1986 TECHNICAL REVIEW SUMMARY

Lassa Tyre Factory
Izmit , Turkey

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Date of Completion: October 1977

I. OBJECTIVES

The prime objective of the architect was to realise a project of this magnitude and quality with local resources. These local resources were his own ingenuity in meeting rigorous, American specifications and in pushing the local building Industry to deliver the quality demanded. This has been successfully accomplished.

II. DESCRIPTION OF SITE

The factory is located 6 kilometres (4 miles) east of Izmit on the main Istanbul-Ankara highway. Izmit is a major industrial town in Turkey, is close to a harbour, and has railway connection with the rest of Turkey.

The site is flat and measures 870,000 square meters (9,360,000 Sq.ft. or 8.7 hectares or 21.49 acres); the single storey plant covers only 12.6 percent of the site, yielding a rather pleasant environment. As industrial towns go, the area surrounding the Lassa plant is quite nice, and trees and grass are more in evidence than are industrial structures. The reason for this is, of course, that large industrial corporations have located their factories in the vicinity, and their profitability and industrial culture is of a much higher order than that of entirely local producers.

Adjoining factories are owned by Goodyear and a subsidiary of the Lassa holding group called Kordsa, which produces cords for the tyres produced

at Lassa. The architecture of the adjacent industrial structures is somewhat non-descript, i.e. asbestos-cement sheet roofs and walls covering sheds, saw-tooth roofs mixed with more solidly constructed administrative offices, etc.

III. DESIGN AND CONSTRUCTION

Architect's brief and functional requirements

The architect was required to cover about 80,000 square meters (860,800 Sq.ft.) of floor area with rather large bay sizes (12 x 16 meters or 36.57 x 48.76 ft.) in a very short time period. These requirements for the internal environment, the bay size and the time schedule, were severe constraints (compared to requirements for traditional industrial structures in Turkey), and the architect's solution reflects many novelties. The architect's brief was, therefore, working simultaneously at two levels. At the physical level, the programme of requirements was as follows (based on completed areas):

		Sq. Meters	Sq. Feet
1.	Main Factory Building		
	Ground Floor	80,528	866,481
	First Floor	5,180	55,736
	Second Floor	1,150	12,374
	Third Floor	390	4,196
	Subtotal	87,248	938,788
2.	Boiler shop	5,466	
3.	Lime Storage	70	
4.	Tyre Test Building	845	
5.	Cement House	196	
6.	Truck Scale Building	15	
7.	Gate House	100	
8.	C.B. Silos	425	
9.	Fire pumps Building	25	
	Subtotal	7,142	76,847
10.	Administrative Block	2,375	
11.	Social Building	3,758	
	Subtotal	6,133	65,991
12.	Ware House	7,687	82,712
Total		108,210	1,164,339

At the level of ideas, the architects were required to innovate, as they were responsible for a building which had no local precedence. The requirements for the industrial process were clearly defined by Hale and Kullgreen (an engineering firm in Ohio, U.S.A., appointed by the American collaborators, Goodrich). Thus, the realisation of the design of spaces was not a time consuming exercise. The challenge lay at the level of ideas, where local Turkish building materials, contractual skills, and engineering expertise were required to deliver a product vastly superior to the counterparts of industrialised Turkey. Thus, much of the consultant's energies were used to resolve structural systems, construction techniques, and realistic time schedules.

Evolution of Design Concepts

User requirements

The American collaborators, Goodrich, provided the technical expertise which made the plant possible. All machinery, as well as the production process, are imported, and, naturally, the layout, the internal specifications, and the spatial requirements were rigidly outlined by Goodrich. Turkey or no Turkey, there was no question of compromise on this issue. Hale and Kullgreen acted as the Goodrich engineering consultants to define the process layout diagram, the bay sizes, heights, gantry locations, etc. The overall "L" shape of the process area emerged from process layout requirements, and possible requirements for future expansion in some areas.

Such advanced process methods implied a correspondingly high level of workers' and administrative facilities, which were also part of the brief.

The plant is highly automated and, during one shift, is operated by only 324 persons, which yields an average of 340 square meters (36,584 sq.ft.) per worker on the shop floor, a ratio which is not at all typical in this part of the world.

To summarize, the user required was an extremely sophisticated shell to contain an imported and highly automated process that could be erected in record time.

