project."[1] This is an idea upheld as well by José Benito Rodríguez Cheda: "Alejandro de la Sota, when designing, opts for spatial isotropy. This is always a starting premise."[2] Couceiro also adds the nuance that in De la Sota's work, "the structure is architecture since it marks use, puts order, and reinforces the idea; it is not something separable from the building."[3]

Likewise, in "A conversation around Clesa," which took place on 21 October 2015 at ETSAM (Madrid School of Architecture) between Josep Llinás and José Manuel López Peláez, both experts on Alejandro de la Sota and his work, López Peláez, apart from explicitly acknowledging the building as "a very important example of Spanish industrial architecture," stressed that "there is a desire for regularity that is always present in De la Sota's architecture." [Fig. 01]. Nonetheless, both authors agreed that the plant's spatiality is not at all evident, describing its structure as "quite complex, not immediate" (Peláez) and even "mysterious" (Llinás), and admitting to a certain perplexity, "not quite understanding the genesis of that structure is" (Llinás). And on another of its most characteristic elements, the system of skylights, they shared the impression that they were "apart from the structure" like "boxes placed on a flat roof" (Llinás).

Having given the previous references, this article formally focuses on analyzing the geometric grid of the Clesa dairy plant and its relationship with the preliminary design. The intention is to explain its rhythms and modulations, but also with an eye to the repercussions on the spatial and structural aspects that are the object of the previous considerations. The special attention given to the grid comes from its striking modular irregularity, with significant anomalous deviations from the more consistent isotropy that is expected from De la Sota, especially in an industrial building. As we will see, some aspects of this modular irregularity can be connected to decisions made on the design of the roofs. Specifically, there are as many as five different basic modular widths, several of them with no apparent numerical or proportional relationship to one another. This is a particularly singular feature that contrasts with the bulk of his architecture, especially from this period onwards, in which grids always offer a disciplined isotropy. This concept was fully applied in his most important projects of the Clesa period.[4]

The main documentation available for analysis of the Clesa dairy plant are the building itself, the approved project, the preliminarydesign, and items in the archives of the Alejandro de la Sota Foundation, with its abundance of plans, sketches, and photographs. There are also monographs and numerous articles and academic works about the author and specific works. Among those exclusively devoted to the dairy plant, the book by T. Couceiro and the thesis of José Ignacio Ferrando Álvarez Cortinas stand out.[5] In the latter, in addition to other aspects, the detailed configuration of the built structural framework is rigorously described. It is a seminal work on which this paper is based, and its dimensional precision was essential to this study. The approved project is also included, with the project report and the cost estimate, and the preliminary design is redrawn. The latter, dated April 1958, is key to comparing the different states we propose, and to a basic understanding of the building's elements. If there are aspects that are still not well understood, as suggested in the conference referred to at the start if this paper, it also seems that the grid, as a support, deserves further  investigation and better understanding.

**Basic Diagrams**

The first available document, the preliminary design, is of great importance, being an early sign of an emphatic  regular order and marking the starting point of the project. The design, surprisingly simple but very complete in program, was almost entirely based on a grid of 12 x 6 metres (m). [Fig. 02] The only exceptions in the plan are part D, corresponding to the dispatch and product exit shed, in which the modules are shortened to 10m x 6m, and the smaller separate volume (G), the area for receiving milk, which does not adjust to the modular system. In this rectangular main part, the part we will focus our analysis on, the fundamental process areas are already defined, placed in an east-west direction from the empty bottle-entry shed (A) to the product-exit shed (D ). Examining it is essential to an understanding of the parts of the dairy plant.

We can already see here which will be the most important sheds in the process – those for washing and filling bottles (B) and those for treating milk (C). They have the same dimensions: 24m x 48m. Although no indications are given, it is reasonable to assume that they would be lit from above, at least for the most part, if north light was desired. In any case, 12m x 6m would fall within the typical range of structural modules, which were usually resolved with saw-tooth roofs in industrial buildings of the time.[6] It follows then that 6m can be understood to be the basic modular unit, although it is striking that 10m is also considered, half of which, or 5m, could provide an exceptional complementary modulation. Area E, with its more heterogeneous uses, would be allocated to storage, technical refrigeration elements, and complementary products, and F would be the administrative area. The orientation that we have marked north in the diagram below will be maintained in the successive plans.

