III. THE FUTURE OF INDUSTRIAL BUILDING

by

NICHOLAS GRIMSHAW,
AADip, AIARB, MSIAD, RIBA

of Nicholas Grimshaw and Partners,
delivered to the Society on Monday 11th June 1984,
with Alan Osborne, Executive Director, Tarmac plc,
in the Chair

THE CHAIRMAN: I have to explain that I am taking the place of Lady Birk, who was to have presided at this meeting but who is obliged to attend a debate in the House of Lords.

Few Bossom lecturers, I suspect, are more committed and prominent in their own field than our speaker this evening. Nicholas Grimshaw trained at Edinburgh and has served as an assessor on many projects, including Civic Trust Awards, Scottish Development Agency Competitions for advanced factories, and Energy Award Schemes, and he is now engaged on Trafalgar Square. That is rather a dangerous place for an architect just at the moment, but I do not refer to the Gallery! He is also the senior partner of Nicholas Grimshaw and Partners, a practice clearly in the forefront of industrial design, with notable successes such as the Miller Assembly Plant in Bath, the BMW headquarters at Bracknell, Digital Computers at Ascot West, Citroen Cars at Runnymede and the Vitra factory in West Germany. The single theme running through these buildings is that of a thinking architect. He is unlimited by the past, he is breaking away from conventional use of space and materials and forms. His aim is high quality at low cost.

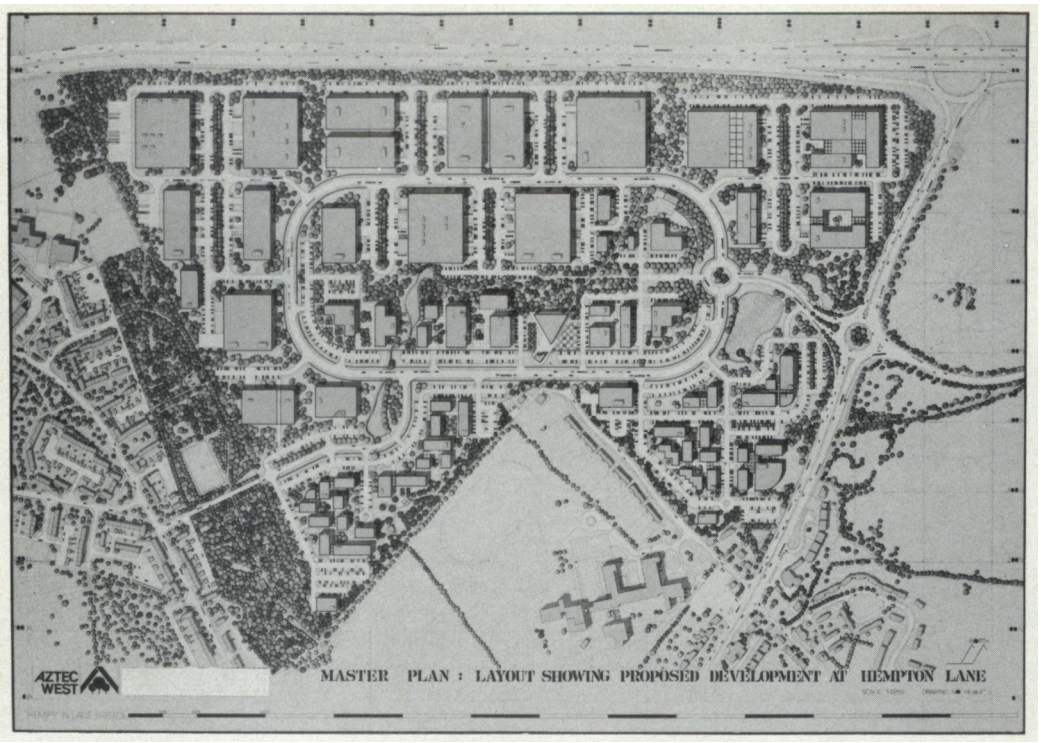
The following lecture, which was illustrated, was then delivered.

IT IS difficult to talk about the enclosures occupied by industry without reflecting to some extent on how industrial society might develop over, say, the next twenty years. I hope I will be forgiven by all those statisticians, sociologists, economists and politicians who feel certain that we are in a 'negative slide' or 'controlled decline' by striking a certain note of optimism.

My experience over twenty years of practice in architecture has led me to feel that a thoughtful approach to our industrial problems could mean that England, whilst being the first country to enter the Industrial Revolution, could also be the first country to begin to suggest ways of resolving all the problems associated with coming out of it.