Architectural response

The user is the family controlled Sabanci Holding Group, one of the largest privately controlled empires in Turkey. The architectural conception of the project is, therefore, clearly conceived and achieved at a very high level, in unity with the power of this industrial group. That the architect was able to respond with such enthusiasm and success while being paid a meagre 1% fee is indeed remarkable. True to his highly professional approach, he produced a series of eight studies showing alternative ways to span a 12 x 16 meter (39'-8" ft x 52'-10" ft.) bay. The selection of an appropriate system would determine the construction, detailing and architectural conception. All eight studies projected implications on the elevation of each system (discussed below). The final choice of a pre-cast concrete system was then moulded into a very elegant architectural statement, in terms both of construction and aesthetics. Thanks to well established Turko-German relations in architecture, which date from the 1920's, the handling of concrete and precasting was of a rather high order, and the architects therefore realistically assumed that a pre-cast technology could be effectively used to deliver the building on time.

The use of pre-cast wall panels also permitted horizontal expansion without much ado, as the panels can be removed and re-used.

In the administrative building, which is in poured concrete, a waffle-slab roof system on a regulated grid makes internal planning rather flexible, and the users constantly move their aluminium and glass partitions up and down the waffle beams.

Formal aspects of the architecture

There is no doubt that to see and experience this project is to realise how ideal industrial structures should be constituted in this part of the world. There is nothing traditional here; but neither should we be searching for it. The architectural aesthetics and the use of formal architectural elements, such as the round window, the curved roof parapet edge, the fibre-glass sky lights, and the aluminium glazed administrative building, all belong to a European tradition that has employed pre-cast technology with great skill. This is a straighforward industrial structure, free of any pretence of making a local, cultural statement.

It addresses itself to the sophisticated manufacturing facilities commonly found in highly industrialised parts of the world. In choosing his images and motifs, the architect is clearly identifying with those facilities, and is saying that Turkey can match the best in any part of the world.

Structure, Materials and Technology

The building technology used in this project in 1975-1977 is, in a way, the culmination of the development of indigenous industrial building technology in Turkey. When, in the 1960's, Turkey began to expand its industrial base, factories were brought in as packages from outside, and there was very little Turkish contribution to the technologies used in, say, the Izmit Paper factory or the State Textile Factory, where German and Soviet expertise were crucial. Even as late as 1963, the Chrysler Truck Assembly plant came in as a package, and 6000 square meters (64,560 sq.ft.) of space were covered with imported building systems. The Chrysler plant was handled at the local level by the same architects, and over the next twelve years (1963-1975), these very same architects increasingly developed local building technology to cover space for Northern Electric of Canada, German pharmaceuticals, and, eventually, Turkish industries in spinning selected them. Thus, when they handled the Lassa Tyre factory in 1975, they already had behind them adequate experience in structure, material, and technology to offer the user a choice of eight separate structural solutions.

I was able to obtain only seven of the eight drawings for these choices, and they were :

System	Bay Size	Cost per sq.m. in Turkish Lira
1. Steel truss with north light and precast roof filler	16m x 8m	721
2. Steel truss with overhead Polyester covered openings, steel dacking, and insitu concrete	16m x 8m	655
3. As in 2 above, but with precast roofing	16m x 8m	657
4. Pre-cast concrete slabs with overhead polyester covered openings	16m x 8m	665

(selected)

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System	Bay Size	Cost per sq.m. in Turkish Lira
5. Traditional saw tooth northlight steel trusses with cement sheet roofing	16m x 8m	795
6. Steel truss with overhead polyester covered openings, steel decking, and insitu concrete (variation on 2)	16m x 8m	770
7. Steel truss A-frame type, with concrete gutters and cement sheet roofing		704

The costing clearly shows that the solutions using steel trusses were generally more expensive. However, even though the selected solution was not the lowest in price (TL 665, as apposed to TL 655 for option 2 above), the humidity of the process (due to steaming, etc.), and the need for a more sophisticated internal environment gravitated the final choice towards No. 4 above - a pre-cast concrete system.

The final solution is comprised of :

- Prefabricated columns forked at the capital, to receive the -

- Prefabricated beams spanning 12 meters, supporting the -

- Double T pre-fabricated and pre-stressed roof panels spanning 16 meters, joining at the edge the -

- Pre-fabricated quarter round edges that form the junction between the wall and roof avoiding a parapet.

- Pre-fabricated fibre-glass polyester coated half round tubes to cover the roof lights.

The extremely careful detailing involved in such a massive pre-casting job was done with the aid of a publication by the Swiss Engineer Koncz ("Manual of Precast Concrete") and by his personal visit to the architect's office during the design stage. The façades of the main process area are in the original exposed concrete, whose present condition is rather good considering the industrial environment and 10 years of use. The administrative building was also to have been done in exposed concrete, but has now been painted to give it a much neater and smoother appearance. The other relevant information is as follows :

Factory

Floors	Concrete with hardener
Ceilings	Exposed concrete
Ancilliary Structures	Steel trusses fixed to columns to carry gantries, cables, etc.
Insulation	Parolite concrete (foam type) used on the inside of the wall pannel (3cm thick) and over the roof panels to obtain the required slopes and insulation.