After the previous design, the project dated September 1958 – although approved in May 1961 – already corresponds fundamentally to the building that was raised, and therefore includes all the important changes done on the preliminary design. In a short schematic description of these [Fig. 03], without for the time being making any references to the dimensions, parts A, B, C, D, E, and G remain in their relative positions, although the administrative part F, or offices, changes its layout, forming an L-shaped block inserted into the main body of the complex. The longest side of this L-shape, to the west, sits on top of dispatch shed D, while the northern, shorter side is subtracted from shed C, which becomes shorter than B. It is also important to highlight the raising of part of the ceiling (t) of the washing shed as a protruding tower, which was required for the sterilization process.

Although it is not indicated in the diagram, there were two low-rise floors under shed C. One was a warehouse and the other allowed continuity of the bottling lines running under the treatment lines. Consequently, the ground levels of the main warehouses are different, and the treatment plant is 4.33m higher over the washing plant. This is an important issue in the plant, as it causes a staggering of levels, with a clear impact on the external volume.[7] Apart from this, the main change is the inclusion of the annex containing changing rooms and canteens (V), linked to the main volume by a narrow walkway. The design of this annex, represented in the diagram, is already that of the built version, shorter than the one in the approved project.

It should also be noted that in the 1958 project (hereafter, the project), the central sheds B and C were designed with a single span, which was ultimately not built because intermediate supports were introduced in both.[8] In shed B, the raised volume of the sterilization tower (t), required two supports on the axis of the shed, which would be retained in the built version.

**North-South Grid**

Focusing on the constructed building, it is in the north-south direction that the first clear modular anomaly can be spotted, owing to the dimensional difference between its intervals. The north-south grid follows this sequence: 6m, 6m, nine equal intervals measuring approximately 5.3m, 4m, 6m, and 6m [Fig. 04]; this is significantly different from the uniform 6m module in the same direction of the preliminary design. In this sequence, every three 5.3m intervals are grouped in a larger, 16m one, corresponding to the separation of the main supports of the central filling and treatment sheds. With this, an important tripartite rhythm is introduced for the common length of these sheds, as three large sections are marked in a north-south direction in each one of them. These three sections can be seen mainly on the roof, corresponding to the stripes of the skylights [Fig. 04].

In this sequence, both 5.3m and its multiple 16m obviously deviate much from the initial 6m module, and pose the first modular anomaly to consider. However, it is very important to note that 16 x 3 = 48, where 48 is also equal to 6 x 8. Or, in other words, that the nine intermediate intervals of 5.3m correspond exactly with the transformation of eight hypothetically initial ones of 6m, and, furthermore, coincide with the eight length intervals of the sheds in the preliminary design. So, everything leads to the thought-provoking hypothesis that for this set of intervals, the total length was maintained, but the modulation was changed. There being nine intervals divisible by three would then explain the sheds with tripartite divisions, which would not have been possible with the modular system of the preliminarydesign.

This is a very important dimensional question in the project, as it introduces the specially emphasized rhythm and tripartite characteristic of the main sheds and their skylight silhouettes. As will be seen in more detail later, it is clear that without this change, the skylights would not have been designed as they were. The rhythm is also marked – although to a lesser degree – on the east and west facades of sheds A and D, in the latter as the supports spaced every three intervals are noticeably thicker.

This had to be a conscious change, but with what consequences? Analyzing the project, several important reasons for altering the modulation can be seen. The common reasoning behind the alteration is that the step from eight to nine modules allows a more adequate dimensional adjustment in some parts of the project. With this, for example, the distribution of loading docks is improved both for reception and for dispatch, which, in the preliminary design, wasted the available docking space with only five docks on each side, compared to the nine finally achieved for that same length. It is also interesting to note that the preliminary design envisaged leaving those dock areas free of pillars by eliminating some of them. Thus, a sequence was suggested of 3-2-3 modules, which in a certain way already pointed to two tripartite elements. Consistent with the above, an attempt to regularize all parts could equalize the central spacing, increasing the modules from two to three, although resizing them all to maintain the total length.[9]