My talk will cover six main themes relating to industrial enclosures. The first will be the question of planning, location and the industrial environment. The second will be the question of the types of building we have become used to associating with industry and how these might change and develop in the future. Thirdly, I will cover the question of size and scale, which for many industrial companies is the key issue. Fourthly, I will talk about questions of energy; this is an entire topic in itself but it is so relevant to industry that I shall have to devote some time to it. Fifthly, I will discuss the question of home, work and leisure time and the relationship of these three activities; and finally, I will close by talking about the impact of technology on both building enclosures and on the industrial processes which take place in them.

My first theme is the question of the location of industry and the planning and environmental issues relating to it. I am quite sure many people, and particularly planners, still think of industry as being a noisy, polluting activity carried on in buildings of inhuman scale and run by powerful economic forces which can run roughshod over all other considerations. Of course we still have our heavy industry but it has been massively cut back in the post-war period and those plants which are left are now under serious environmental consideration in terms of their proximity to residential areas and in terms of pollution or other ecological issues. It is interesting to think that



Aztec West, Bristol: Master Plan study for 180-acre site adjacent to M4 and M5 motorways showing integration of industry and landscaping

something as clean and well detailed as a Ford motor car can come out of the fairly antiquated buildings of Dagenham, and of course the tragedy of Seveso brought to light in a very poignant way the dangers of chemical plants being near residential areas. However, if these special cases are put aside, it is a fact that the type of industry we are likely to be dealing with in the next twenty years will be non-polluting, non-noisy, without any particularly unsolvable traffic problems, of the same height as residential accommodation and, with rising standards of design and landscaping, will have, in my view, the potentiality of being well integrated with many ordinary residential environments.

I do not agree with the opinion I have sometimes heard expressed that the vast areas of between-war and post-war industrial buildings which are now empty can easily be used for new industrial activity. Areas such as this high density pre-war development, although now actively used, will not be very usable buildings for small or medium-sized industry when they become empty. Parking and loading facilities present a serious problem, and also the total lack of any environmental consideration or landscaping adds its own depressing effect to the environment. When such factors as the very low floor loadings, low ceiling heights, bad insulation and low standards of servicing are taken into account then there are quite strong grounds for pulling down these buildings and building quite afresh a more flexible type of structure which can be and would be funded by pension fund institutions.

Perhaps I can quote as an example of this our Business Parks at Aztec West near Bristol and Gillingham in Kent. The Aztec scheme makes a very real attempt to improve the environment for industry. Landscaping included the biggest single order for trees ever placed in the United Kingdom. An extensive permanent infrastructure of landscaping and services has been installed together with the sensitive landscaping of the balancing pond for the rainwater run-offs from the hard areas and roofs of the buildings. In spite of all the major investments by the pension fund in these projects, the buildings can be leased by new businesses for rents in the region of £2-£3 per square foot. This means that for a small company of, say, fifty people occupying an

Herman Miller Factory, Bath: long distance view of factory showing successful integration into Bath townscape

assembly unit of maybe 10,000 square feet, the total rental is equivalent to about the salary of three or four of the workpeople. Bearing in mind the fact that the building is a much more useful resource to them than a semi-derelict factory, and that their own fitting-out costs may well exceed the cost of the building in any case, then it would seem that the investment was well worthwhile. Even if our urban industrial property is let for, say, only 50p per square foot, then often the rates charged, particularly by Inner London boroughs, will add a substantial burden to this when compared to development on a green field site.

However, whilst I can make the case for industrial parks or business parks on green field sites, I think that the development of new industry in urban areas presents a far greater challenge and possibly is a more valid exercise. As an example of this I should like to quote the 6,000 square metre furniture factory we built for Herman Miller in Bath in 1977, which I believe sits well in its inner urban environment and I know provides many advantages to the workpeople, many of whom walk and cycle to work and benefit greatly from the building being near shops, schools and other amenities that the town has to offer. Had this building been funded by a pension fund then the total rental would have been in the region of £90,000 per year or the equivalent in salaries of about a dozen employees. I should like to look at this building in a little more depth and lead into my next section which covers the question of building types.

I have already made the point of scale and the fact that modern assembly buildings can fit happily in residential areas. As far as this building is concerned, it is totally open to the public on all four sides. The building presents a flexible framework for use of the occupying company. Herman Miller themselves were very interested in the

Herman Miller Factory, Bath: factory interior showing relationship with external landscaped courtyards and river

concept of flexibility and indeed their whole office furniture system, which is known as Action Office, was based on the users being able to manipulate their own working environments and to be able to change them as frequently as changing needs demanded. (It can be seen in use in our own office – we were users before we got the job!) They were very interested in the concept of constructing a building which would somehow reflect their own philosophy.

