NOTES & NEWS

THE FRENCH CONSULTING ENGINEER

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What is consulting engineering ?

Here is the nearest thing to an accurate definition of the word as it is understood by French practitioners:

" Consulting engineering is the sum of all operations preceding or accompanying the execution of any technological project in so far as they are distinct from the actual performance of the work to be done ; the word " project " being understood in its widest sense, as being applicable to individual objects (such as machines, or bridges or aqueducts) as well as developments and extensive undertakings of an agricultural or an industrial character, including developments of large areas, such as territories or cities, along with the substructural systems required in that kind of developments—in a word to all works of man that help to raise the standard of human living ".

Among preliminary tasks are included:

1.—The surveys, research and investigations for the purpose of determining the economical, social and financial conditions in the country, territory or other populated area in which a development problem exists ;

— to inquire into the ways and means for improving them ;
— to determine the character, the order of sequence in which operations are to be conducted so as to bring about a harmonious progression towards the end in view at the least cost ;
— to set up a programme-plan of what is called pre-investment.

To be examined, among other things, are such matters as: problems relating to population and the social order, to the education and training of the working class, the artisans and the farmers as well as the higher échelons both industrial and administrative ; problems of housing, of sanitary arrangements, of agriculture (specifically soils, water power, land improvement, methods of crop production and the like; problems of power resources, of geological and mining surveys, of transport and communications, of industrial possibilities, of trade and much more besides.

2—(*a*) Still in the realm of prelminaries are surveys having to do with the preparation of a specific undertaking, so as to obtain the fullest grasp of the problem, of the extensiveness of the job, the while bearing in mind of the economic and social circumstances and of the best possible mode of financing the whole undertaking—surveys which take into account the various possible alternatives, the various processes that could be employed and the reasons for preferring the one recommended, outline of a draft-project, with figures indicating probable costs, and which foreshadow the conditions for putting out the contemplated commodity in the given state of the market.

(*b*) The main features of the draft-project having been decided upon, the next stage will consist in drawing up the general plan, in specifying just what the needed equipment must be fit to do, in fully outlining specifications before calling for bids, with mention of standards of material and conditions of delivery, meanwhile carrying forward in fuller detail the aggregate estimated cost as well as an estimate of probable maintenance charges and return on the investment.

All the peliminary surveys having been accomplished and the money to finance the project secured, the head of the undertaking may pass on to the execution phase, but this is not to say that the consulting engineer is through. The concomitant operations are only now going to begin. These are:

1.—Comparison of the offers received with technical counsel's opinion, preparation of contracts with supply firms as prescribed by the head of the undertaking, drawing up of execution plans.

2.—Supervision of the work to be done on the contractors' premises, taking delivery of equipment and supplies, checking on the spot the civil engineers' work; assembling of machines while constantly keeping in mind the importance of coordination among the different firms so that the work might be carried on and out without any slip-up, without any hiatus in fitting together the parts supplied by the different contractors and without any delay in the time-limit agreed upon.

3.—Working out the details of getting the project into operation; participation in laying down the operating orders; helping the management in getting things going on and in posting the staff.

Such are by and large the goals and tasks of the consulting engineer. They are, as will have been seen, a long and complex series of activities which are not exclusively in the province of the engineer, which go far beyond such limits and call into play also the economist, the statistician and many other specialists including financiers.

This somewhat chronological exposition would not be complete, however, if we did not mention a lateral form as it were of what the English-speaking countries call "Engineering Research". It is generally performed in France by institutes of technical research, by specialized laboratories as well as, now and then, by *technical research bureaus*, which either as part of a prearranged programme of their own, or at the request of private firms or communities carry through surveys, analyses, researches with a view to their being applied to new techniques or to improve existing processes, for the production or the utilization of new and improved substances.

On the other hand, we in France do not regard personnel management (labour recruitment, psycho-technical tests, division of labour, type of remuneration and so forth) as falling within the province of the consulting engineer, any more than we would so consider business management, salesmanship and similar specialties which with us in France belong in the sphere of specialized organizations.