Another perhaps favorable aspect, a consequence of the above, is that the reduction from 6m to 5.3m was transferred to the separations of the porticoes of the two office floors located to the west (F), just above the dispatch shed. This reduction appears to be more adjusted to this type of space. In regards to the relationship between the structural grid and the lines of machinery and bottling belts represented in the project, but not reproduced here for purposes of brevity, a simple comparative study of the two distributions does not seem to offer any advantages over the uneven distribution. Quite the contrary, it would be slightly more unfavourable, the supports being less separated. However, there would still be another question, one which is more difficult to solve with even modulation, and that is the position of the two independent supports of the sterilization tower located on the axis of shed B. A simple checking also shows that for these supports, if they had been separated by the two or three intervals of the even modulation, their locations relative to the machines would have been worse than with the uneven system.

Surely all these elements would have been weighed up, and were probably decisive in the modular change, as is clear from the fact that the overall lengths of the bays did not vary. They all point to the fact that the uniform grid of the preliminary design was altered early on, as a consequence of these difficulties. But a modular change of this nature is neither frequent nor obvious as a decision. In this regard, the happy coincidence that the new subdivision is as favorable for the floor plan as it is for the roof is notable.

A confirmation of the persistence of the old modulation can be found in the same 1958-approved project. It shows that, in effect, these eight modules were considered up to a relatively advanced stage, as we can see, for example, in the structural project report attached to the project [Fig. 05]. In it, those eight intervals were still drawn, forming the grid of pillars under the floor slab of the bottle reception shed; a remainder from the initial, ultimately unexecuted scheme, coexisting in parallel with the tripartite scheme of large 16m (3m x 5.33m) sections of the central treatment and filling sheds, and already extended to the rest of the plant. Thus, the approved project contained a combination of both modular schemes. On the ground floors the 6m module was maintained, but on the roofs it became 5.33m. A new modular singularity in the supports under the floor of the treatment shed is also striking in the project. In it a division into two of the 16m module gives rise to six 8m sections that were even more anomalous and were not built either. All of these alternative modules eventually disappeared in the constructed building.

**The Roof**

In keeping with standard practice, the possibilities for covering the spaces of the shed would use the established modular schemes as a starting point. It is likely, therefore, that solutions for the eight-interval modulation were at some point imagined, but this is not relevant to the following reflections. In either case, a saw-tooth roof would have been the usual solution in Spain for covering these rectangular sheds and illuminating them from overhead. The original solution of a system with triangulated girders of 20m or 25m to span the sheds without intermediate supports, with trusses of 6m or 5.3m, was perfectly feasible, and there was no apparent significant difference if it was applied to the eigh-t or nine-interval system. But it was not applied. Why was a solution executed that was so unique and so unobvious at the time?

We believe several arguments could have been influential, especially those forwarded by the architect himself. A main one was not to use a metal structure, for reasons of cleanliness and hygiene, as mentioned in the project report.[10] This would rule out a saw-tooth metal framework, although concrete solutions did exist, such as pre-cast trusses.[11] Another option would have been a cylindrical shell solution in concrete, but there were few previous examples of this being put to use in Spain. Nevertheless, the project description expresses a clear desire to make an impact; "the large production sheds are covered in a quite spectacular way,"[12] which would be justified "because this kind of industry is extraordinarily visited by a large number of people, which means that the first publicity has to come from the installation itself; the fact [of] favourably impressing those who visit the centre was considered important and essential in the first ideas that influenced the project".[13] There is no doubt, therefore, that a certain spectacularity was among the requirements for this future roof.

If a saw-tooth solution had been used, they could have been arranged side by side, every one, two or three intervals depending on the illumination desired [Fig. 06]. Although any combination is possible, it would have needed a deep beam (V) when the skylights were separated. Getting round this inconvenience, however, an arrangement of every three intervals gives a glimpse of the adopted solution. And again, it is important to remember that it would have been difficult to maintain a division of eight intervals, simply for rhythmic reasons.

We must ask ourselves, therefore, how the final built solution was arrived at after rejecting the usual solutions, and if it is reasonable to assume that it was through the development of the solution of the skylights every three modules. To do this, it is necessary to make a significant leap, and bring the idea of deep beams into play only every three intervals, with corbels between them to support the skylights. It is possible, but was there some sort of benchmark to serve at least as a starting point?