Thus on this building the panels, glazing, louvred panels and doors are all interchangeable and can be moved around to reflect the changing pattern of usage inside the building. Over the last seven years the use of the building has changed radically. One-third of the building which was used initially for storage has now become manufacturing and assembly and major new technological facilities have been built into the interior, such as paint-spraying areas with major heat reclamation plants attached to them. There is plenty of evidence that this building is liked not only by the occupants, who see it as a type of 'user-friendly' building, but also by the people living in the surrounding area. It has not been vandalized and very few of the extensive areas of glazing which look out on to the pleasant riverside environment have been damaged. I believe this is something to do with the fact that people living locally can see what is going on in the building; many of them, of course, do work in the building and they are aware of activity both in the day and after dark. This gives the working activity a meaning in the society in which it is taking place. I can see no reason why this type of building should not be erected in many an inner urban area.

The alternative to this type of building is what I would call a typical pension-funded shed with two metres of brickwork, a few small windows for the boss by the front door, metal-clad sides to the building and a cavernous windowless interior which is of little use other than for the storage of cornflakes packets. Hundreds of millions of square feet of this type of building have been erected in the last ten years and I must say I am extremely concerned as to what real use they can be put to by an industrial society which is conscious of what it is doing and is making more and more demands on its internal and external environment. Of course we will need storage buildings in future years, but the employment ability of these is very small, especially when one considers the level of completely automated storage and picking which is now available. Very much like Buckminster Fuller's definition of warehousing as urban or suburban 'mines', I suppose you could describe our building for BMW, which centralized all their spare part storage for the UK, as a 'spare parts mine'; or this cold store building (which we did not design) as a 'food mine' (and of course cold storage does allow food to be mined over a long period of time). However, unlike the traditional mining industry, these types of mines will not be employing very large numbers of people in future years and it is to other areas that we will have to look to consider real working environments.

The first problem we are inevitably faced with when considering buildings which employ people is that the question of employment always offers a very large range of choice. Herman Miller, for instance, deliberately chose to install a large number of machines each doing one small step of a process. However, we have all heard of factories often using several million pounds of government aid in their construction and the building then being filled with highly automated equipment which probably needs only six Swiss

The Hoover Building, London: symbol of the monumental industrial thinking of another age

technicians to run it. The choice is an interesting one, and Ford in their recent advertisement are clearly claiming to have solved it – the happy employee refers to the robot doing most of the work as 'my mate Fred'. Fiat also have made much of automation in the advertisements headed 'hand-made by robots'. I should like to suggest that when these more sophisticated relationships between men and machines do grow up, higher levels of environment will be demanded by these thinking employees, and that companies will actually start becoming proud of the interesting and flexible structures that they erect. An example of this was Norman Foster's factory for Renault. In a recent advertisement by this company, the following text was used: 'Up to now the image of industry projected visions of severity, of minimal commitments to environment and community, of form and design which followed function but which ignored aesthetics – but times have changed: to-day culture is affecting industry, good working environments are a social responsibility.'

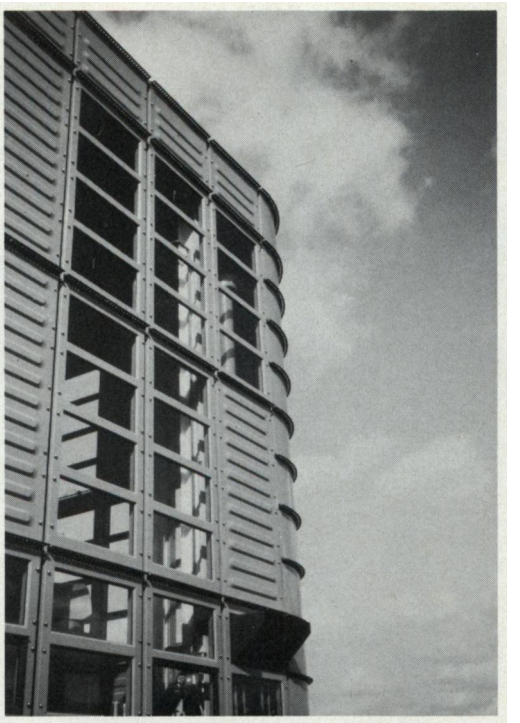
So I am advocating a range of lively, interesting, colourful, user-friendly and flexible buildings which would respond to the needs of industry in all the complicated and diverse directions in which it is bound to go over the next few years. I think that the days of building monuments which express the grandiose aspirations of the owners of a particular industry, such as the Hoover building, however fine it is as a piece of architecture, are over; if only because they tended to fix an established way of working with the 'offices up front' and the 'factory sheds' behind. What we will see in future is buildings which have no backs or fronts but are flexible structures such as the Patera System designed by Michael Hopkins, which is available as an 'off-the-peg' kit of parts to any industrialist to put up in a very short space of time on any site and which is capable of growing and changing in accordance with his needs. Or perhaps this small flexible building we put up for a music publishing company in France, which has a whole range of activities going on inside it and again has the attribute of flexibility, of movement of panels and glazing to suit the activity going on inside. Yet another example of new industry is the micro-chip factory by Richard Rogers & Partners for the government-backed Inmos company. This is an exciting and flamboyant structure which very much represents the aspirations of the young team of scientists who got the company going. I think it is also a