Office

Floors	marble, tarazzo, vinyle and carpet
Ceilings	Concrete, painted white
Windows	Aluminium sliding

Construction technology :

The architects prepared rigorous specifications for contract in which the central idea of the punctual delivery of the pre-cast elements was the crucial issue. 13 contractors bid and much doubt was expressed about the realisation of this innovative design by contractors who bid. GAMA, who had a pre-cast concrete plant in Ankara for the production of beams and columns for standardised sheds, won the contract. The contractors were part of an industrial combine and hence had the proper background and technical expertise to implement the project. The contractor willingly set up a pre-casting yard at the site to produce the various pre-cast elements. The moulds are still at the site, though a little rusty for their age.

The polyester fibre-glass roof lights were made in Istanbul and transported to the site.

Building Services and utilities

The architect and his electrical, structural, and plumbing consultants worked together very well. The level of natural lighting in the plant is excellent. The overall environmental temperatures vary enormously from area to area, depending on those parts of the process that do or do not release heat. Heaters have been provided on at least 80 columns to boost the internal temperatures in winter, but it would be stretching the point too far to assert that lighting and heat levels had been theoretically calculated and then re-measured. The management assured us that their power bills were low because of adequate daylight, but there is no basis for this and no comparisons are available. It is enough to state that the quality of daylight within the factory is excellent.

The users are pollution conscious. Domestic waste from the toilets goes into bio-separators which were set up in 1980, and solid waste is given to a local contractor who sells it to the villagers as manure; waste water is chlorinated and put out as treated waste. There is also an oil separation process where the wastage of oil resulting from the manufacturing process is extracted from its solvent, packed in barrels, and sold via contractors as a sort of primitive industrial fuel.

Origin of Technology, material, labour force and professionals

Entirely Turkish, with a little help from a Swiss manual and engineer (Koncz).

IV. CONSTRUCTION SCHEDULE AND COSTS

History

Lassa A.S., the user company controlled by the Sabanci Group, was incorporated in 1974 and concluded a manufacturing licence and engineering agreements with B.F. Goodrich USA (International Division). The plant, which is the largest tyre factory in Turkey, began production in January 1978.

Date of Goodrich - Lassa Contract : 1974, 30 May
Ground breaking : 1975, 24 July
Official inauguration : 1977, 30 October

When, in January 1976, Lassa began production, it was the most modern tyre plant in Turkey; it still is. The plant makes pneumatic tyres, tubes, and flabs, and re-treats tyres.

Additions have been made to the plant, the workshop, the laboratory and circulation areas (a covered passage connects the office to the process area).

Costs and Finance

The total cost of construction in 1977, was 230 million Turkish Lira (at a conversion rate of TL 20 = US$ 1, the total is equivalent to 11.5 million US$). Financing was done through a loan from the Exim Bank of the U.S.A., as Turkey did not have adequate foreign exchange reserves. The loan for the project amounted to some 50 million US$, to cover the import and fees of Goodrich technology.

V. TECHNICAL ASSESSMENT

Functional Assessment

There is no criticism from anybody about this project. One employee admitted (over a glass of wine) that she had switched from Goodyear (rivals across the road) and was much happier with the physical and social environment of Lassa. Modernisation of equipment and facilities is ongoing and continued. A new IBM main frame computer has been installed in the administrative building, and the required changes in partition layout were carried out without any problems. Contrary to fears, the fibre glass rooflights have not yet presented any problem, and have an expected life span of 15-20 years. In short - no problems, only happiness.

Ageing and Maintenance

187 workers are utilised on maintenance. The user spends about 60 million Turkish Lira a year on maintenance of the factory premises (excluding any expenditure on the plant). For this reason, the factory

is excellently maintained. The process area is ageing very gracefully if one considers its industrial use, and the administration building gets periodic face-lifts of concrete colour paint to smarten it up. The management assured us that it was not a problem. From the figures obtained from the factory manager, the following picture emerges :

1. Energy consumption	1978 - 100	M.BTU/lbs product
reduced to	1985 - 38	M.BTE/lbs product
2. Scrap as a % of	1978 - 100	units
material used	1985 - 24	units
3. Productivity	1978 - 100	lbs/man hour
	1985 - 204	lbs/man hour