In monographic publications of industrial architecture of the time, there is a structural type that may not be exactly the same, but coincides with the main features of the basic elements used in Clesa – the scheme of pillars with corbels on both sides supporting skylights [Fig. 07].[14] Several of the examples studied, all located abroad, also have spans close to 16m, reaching 20m in one case. Visually, all of them have the attraction of leaving bands of skylights "floating" (similar to the idea of boxes on a flat roof proposed by Llinás), supported by elements in flight. In addition, the skylights do not occupy the entire roof, but only a part of it, and in the desired proportions, as in Clesa.

Of course it cannot be demonstrated that this type was taken as the starting point. Nevertheless, granted that it was, in Clesa there are original transformations. Firstly, a change of orientation: the schemes illustrate the longitudinal profile of the sheds. In Clesa, however, the solution resolves the transversal sections of the shed. Secondly, none has a north-facing skylight, all are symmetrical. To these two possible transformations we should add the initial idea of supporting the corbels with transversal girders of a presumably higher span (20m and 25m) than in the examples described, and, finally, the specific and particular cable-stayed design of the corbels of the Spanish plant.

**Details and Analogies**

The singularities described in the roof structure of Clesa call for some additional comments. Although we will not spend time on the detailed solution of the corbels – based on the desire to use prestressed pieces as much as possible, as they have been sufficiently explained by their authors,[15] – it is worth noting that cable-stayed solutions were at the time very rare in industrial roofs [Fig. 08]. In Spain, although not industrial, an advanced and relevant example – which draws our attention on account of the visual similarities of its powerful braces – is the Tempul aqueduct that Eduardo Torroja built in 1926. Another notable reference that is strikingly similar in its structural configuration, albeit different in scale, is the group of large hangars with symmetrical cantilevered elements that were built precisely in the same period.[16] There, the appearance of raised structural trestles like Clesa's is noteworthy, although with big dimensional differences. Also striking is the coincidence of one unique contemporary case of corbels with tie rods, although made entirely of concrete, for the facilities of Española del Zinc in Cartagena, in the project by Carlos Fernández Casado that was published in 1959.[17] It is important to note that the concept of balance by compensation, represented by the double corbels, from this moment on played a prominent role in De la Sota's solutions, and can be seen in later projects.[18] As strange as it may seem, it is not easy to find previous or contemporary corbel solutions with the similarities indicated here, which adds to the originality of the solution. In terms of the skylights, the use of a plate girder in Clesa to configure their silhouettes had precursors at the beginning of the 20th century in Germany.[19] However, their use in saw-tooth roofs was less frequent, with trusses generally preferred. It is after World War II that we find more examples of plate girders in saw-tooth roofs, but only in the 1950s do examples with broken profiles appear, as in Clesa [Fig. 09]. At least two notable cases can be cited: the Pirelli factory in Settimo Torinese, Italy, inaugurated in 1954, and the new Volkswagen factory in Hannover, inaugurated in 1956,[20] in which this profile was used in all the sheds.[21] Neither were very common solutions, which is why Clesa's design is so unique; it is one of a kind among Spanish industrial projects of the time.

**The Main Facade. East-West Grid**

Returning to the modular analysis, the idea of an east-west grid with equal intervals still seems to remain in a colored drawing of the north facade in which a constant module, presumably 6m, runs along its entire length, including the volume of the changing rooms [Fig. 10]. In this drawing, the two main sheds are still identical in width, unlike in the finished building, suggesting that the whole project may have kept a regular grid up to a certain stage of its development. But evidently this was not the interval system ultimately adopted.

Concentrating on the rectangle of the main body, the modules of the constructed building in this direction follow this sequence: three modules measuring 6m, four 6.25m, and six 5m [Fig. 11]. These modules are grouped in the dimensions of 18m, 25m, 20m and 10m corresponding to the widths of the sheds for receiving bottles (A), washing and filling (B), and milk treatment (C), and that of the expedition shed, with the west volume of offices located above it (F/D). They are even more heterogeneous dimensions than in the north-south direction, and indicate adjustments of greater variety than the previous ones with respect to a regular grid. The new widths of the main sheds are most notable in the sequence, now 25m and 20m (previously both 24m), creating the main discrepancy from the 6m base module. However, the part of dispatch-offices to the west also insists on discord with its two modules measuring 5m, although these already figured implicitly in the preliminary design.