user-friendly building and I am sure the people working there must feel a sense of excitement every time they approach it. It is designed to expand and change over a period of years and the external structure gives a total flexibility of the use of space internally.

This brings me to my third theme, and that is the question of the size and scale of industry. One of the few graphs I know which starts off completely horizontal and ends up completely vertical is that which plots the number of strikes against the size and number of employees. In a firm with a very small handful of people strikes are virtually unknown, whereas with our largest company you could almost guarantee that someone is on strike some of the time. The key point on this graph is around the 300 people mark. Apparently this is the size of company which runs well, where a large proportion of the people know each other, and the level of strikes or industrial unrest is still very low. In building terms this might represent a structure of 8,000 or 9,000 square metres dependent upon how intensely occupied the building is.

This is about the size of the recent building we have completed for Herman Miller at Chippenham. Here flexibility has been carried on: window panels, door panels, loading doors, ventilation, inlets, etc., can all be moved on a flexible basis on the outside of the building. Ancillary buildings such as the electrical sub-station and sprinkler pump houses and so on have been moved to small ancillary buildings outside the main building, leaving a completely free open space in the interior which gives maximum flexibility. In fact this building is designed to expand, and one whole wall can be removed, the structure extended and then the panel and glazing refixed. It is designed to expand to about 25,000 square metres but quite a large proportion will be straightforward warehousing so that the population of the building will probably not exceed 300 people in the long term. This type of flexible structure could accommodate the whole range of activities which will be associated with modern industry: warehousing, storage, assembly, manufacture, laboratories and testing facilities, offices, canteens, sports facilities, medical treatment facilities; indeed the whole range of activity needed for medium to small-sized go-ahead companies.

This building was funded by Legal & General Insurance and I believe that the investment



Herman Miller Distribution Centre, Chippenham: corner detail showing interchangeable cladding panel system

market is now turning its interest to this type of flexible building rather than to funding of specialized large-scale industrial plants such as IBM's campus style development at Havant. The trend of companies to become smaller can be seen everywhere. This is happening either by necessity, as in the case of British Steel, or by government pressure, as in the case of ITT, where the company has been virtually forcibly broken up by the US government. Whether we will ever reach the situation outlined in E. F. Schumacher's *Small is Beautiful*, where he writes about two million villages around the globe all working on a self-supporting basis, I don't know, but few people would disagree that there is a trend towards diversification, smaller inter-related units of effort.

The recent case of British Telecom is an interesting example of this. There was a plan to move into a vast £20 million decentralized building in Milton Keynes designed by James Stirling. Unfortunately for Jim Stirling the project has now been scrapped, but I wonder if anyone has actually considered the possible scenario if all the workpeople in British Telecom headquarters,

which after all is to do with communications if nothing else, worked from home and used the most up to date communications systems that were available. The use of energy comes into the equation at this point and I should like to devote a little time to consideration of this issue.

At the Energy Conference held at the RIBA in 1980, I put forward the idea that the working population of a small industrial plant of, say, around 8,000 square metres would only need to live about 2.4 miles away from the plant for the fuel they used in their cars to be equivalent to the energy needed to heat the building in the course of the year. In reviewing these figures in 1984, I find that my assumptions for heating costs for the building can be reduced considerably owing to much enhanced concepts of insulation, the control of air infiltration into the building and controlled air locks for loading and unloading. The energy requirements of the buildings have therefore diminished considerably. However, petrol has increased in cost in the space of four years *only* from 110p per gallon to about 180p per gallon, and the net result of these factors is that the travel distance of the workpeople is now only half a mile away before the fuel they use will heat the building.