As for market surveys, we should be tempted to include them in the sphere of the consulting engineer only if and when they are a part of a more general survey preliminary to an investment project, but as lying outside it when their purpose is purely commercial.

In the preceding pages we have cut a wide swath in the field of what might be called the consulting engineer.

We would like now to define more fully another form of engineering—"contract-tendering engineering", the end and goal of which is the delivery of a plant "key in hand", that is to say, all ready to run, and in case the tender is accepted by the head of the undertaking, this species of engineering having now become "practical application engineering", takes up the matter of perfecting the execution plans, the coordination of the wok of the different contractors and (if desired) of providing technical assistance after the plant has been delivered.

Whereas in France, the profession of consulting engineer is nearly always exercised by a research bureau independently of any business concern, "contract-tendering engineering" is as a rule carried on either by research bureaus forming part of or affiliated with an equipment manufacturing concern or by public works contractors, or, again, by large concerns such as chemical corporations. It happens also, however, that non-affiliated research bureaus (consulting engineers) tender contracts in combination, if need be, with groups which in their opinion offer the best possible chance of carrying through the particular operation.

PRINCIPAL AIMS

The realm of the consulting engineer is as we see so vast that any man who undertakes to create something with a bearing on the economy might call himself a consulting engineer. It is, therefore, important to make clear that the main rôle of the consulting engineer is to conceive a made-to-measure job-idea and chiefly to coordinate the activities of all the concerns taking part in its execution.

It would be difficult to overemphasize this rôle of "orchestra conductor" which the consulting engineer has had to assume in the modern world with its varied and complicated tasks and in the absence of which the assembling of the different parts of a construction job would be in danger of being lopsided, overdone in one direction, inadequate in another; in the absence of which also, costly changes might often become necessary, with teams of workers of different backgrounds getting in each other's way, interfering with one another and exposing the progress of the work to considerable delays.

This rôle demands a thorough acquaintance with all aspects of the given problem, of the modern techniques required for its solution, full knowledge of what industry is or is not in a position to provide, a personnel capable of operating as a team and trained for the job, highly developed gifts of adaptation to changing conditions.

THE CONSULTING ENGINEER IN FRANCE

We shall not dwell too long here on consulting engineering as part of organized enterprise, though its importance is by no means to be underestimated. The number of trained specialists employed in such concerns and the things they are capable of doing are enormous; but that aspect of engineering is too well known. And although it is quite able to offer technical assistance of great value in certain fields, we believe that it is chiefly from firms of consulting engineers unidentified with any particular manufacturing concern that increasing technical cooperation is likely to be forthcoming out of France.

The main facts about consulting engineering in France are the following:

1.—The number of trained specialists in these unattached French research bureaus is estimated to be about 8,000.

2.—The size of the research bureaus varies a great deal. The largest employ more than a thousand trained specialists, the smallest but a handful; the average is about 70.

3.—Some bureaus are specialized—in general economic surveys, for instance, in planning, in agricultural surveys, in water power, dams, electric power, geological, mining or petroleum research, and in many other fields. Other bureaus encompass a broader scope, while still stressing an interest limited to civil or mechanical engineering, or some other restricted field.

4.—The organizations of this type may roughly be divided into three classes:

(*a*) Those in which the State or a State-controlled corporation plays, through its agents, a more or less important rôle in the board of directors;

(*b*) Those in which a manufacturing company or a business bank plays such a rôle;

(*c*) Those which have no such connections at all.

Irrespective, however, of the class to which they belong, these concerns operate under certain conditions:

1. They respect the usages and obey the rules governing the liberal professions;

2. They conform to a code of honour and undertake to comport themselves with complete fairness and integrity toward their clients and their clients' interests; they undertake with regard to the work entrusted to them not to accept any other remuneration than the one agreed to and not to accept from any third party any advantage, commission or compensation;

3. They are ready to work for any client, whoever he may be, without discrimination;

4. They fulfil their professional engagements independently of any third party—purveyors, contractors, builders;

5. Their remuneration is in the form of fees.

We believe that the idea of *formal* independence is of minor importance, and that the only independence that matters is the kind expressed by deeds. The client has in any event the choice of demanding that his consulting engineer submit a pledge from the manufacturing concerns with which he may be connected to forego any allocation of contract resulting from the surveys entrusted to him.