It is clear, therefore, that in the final project the module of 5m is not only reincorporated into the expedition shed, but also expanded to the neighboring treatment shed, which is now 20m. With this, the 5m interval takes center stage in almost half of the dairy plant's main volume. Seen in this manner, it seems as if a partition had been made along the shared line between the filling and treatment sheds. On the right, 5m modules, and on the left, 6m and 6.25m. This 'backbone' was also considered of great importance by Llinás.

In terms of the widths of the sheds, and due to the modular consequences, their new dimensions had to be well considered and based on precise functional requirements. In the one measuring 20m one, as just indicated, a width congruent with the 5m system was chosen. It reduced the 24m width of the preliminary design and, because it needed to be close to 20m, it was adjusted within the 5m module, which, again as just indicated, already figured exceptionally in the preliminary design and was incorporated in the right (west) wing, where the 6m module was waived for the sake of homogeneity.

The 25m dimension is more difficult to justify, since with only one meter less it would have been within the 6m modular system. Again, the different floors of the approved project provide an interesting piece of information [Fig. 05]. They show how the width in the south part of the shed is obtained as a sequence of intervals between supports of 6m, 6m, 6m, and 7m. In other words, the 7m anomaly was introduced as a counterpoint to the obvious distribution in modules of 5m, which would have provided an exact subdivision. Either way, that is how the 25m was achieved, which, it has to be deduced, needed to be the width of the shed, with the 24m of the preliminary design proving insufficient. And this was done using the base module of 6m as far as possible. However, in the same plan and in the north part (below), the total width of this shed was divided into four equal intervals, giving rise to the 6.25m modules. A possible reason for not considering modules of 5m was, surely, that its uneven condition would not fit the division of the shed's axis imposed by the two supports of the sterilization tower.

**Rhythms on Roofs**

A new aspect of rhythmic importance appears in the special modular scheme of the skylights, that is, the separations between the corbels and between the girders of the skylights. The perception of the rhythms of these elements from inside the sheds, and detailed analysis thereof, provides a new example of the care that went into balancing the modular composition of the structure's visible elements.

In this regard, the information provided by the scheme of the roof plan in the structural project report mentioned before is interesting, and corresponds to the approved project [Fig. 12]. The sheds would be divided into six and five sections, respectively, with 4.16m and 4m separations in each shed.[22] Although not all of them appear to be equidistantly distributed in the scheme, in general terms the differences between separations would be visually imperceptible. However, it was not built in this manner, as the sheds were divided into eight and six sections. The resulting separations are 3.125m and 3.333m, somewhat less but also similar to each other.[23] The reason for the change was almost certainly the final decision to introduce intermediate supports in the sheds, which, in the 20m one would imply that, being divided into five parts, these would not have coincided with the position of the corbels. Consequently, in this narrower shed, in its northern part, there is congruence only with the supports in the center, as the divisions in six and four do not totally overlap. This last contrast of subdivisions is a curious rhythmic exception due to the discrepancy between adjacent parts, unique in the entire building. In the roof it gives rise to a subtle overlap between modular schemes, visible in how the tie rods of the corbels, when anchored on the roof of the office section, go beyond their modular area, 'invading' the neighboring field of the offices [Fig. 13].[24]

Finally, the same scheme of the roof offers another modular detail that deserves mention [Fig. 12]. In it appears the eastern (left) zone, divided homogeneously into 4m modules. This is obtained by dividing all the central intervals of 16m by four into four parts, and into three parts the contiguous ones of 12m by three. It is an interesting unifying approach based on common divisibility that would have recovered for the roof the regularity lost in the north-south direction, but would have meant a gap between supports and modulation on the roof, so was discarded.

**The Modular Return of Canteens and Changing Rooms**

The 6m grid was rigorously reused for the protruding volume of canteens and changing rooms, which continues in the walkway connecting with the central body. There are a total of five modules for the walkway and three for the pavilion [Fig. 14]. If the 5m module had been used, it could have been easily linked to the office part, but it seems clear that the 5m modules were insufficient and that returning to a 6m module system was more suitable for the required floor areas. As a consequence, however, this construction appears as an autonomous entity, dimensionally discordant with respect to the grid of the main body.