In general terms this means that if the workforce in the building lived an average of ten miles away, then the fuel they used could heat the building twenty times over. If this fuel was not used for travelling but the workforce lived much nearer the building and the fuel could be used not only for heating but also for process energy, the savings in the energy consumption of that particular industrial plant would be very striking. In the 1975 Symposium which was entitled 'Energy Options', Dr. Peter Chapman in his paper entitled 'High and Low Growth Scenarios' identified personal transport as the fastest area of growth in the energy demands of any sector. Since 1975 the energy situation has, if anything, grown more shaky and it seems to me that very serious consideration of journey times to work and the positioning of the relationship of activities such as work, shopping, leisure and home are becoming more and more critical factors in terms of energy usage as a whole.

It is an interesting fact that taking the same 8,000 square metre building and assuming a high car ownership level of 400 cars, then the value of the cars parked in the car park of the building doing nothing all day is almost exactly the equivalent to the capital cost of the building. Furthermore the land occupied by the cars is almost exactly equal to the area of the building. If you add to this the consideration that if the workforce leaves its personal cars lying idle during the day outside the building, then it is quite likely that a number of other cars would be generated within the family to deal with the other issues in life such as shopping, taking the children to school, etc. Therefore the arguments for bringing industry and living closer together are very compelling.

In the new town of Milton Keynes a very big attempt was made to integrate the industrial and residential areas. Although these areas are still physically separated, on a grid pattern there was introduced a network of footpaths and cycleways to try to encourage people to use other means of getting to work than in the motor car. Unfortunately the car ownership levels demanded by the planners at Milton Keynes for industry seem to be the same as elsewhere around the country, and indeed the industrial plants there seem to be surrounded by as many cars as elsewhere.

Before leaving the question of energy, I should like to touch on the possibilities of industrial and residential areas using combined heat sources. It is fairly simple to conceive of a system whereby energy sources used by industry during the day could be kept in operation to provide heating and hot water for residential areas during the night. Considerable saving could be made both in capital plant and in running costs if this idea was pursued.

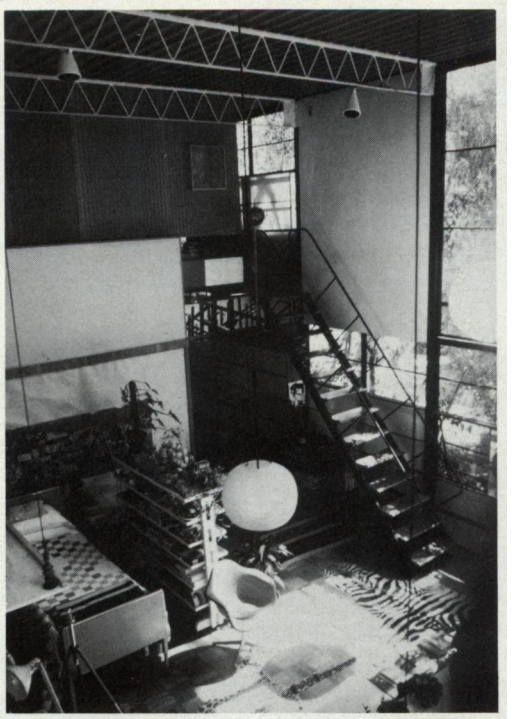
E. F. Schumacher stresses the question of energy self-sufficiency throughout the world, and indeed in many areas of the world where wind or solar power can be tapped this may well be possible. However, in a small country such as ours, where solar energy will never be a major provider and wind power has limited potential, central generation of energy is almost inevitably going to be the case. Yet there are major untapped resources that we do have, such as the scheme for using the tidal variations in the River Severn to generate electricity, or the more advanced concept of electricity generation from wave motion which must have very interesting prospects in a country such as ours which is surrounded by fairly rough seas. A further interesting aspect of energy in relation to industry is something I picked up in discussions with some people at the Gas Board recently, and that is that the gas system of the country runs very substantially *under* its potential

on the basis that it has to be able to deal with a severe cold snap at twenty-year intervals. Apparently it is very dangerous for the gas system not to be able to supply demand when it does happen. If major gas users could be persuaded to provide alternative fuel sources on site, such as relatively small oil or propane tanks or coal storage, so that they could provide 28 days supply for themselves if the gas was cut off, then it appears that the potential of the gas network throughout the country could be increased by as much as one-third. Returning to my earlier point about the question of energy and the advantages of industrial and residential properties being nearby, I should now like to move on to my fifth section which deals with the question of a relationship between home, work and leisure time.