The success of the venture, its reduction in energy consumption per unit, its increase in productivity in lbs/man hour, is simply the economics of scale getting into gear. With minor expansion, the selected production figures below demonstrate remarkable growth :

1978 -	477,482	units
1982 -	848,943	units
1986 -	2,354,941	units (expected)

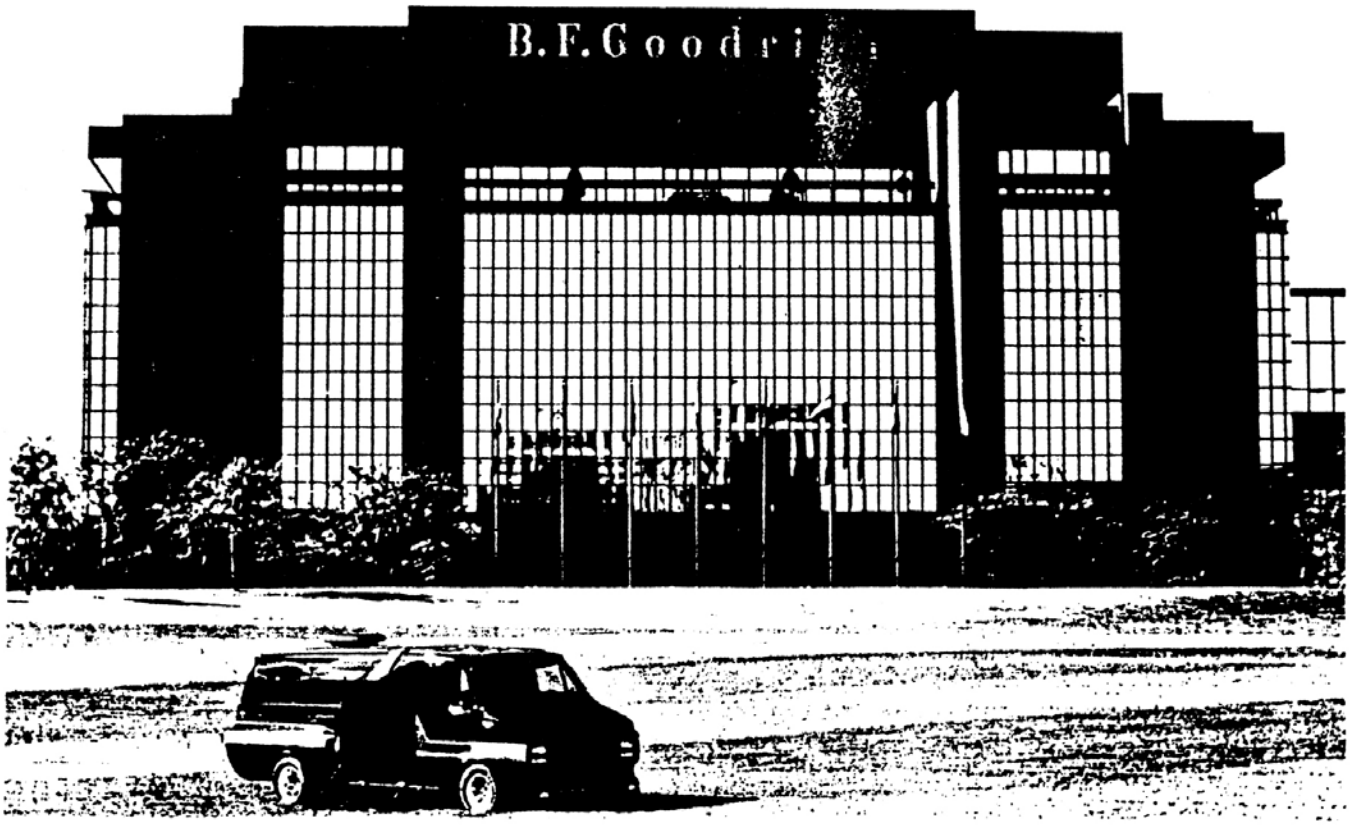
It is clear, therefore, that as an industrial production unit in the course of its 8 years of existence, it has achieved spectacular commercial successes.

Costs

The architect gave a finished cost of TL 2,840 per square meter, which is equivalent to US$ 142 per square meter (TL 20 = US$ 1). Apparently, official statistics give the corresponding figure for construction of industrial buildings at the time as US$ 73.16 per square meter. But this difference must be considered suspect because, for the specifications and facilities provided at Lassa, no Turkish equivalent is available.