This part in a very obvious way addresses the clash between modular schemes, which is visually expressed in the rhythms of the facade. There was nevertheless a connection solution worth mentioning, through a small auxiliary volume for the passage to external stairs, 3m wide and located in the northwest corner. With it, congruence is achieved by the dimensional equality of the sums of the opposing modular schemes, in a total length of 18m.[25] It is a curious and unusual rtrick, which makes the axes of the modules coincide in their extreme lines.

There is finally a second point of incongruity that stands out. It is produced by the displacement, in a north-south direction and with respect to the main volume, of the grid of the changing rooms. In that direction, they are both a 6m grid, but they are misaligned [Fig. 15]. However, again a small element seems to act as a connector by placing one of its facades in perfect horizontal alignment. It is the small auxiliary pavilion that accompanies the canteen and joins it at the southwest corner. It gives the impression that this was there to measure the displacement of 2.5m. and that, in its location, it acts as a vestige of the regular pattern. It also seems a very conscious decision that the line of its south facade, continuing to the east, marks the paved boundary of the square patio (P) located between the plant and the canteen.[26]

**Conclusions**

The ideal of regularity that exists in much of De la Sota's work can be seen in the outline of the preliminary design, although it had to be modified in successive stages of development by adapting to conditions that arose during construction. This circumstance, which may seem obvious in any project, deserved closer attention given the significant alterations in the uniformity of the final grid. These changes, whose nature and consequences have been addressed, are also observed in the evolution from project to actual construction. In both, as we saw, there was a dimensional coincidence in terms of distribution and spaces, but not completely in the modular grid. The final grid of the approved project presented frequent interruptions of the grid lines, which corrected as much as possible during construction. [Fig. 16]

Due to the variety of its parts, the modular differences are arguably simply the result of assembling dissimilar functional parts. De la Sota himself pointed out that "each element of Clesa had an extraordinary importance. So each one was studied and they were put together".[27] But, precisely because this is De la Sota, it is hard to admit that even with these conditions, a more homogeneous and inclusive global order would be renounced.[28] On this point, the existence of an initial preliminary design with a uniform modular scheme shows that, at least from this stage on, and despite the previously quoted statement, the process followed had more to do with successive adjustments and adaptations based on a regular initial scheme, than with the sum of different parts. Due to the process and difficulties posed, the Clesa dairy plant is perhaps De la Sota's most difficult work with respect to that underlying ideal. The isotropy is not solved, but there is a constant dialogue between the desired regularity and the accommodation of the parts.

In the same way, the specific solution for the roof can be related to the modification of the grids and the interesting change from binary to ternary subdivisions. In reference to the designs adopted for the roof, there have also been suggestions regarding their originality and position in the context of solutions common at the time. The concept of balanced corbels received special attention during that period. This analysis does not claim to be exhaustive, leaving parts like the milk receiving shed uncommented on. The small deviations caused by the expansion joints, the duplication of columns, the differences in their sections and forms, and other details required for effective construction of the structure have not been considered either.[29] We do not, however, believe them relevant to the general approach taken here. As a milestone in De la Sota's work, the Clesa dairy plant seemed to call for a study like this one, pursuing a deeper understanding of his dimensional exceptionalities, because for De la Sota, rhythms and modulations constituted a fundamental warp thread in the work of an architecture project.

1. T. Couceiro. "Learning with Alejandro de la Sota." Conference at the COAG Delegation in Pontevedra (20 December 1918).

2. J.B. Rodríguez Cheda. *Alejandro de la Sota. Construction, idea, architecture.* COAG. Santiago de Compostela, 1994, 287.

3. T. Couceiro, op. cit.

4. We can highlight here the projects of the Delegations of Finance of A Coruña (1955) and San Sebastián (1955), the Civil Government of Tarragona (1957 competition) and the Maravillas school (1961), with 6m square grids – like the initial design for Clesa – in the last two and very close to these dimensions in the first ones.

5. J. I. Ferrando Álvarez-Cortinas. *Espacios máximos con recursos mínimos* (doctoral thesis), 2015. Includes a large bibliography specifically related to the dairy plant.

6. It was, for example, used by De la Sota himself in a previous version of the Tabsa workshops, as recorded in his digital archive.