To start this question off, I should like to make a fairly long quotation from Christopher Alexander's Book, *The Pattern of Language*. It may be that the quotation is couched in slightly over-dramatic terms, but it certainly summarizes in very cogent language what I feel must be a lot of people's feelings about the relationship between home and work.

> If you spend eight hours of your day at work and eight hours at home, there is no reason why your work place should be any less of a community than your home. When someone tells you about where he lives he is always talking about the *house* or the *neighbourhood* the house is in. It sounds harmless enough but think what it really means. Why should the people of our culture choose to use the word 'live', which on the face of it applies to every moment of our waking lives, and apply it only to a special portion of our lives: the part associated with our families and houses? The implication is straightforward – the people of our culture believe that they are less alive when they are working than when they are at home, and we make this distinction subtly clear by choosing to keep the word 'live' only for those spaces in our lives where we are not working. Anyone who uses the phrase 'where do you live' in its everyday sense accepts as his own the widespread cultural awareness of the fact that no one really lives at his place of work – there is no song or music there, no love, no food – that he is not alive while working, not living, only toiling away and being dead. As soon as we understand this situation it leads at once to outrage. Why should we accept a world in which eight hours of the day are '*dead*'? Why should we not create a world in which our work is as much a part of life, as much alive as anything we do at home with our family and with our friends?

To try to express this powerful quotation in building form, we laid out what might be called a framework building in which work, living, leisure, education and every possible other kind of activity could happen in a simple physical framework on quite a small scale, say covering a total area of 10,000 square metres, I would not suggest for a minute that this would be a self-contained community. Many people would need to travel to other similar set-ups to work or to live but this degree of integration would inevitably result in an energy saving of quite dramatic proportions and might well encourage a much greater integration between living and working, which I feel is basically favoured by everyone. Is there any reason why our work place should not include sports and leisure activities and eating places which all the family can enjoy, and indeed which are a quality standard rather than a necessity standard? The interior of Charles Eames' house, which amazingly was designed in 1947, sums up for me the ideal sort of environment for living and working. Is there any reason why this interior should not be the base for a small dynamic firm in the developing rôle of electronics? Is there any reason why the exterior of this building should not sit happily amongst a residential area, even though it might be primarily industrial in use? Is there any reason why in fact



Charles Eames House: interior illustrating lightweight structure and cladding system

Charles Eames House: exterior showing successful integration with landscape

if the industry moved away the structure should not turn into a residential property?

I should like to start my brief section on technology with a quotation from Cedric Price, one of the few architects known for his consistent thinking and questioning of the way we do things: 'Technology is the answer, what was the question?'. This simple quotation distils the conflicting attitudes to technology in to-day's world. Why do miners strike to preserve their 100,000 jobs when probably a vast amount of the work could be automated in any case? Why do millions of people travel to the centre of cities to work in offices when they could be linked simply and cheaply by computers, facsimile machines and video telephones? Why at Charles De Gaulle airport has an incredibly complicated movement system been installed when ultimately the passengers have to be moved by mobile lounges to aircraft parked on remote parts of the tarmac? Clearly society has an enormous built-in inertia and this is probably a very good thing. However, I have tried to identify those trends which I think will affect the future of industrial buildings and indeed which will affect the living and working relationships of people in general.

I have said that with the dying out and breaking down of large-scale and heavy industry I believe that all industrial activities will get smaller and that industrial buildings will reflect this. I believe that people will require a much greater degree of flexibility from their buildings so that they can grow and change and reflect the rapidly changing and diverse series of activities that will be taking place in them. I believe that industrial buildings will become more user-friendly and that the occupants will be much more involved in the shape and size of them and the way they develop and change. I believe that users of industrial buildings will become much more energy-conscious, and that a much closer integration with living and working will become possible. It is my view that greater and greater proportions of people will be working from home and therefore the relationship between home and work will become very much more complex but in general very much more integrated. Finally, I believe that people will continue their scepticism of technology and will only adopt systems and processes when they feel they are genuinely going to improve their way of life.

I should like to end with two images. One is of the Hoover building which clearly is a symbol of the monumental industrial thinking of another age, and the other is of the Herman Miller building in Bath which I previously discussed, and which I hope in a subtle way represents less monumental and more hopeful potential for the users.