VII. AESTHETIC ASSESSMENT

There is no doubt that the owners of the factory (The Sabanci family), the collaborators (B.F. Goodrich), and the Architects (Dogan Tekeli and Sami Sisa), all had the clear intent to produce an industrial building with a strong architectural image that draws on sophisticated technology. The Goodrich Headquarters building in the United States, shown below, with its mirror glass and green lawns, reflects the image of the owners:



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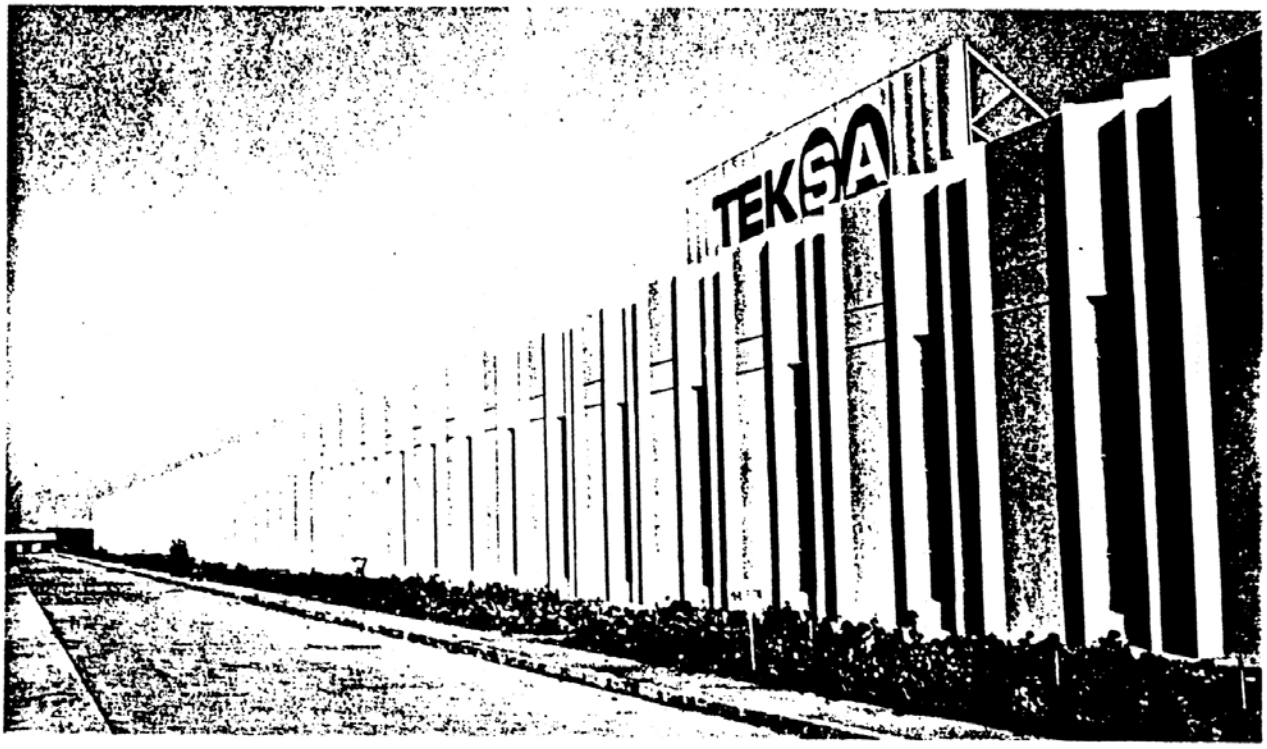
Similarly, other buildings in the Sabanci Group are also sophisticated industrial environments within the Turkish industrial landscape, as shown below :



For the architect, this project was part of the continuing and consistent statement of their beliefs about contemporary Turkish architecture. Dogan Tekeli and Sami Sisa graduated from the Technical University at Istanbul in the early 1950's, when the mood of Turkish architecture was agressively looking to the West for new solutions. The Istanbul Hilton (1952) had already shown how American standards could be imported into the country to achieve a cultural leap. Tekeli and Sisa have consistently rejected the idea of historical or ethno-cultural forces exerting any influence on their work. They did not "shy away from the daring dimensions and technical virtuosity that one finds in the architectural experiments of wealthier countries".

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The Lassa project must, therefore, be seen in the context of these beliefs about the role of Turkish architecture. The question asked of such architecture by Turkish critics is whether or not it is "culturally and economically fatal for the development of a sensible, appropriate, architectural behaviour interpreting the real potential of the country."

Date of Review : February 19-26, 1986

Technical Reviewer : Romi Khosla
Photographer : Argun Dündar
Invaluable Help : Sibel Bozdogan
Date : April 9th, 1986

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