7. Llinás addressed this stepping in the mentioned meeting, emphasising the unusual nature of the discontinuity between sheds, which is nevertheless justified by the obligatory layout by levels of this type of installation. Its impact on the height difference between the roofs of one shed and another is one of the surprising elements of great spatial interest in the interior.

8. Ferrando, J.I., 206, mentions both cost reduction and the impossibility of transporting beams greater than 21m long as possible causes.

9. A strip of 4m also exists that does not fit the module either. In the project it seems to emerge as a service band inserted to solve some minor technical and distribution spaces. Its exceptional character differentiates it from the rest, even though, in any case, it is still a fraction, 2/3, of the 6m module.

10. Manuel Ramos Amieva, agricultural engineer, and Alejandro de la Sota, architect. *Memoria, Proyecto de Central Lechera en Madrid*, Madrid, September 1958, 18.

11. The monographic edition "Prefabricación I," *Informes de la Construcción*, no. 113 (1959), offers an overview of what had been built in Spain up to that time with concrete saw-tooth roofs.

12. Amieva and De la Sota, p. 19.

13. Amieva and De la Sota, p. 18.

14. Armando Melis, *Gli edifici per le industrie* (Turin, 1953), 81, 189, and 190, and Walter Henn, *Buildings for industry,* vol. 1 (London, 1965), 109 (original ed. 1961).

15. Alfonso Corral López-Doriga and José A. Fernández Ordóñez, "Cuatro ejemplos de prefabricación de hormigón pretensado" *TA. Temas de Arquitectura,* n. 71 (1965): 9-12 and Manuel Burón

Maestro and David Fernández-Ordóñez Hernández, "Evolución de la prefabricación para la edificación en España. Medio siglo de experiencia" *Informes de la Construcción*, vol. 48, no. 448 (March/April 1997), 25 and 27.

16. A hangar for Trans-World Airlines (former TWA) in Kansas City, another at New York International Airport, and a third at Idlewild, later renamed John F. Kennedy International Airport. Charles Payne, "Folded Plates Roof New Hangars", *Architectural Record*, no.3 (March 1958): 223-27. Later came Hangar III in Frankfurt, inspired by the previous ones. Apel and Beckert, "Hangar at Frankfurt-am-Main Airport," *Informes de la Construcción*, vol. 15, no. 145 (1962).

17. "Prefabricación II," *Informes de la Construcción*, no.114 (1959). Confirmation of authorship on file CEHOPU FC-095.

18. The clearest example is the Pontevedra sports center, although on a smaller scale this idea also materialized at the same time in elements like the washbasin supports in TABSA.

19. Alan Windsor, *Peter Behrens. Architecte et designer* (1981).

20. Henn. *Buildings for Industry*, vol. 2, 247 and "Il nuovo stabilimento di Torino," *Fatti e notizie. Mensile internol per il personale della Pirelli società per azioni*, year V, no. 2-3 (February–March 1954): 9.

21. Henn. *Buildings for Industry*, vol. 1, 88 and web ref. Volkswagen.

22. It was with these separations that the model of the project was made, which can be seen in the division into three parts of the window of the emerging tower, with four openings in the constructed building.

23. It is a striking coincidence that the separation of 3.125m also appears, and is repeated three times, in a sketch annotation for the roof of the unexecuted, 1963 competition project of the National Delegation of Physical Education and Sports. The system of cable-stayed corbels (which he calls gulls) and central skylights is also used, this time symmetrically. A. de la Sota Foundation Archive.

24. Part of this effect has subsequently been hidden by a roof added over the tie rods.

25. As can be seen in photographs of the finished work in the archives of the De la Sota Foundation, this small projecting body seems to have had a clear intention, initially being differentiated from the rest by means of the dark blue paint of the upper slab edge.

26. The alignment corresponds to what was built, the boundary drawn in the project having been modified.

27. A. de la Sota, "Alejandro de la Sota. Simple justification of his work" Conference in A Coruña, 1986.

28. Due to his recognized musical aptitude, it is highly probable that this ideal of regularity was also associated with an underlying musical conception of architecture. From this it could be derived that all architectural composition should, as in music, be based on a well-defined rhythmic base.

29. There is also a displacement, albeit not visible, in some supports under the washing shed, due to the foundations of the machinery.

Clesa dairy plant
Alejandro de la Sota
Structural grid
Modern Spanish architecture
Industrial architecture