DISCUSSION

THE CHAIRMAN: I should like to open the questioning as a simple contractor by saying that we all feel that flexibility, in a time when technology is changing so quickly, is an essential part of an industrial building. I know an American who says, 'We rebuild a newspaper plant every five years and move simply because technology has moved on', and he is surprised to find we have been in Fleet Street for one or two hundred years. This flexibility is essential and I should like to ask what are we paying for it? The cost of the envelope is quite small compared with what goes on inside but there is obviously extra cost for greater flexibility. How does this relate to the total cost and are customers and insurance companies and funders generally prepared to pay the extra?

THE LECTURER: It is interesting you should mention newspaper buildings. Some of the best examples of new thinking in semi-office, semi-industrial space can be seen in them. All around the world this is looked upon as an area for experimentation. A lot of the extra cost of flexibility comes out of the architects' fees in thinking time and trying to make it work. Generally speaking, the margin of extra cost between a flexible and a non-flexible building is negligible.

MR. FRANK HAWES, DipArch, RIBA: Have you any examples of such flexibility actually being used? Having talked to a large number of development corporations and industrial estate owners in the last few years, I find they all seem to speak in terms of tenants preferring to move to another building. Developers' preparations for future expansion are in general not being utilized.

THE LECTURER: It is an interesting issue. When they do move to the new place, particularly in new towns where we have done a lot of work, they move into new buildings put up by the new town. What happens to the unit they have moved out of and is it actually usable by the people coming in? The argument always is that if you have a big enough mix there is going to be something for everybody. It never seems quite to work out like that; there is always quite a high proportion of empty buildings. There are 175 million square feet of empty space in the country at the moment. As Nicholas Falk pointed out in his lecture, a lot of that has been built in the last fifteen years. If it is so usable, why are not people using it?

MR. DENIS BROWNE (Planning Officer for Islington): Mr. Grimshaw, I think what you are telling us is that by skilful design and sensitive handling of individual problems you can reconcile things which would otherwise be unreconciled. I was interested both positively and negatively by your building in Bath, because it seemed to me that in this instance you did not achieve harmony with the scale, pattern and texture of the existing urban scene. You did, however, produce a building which is very attractive to be in and a social asset to the community in a way which most industrial buildings are not.

We have an enormous capital investment in our existing urban fabric. We need buildings which fit in and reinforce our urban structure. I do not think that it is a fundamentally useful contribution to produce an aesthetic which only sits well in a new town environment. Designing for industry is a much more difficult task; not only have the technical problems of flexibility to be solved, but there is also the problem of scale. Flexibility is not the only answer; there has also to be a great sensitivity to a building's urban setting. You have made a marvellous beginning, but I do think the example of Bath shows that there is a lot more work to be done.

THE LECTURER: Relationships with planning authorities have always been interesting. On the whole I have had a fairly good run for my money with planning. Planning officers should turn down far more and demand higher standards in design. I subscribe to the view that well designed buildings can stand side by side whatever age they are. In a sense it is up to you to get good designers to come forward. If you turn down more, you automatically in theory raise the standard and get buildings which would blend with good areas of nineteenth-century or early twentieth-century housing.

MR. PETER EXTON, ASAAT (Student, RIBA): Would you expect the type of architecture you are dealing with at the moment to move towards housing, with people becoming more accustomed to living with that style of architecture as well as working in it?

THE LECTURER: Having dealt with some computer people recently, I have come to the conclusion that they would be happiest in Cotswold stone barns! The trouble is that there are not enough of them around, so they tend to convert a Cotswold stone barn and live in that, and try and find a computer factory as near as possible to where they are living, which is one of the reasons why Aztec West was put where it was.

I do not know the answer. It probably comes back to the question of design. Charles Eames's house and Michael Hopkins's house are very fine pieces of design. They both equally well could be computer factories or offices. I find it depresing that almost all the present-day housing need at the moment seems to be supplied by Wimpey, Barratt and Bovis in the form of stereotyped units. There is need for a new type of living environment, but I would not say that I necessarily have the answer.

MR. W. THUBURN, BArch, MS, MSc(Econ): I am interested in Nicholas Grimshaw's defence of aesthetic control by planners. Why should the burden of policing design be placed on planners and not on the RIBA?

THE LECTURER: I don't think it should be placed on either. After all, the planning officers only represent their committee. I should like to see a lot more involvement of people in that. The people who have to live in the thing should decide.