It would take us far beyond the limits of this article to mention even the principal French consulting engineering firms.

We desire, however, to call attention to the fact that at our suggestion a work in 2 volumes entitled "*L'Engineering français*" is going to appear in a few months. It is written in three languages and will be published by the SOFREDOC Publishing Company, 11 Rue de Miromesnil, Paris.

This work is to *list all the larger research bureaus* in the different spheres which are in a position to offer good references outside of metropolitan France. The first volume will name the firms of consulting engineers and kindred concerns while the second volume will mention all the other research bureaus generally affiliated with manufacturing companies.

We expect moreover to publish articles in this review about the principal research bureaus in the various fields along with the main projects which they have brought into being.

THE CONSULTING ENGINEER AND TECHNICAL COOPERATION

From the very definition of the word, consulting engineering, especially of the autonomous kind, seems to us to be an important instrument of technical cooperation.

Technical cooperation, to be sure, addresses itself constantly to technical experts who carry out independently a variety of partial engineering commissions. This way of operating offers, of course, the advantage of being more economical than is resorting to research bureaus, and may be valuable in purely preliminary surveys to rough-hew a problem, indeed to prove that a problem exists, and to search out the ways and means to state it properly.

But once that stage has been passed it seems evident to us that given the multiplicity of angles from which such a problem must be examined, requires the services of a team accustomed to working together and capable of carrying out from start to finish the preliminary as well as the concomitant research leading to the fruition of the projects needed by a country in process of accelerated development.

In our opinion, moreover, it would seem to be in the interest of the assisted country that certain preparatory errands be entrusted not to be unattached experts but to members of a research bureau or of a group of bureaus covering all the disciplines entering into the problem in hand. For this manner of going about it makes it possible to arrive more speedily at the best concrete solutions, to a more coherent development of the operation and to that vital cooperation of data and questions related to the central problems.

That is why we think that technical cooperation in the form of surveys and research is bound to grow in a big way at the expense of the unattached experts' missions. To be sure, it is seemingly more expensive; but we are convinced that well-conducted surveys play a vital part in economy and in making investments that pay.

We find, indeed, that if many investments here and there in the world fail to come up to expectations, the reason is to be found in the inadequate training of the men required to make the fullest use of them, or because supplementary investments have failed to be carried on at the same time, or for other reasons that invariably result from inadequate research. Attempting to save expense by having surveys carried out by incompetent organizations often turns out to be downright wastefulness.

We may add that the French consulting engineer does not claim the right to dictate to his clients the use of exclusively French methods. He is on the contrary most careful to recommend, in keeping with the client's interests, whatever foreign techniques and processes seem best adapted to the job in hand.

The French consulting engineer, by working in close cooperation with the native population, is in a position to make a very considerable contribution to the vital problem of aiding in the harmonious and rapid development of the countries most in need of such development. This is so because of the real ability and adaptability of its engineers, their human understanding, their wide experience in France, abroad and in the lands which once belonged or now belong to the franc area; this is so, also, because of the private firms, the nationalized companies and the government departments which bring directly or indirectly all their experience to the countries in process of developent; and this is so, finally, because of the consulting-engineering firms, both those of world-wide reputation and those more recently organized with their excellent staffs.

FRENCH ENGINEERS AND ENTERPRISE MAKE

— *MONOTRACK ELEVATED FOR CROWDED URBAN AREAS* —

To the ever-mounting problems of big-city clutter and traffic, French engineering and enterprise have come up with an excellent answer: Streamlined cars suspended from an enclosed monotrack.

The cars carry up to 123 passengers in safety and silence at average speeds of more than 60 mph. The system offers a modern and economical means of transport that requires an absolute minimum of ground and air space, and only enhances the functionally smart appearance of contemporary urban areas.

Interested U.S. Observer

Watching the first public demonstration of the new-style " elevated " in France late this winter was San Francisco's Mayor George Christopher. And after witnessing its fast, smooth dourse over the mile-long line put up at Châteauneuf-sur-Loire, near Orléans, Christopher said he was enthusiastic about it, and that it was the sort of thing he has in mind to connect San Francisco with its outlying suburbs.

The Builders

The designer and builder of the system is " Société Anonyme Française d'Etudes de Gestion et d'Entreprises ", a productive collaboration of 18 top French enterprises, including such companies as "Alsthom", "Michelin", and "Renault".

Their first studies of the need and the possibilities showed that underground urban space was scarce and construction of underground transport, in any case, almost prohibitively expensive ; that street and highway space was already terribly congested ; and that the only space was already congested ; and that the only fruitful move would be "toward the sky". And they found that this had proved an unpopular direction for urban transport to take, since previous elevated systems had involved heavy, ugly structures which shadowed the streets below them, were intolerably noisy, and generally had blighted lives and property values in the neighbourhoods served.

So, together the French firms and their technicians worked for years on the problem. They carried out extensive research and test on all

kinds of aerial possibilities before rejecting support of a car on a rail or track in favour of suspension from a track, since they found this eliminated instability and the difficulty of taking curves.

The Track

Their track, as finally perfected, consists of a hollow, electrically-welded Martin steel beam, which was found most economical and stable. And, said the French engineers, "the strength of this construction has a happy consequence for the esthetics of good city planning" since it allows the relatively thin concrete-covered steel supports to be placed 97.5 feet apart. Thus the ground-level encumbrance amounts to a diameter of less than three feet of these well-separated points. And so, it is believed the transport line can be set up without much difficulty in the middle strips between divided highways, or next to side-walks.

" This system ", the engineers point out, " has the added advantage of hiding the less-than-beautiful bogies in the track ; protecting the rolling mechanism, the power supply and signal lines from the weather ; and providing an extra muffler for the very low original noise caused by the rolling of the bogies ".

The Rolling Car

The car hangs from two bogies, each with four autosize vertical wheels and four small horizontal building wheels which run against the inside walls of the track. All these wheels are rubber-tired (as are the trains on certain of the main subway lines in Paris).

Each bogie comprises two traction motors which operate on a tension on 600/750 volts and develop power of 93/115 h.p. each. It is thought, however, that these may be replaced by 140 h.p. motors.

A steel security rim prevents any serious disturbance in the unlikely event of one of the tyres blowing out. There is a double brake system—pneumatic, and rheostatic (action on the motors).

The Car

The aluminium car now being used on the Châteauneuf-sur-Loire demonstration circuit rather resembles the long, slim body of an airplane. It is 57 feet long, ten feet wide and ten feet high. There is room for 32 seated and 91 standing passengers. The weight of the empty car, including its bogies, is 16 metric tons.

The Running

The suspension system joining the car and the bogies is a compressed-air-cushion type, which along with the rubber-tyred wheels provides exceptional operating comfort and lack of noise.

Transversal stability is assured by an automatic mechanism.

The lightness of the car, the traction supplied by its rubber tyres, and the power of its motors permit rapid acceleration, high cruising speed, and quick slowing down.

Because of the frequency of the cars (one every 90 seconds) and the speed at which they would travel in any commercially operating system, the latest-best in safety control is imperative. Therefore, the signals on the line are reproduced in the engineer's cabin ; the emergency brake goes on automatically if a signal is passed ; and the engineer is in constant telephonic communication with the traffic despatcher on his line.

Cost

All-inclusive cost of this new-style elevated comes to between approx. 12 to 15 million New Francs (NF) per kilometer (6/10 mile). This compares with a cost of between 70 million NF and 100 million NF per mile of conventional-type subway lines.

Market

The demonstration circuit at Châteauneuf-sur-Loire already is a " must " for city planners and officials, and the potential market is expected to be big.

THE FRENCH MONORAIL

Harmonious town-planning, which is in turn closely related with the alarming problem of urban transport comes in for a full share in the modern development of human communities.

Urban transport problems are alarming because, owing to the urban road and street congestion resulting of the growing motor car tide, private and public surface transportation means keep paralysing one another.

On the other hand, underground public transportation which no doubt provides the best solution, from both technical and town-planning standpoints, is leading to great and even insuperable financial difficulties owing to their present excessive construction costs. In all cases, they lead to share between all taxpayers' charges which cannot be supported by their users.

No doubt there remain the well-known solution which consists in looking no longer for the " third dimension " under the ground, but to look for new lanes up in the sky of the streets of the cities.

This solution of overhead rapid transits had fallen into disrepute, because of both:

— the unbearable noise of rapid transit trains for those living along their tracks.

— the unaesthetical volume of their heavy structures above the streets taken by their lines.

The use of tyres, which has been crowned by great success in the PARIS Subway (where it has eliminated noise) allowed one to wonder whether it would not also prove possible to reduce overhead rapid transit superstructures to a minimum consistent with aesthetical town-planning requirements.

Ruling out the so-called " elevated " rapid transits on viaducts existing in the U.S.A., we came back to those more or less rightly called " monorails " and whose pioneer, the " WUPPERTAL " suspended overhead rapid transit of the RUHR, has now been operated successfully over 59 years.

This is the problem which has been tackled by an important French Group under the leadership of " SOCIETE LYONNAISE DES EAUX ET DE L'ECLAIRAGE ".

The thorough studies made by the said Group over several years have first led it to brush away " monorails " whose car bodies are supported by the running track and to choose a type of " monorail " whose car bodies are suspended to the track.

Indeed, the first one has a trend to unbalance which can only be made up by expenses in materials, in particular of those entering into the construction of the running track.

Furthermore, such a monorail has difficulties in following small radius curves and is not easily provided with efficient and safe switches.

The second type does not include any major difficulties of such kind.

The rational studies carried out have materialised into a system including several very remarkable features:

The running track, in the shape of a split girder box, provides most economical structure and is helping in best with the transverse stability of car trains moving at a high speed.

The running track rigidity provides fortunate aesthetical and town-planning results: supports may be placed every hundred feet. This enables getting a double overhead running track above existing surface traffic ways, at the cost of a ground space, for cylinder shaped supports, which take every hundred feet a base circle of 32" in diameter and may be easily located for instance in the existing median separating strips of the streets.

Savings in the structure are all the most important as in such a system running tracks with their columns are standing 50 to 55% of the total cost of the system.

Such a running track also provides the advantage of hiding the ugly bogies, of shielding the running tracks, the power feeding system and signal lines against inclement weather and lastly of forming a sound prison for the noise—very low indeed—of the bogies.

The car bodies proper included three special noteworthy features:

— their double pneumatic suspension (rubber tyres and compressed air rubber bellows springs) makes them very comfortable.

— their low weight and the huge capacity of their driving equipment enable making the greatest use of tyre adherence to give

car trains very higt accelerations and decelerations while added to cruise speeds ranging between 85 and 110 km/h (according to the type of drive equipment) provide high commercial speeds guaranteeing the success of such a system.

The transverse stability of car bodies is provided by a servo-control mechanism which has undergone thorough studies and extensive tests.

The high speeds of trains and the rate of one train every 90 seconds, which is customary in the case of mass public transportation, require the use of modern proved out signal devices: tracks signals are "duplicated" in the drive cab. Emergency braking is automatic when a signal has been run past. The driver of each train is permanently connected by phone with the traffic despatcher of his line.

Such a system has a transportation capacity of 30,000 passengers an hour each way. Besides, there are plans to provide overhead rapid transit stations with easy interchanges, either with any all other existing means of public transportation or with private car parking lots.

Lastly, a major factor resides in the price of such an overhead suspended rapid transit, which includes all installation costs around 3.5 millions U.S. $ per mile, while a conventional subway costs between 15 and 20 millions U.S. $ per mile depending whether it is constructed in covered trenches of the "cut and cover" type used in U.S.A. or constructed under-ground, as more generally done in EUROPE.

The dilemma entailed by the development of large cities and car traffic has certainly found a modern solution in the overhead rapid transit which enables allying speed, comfort and economy for urban transports.