THE CHAIRMAN: There is an argument for saying that the competition ought to be with your peers. In other words, you ought to be competing with other architects and not with planners. The architect is under pressure to do whatever he thinks will satisfy the planning authority, which is the wrong objective. May I ask Denis Browne, who said that the building did not fit in at Bath, whether he thought if it had been a different colour it would have fitted in?

MR. BROWNE: I think it is a sensitively designed building. I was worried by one slide which showed the car park shimmering in the night sky, which suggested that there was a large ashphalted space at the back. But looking at it from the view down the hill, the slide showed this nicely designed industrial package fitting into this complex of small-scale buildings, which are probably less than 1,000 square feet each, each with its own garden. There is a major problem of scale there which I think you have gone a long way to solve. It is not just the scale of the buildings, it is also the scale of the access requirements which needs to be reconciled.

THE LECTURER: The problem is to reconcile a million square feet, or 16,000 or 6,000 square feet, with Bath.

MR. WILLIAM HENRY WILLATS (Engineer): In some of the buildings shown you wisely avoided brickwork; wisely, because to-day with many local authorities the design of load-bearing brickwork is more complicated than designing steelwork. This may sound silly when you think of the long traditional brickwork heritage of this country, but it is true. Because we have this accumulated experience in this country going back hundreds of years, we should rely more upon our building sense and allow our experience to dictate. Probably we could then produce better and less troublesome buildings. Two brief technical questions: did you have any trouble with Building Regulations in the design and construction of your flexible buildings? Presumably you could not move fire exit doors around too much because fire officers would be worried?

THE LECTURER: Fire exits are not actually fixed in position. Provided you do not have any part of the building farther than the required distance from the door you are all right. You could reshuffle them and if you have part of the building too remote from the fire door you have to put another exit in. Building regulations are part of the rules of the game and they are, I think, in many ways easier to overcome with dry construction types of buildings.

Brickwork is difficult to work with these days, I agree. In the past, brickwork was a well detailed, very flexible component system. It is depressing to look at modern brickwork and see the appalling lowering of standards and all the problems that follow. If people really feel that brick means home and hearth, then they ought to be prepared to pay for it and not just stick it like wallpaper on their timber-framed houses.

MR. PATRICK UDEN (Uden Associates Limited): I should like to take up the question of flexibility. First, I must declare my colours – I am a consultant to Ford on media affairs. In one of your slides you showed the Ford factory, saying that they are producing quite well designed products in these 'fairly antiquated' factories. The *design* of Ford cars is shared by Britain and Germany. In the Dagenham factory you showed us they have installed robots which overnight doubled the number of automotive robots in Britain when they started to build the Sierra. Although both BMW and Renault warehouses were shown as examples of flexible building types, they suffer from exactly the same antiquated factory problems back in their own countries. The problem that flexibility raises is whether it would be profitable for a company like Ford to remove the Dagenham factory and replace it while maintaining constant production of the vehicles from which they earn their living. So, is there any way in which flexibility, in the sense that it would be possible to remove the Dagenham plant a piece at a time, can become a reality using the systems you have described, or is it necessary to take a green-field site and simply start afresh?

THE LECTURER: Really the only issue is the assembly. I know they make engines at Dagenham as well, but they do cast things there also. That has been very much under dispute. At various times it has been said about Birmingham and British Leyland that it is not just the company going down, it is all the small companies which supply it, which represent something like three times the labour force of British Leyland itself. Obviously a large number of components for cars are made in very small plants throughout the country, and – I don't know whether it is an increasing trend or a decreasing trend – most machines are getting much smaller. Even plastic panels for dashboards can be made on quite a small machine and can perfectly well be decentralized. The real question with car assembly is the actual logistics of moving all the parts around and getting them together in one place. Even the assembly could be done in quite a small building if it was highly automated.

That raises the whole question of interchangeability of parts. Are you making parts simply for Ford or are you making a starting motor to be used on a number of other cars? If you are, there is no real reason to have it in the same place. I think there is a lot of scope for diversification in the motor industry and probably a great deal of scope for shrinking it too.

MR. UDEN: That does not answer my question. Is it possible to produce buildings which can be built as one building is knocked down, and maintain production?

THE LECTURER: All you need is a bit of spare capacity. It is like the Chinese game of squares where you have one empty square and you have to move all the other squares around. I am sure that can be done. The problem with the Dagenham situation is the long

tailback of history. I have been round that plant; I have seen the men in the casting zone pouring molten metal, making engines. It could well have been a scene from the last century. I am not surprised that they want to close the engine plant. In that situation you have to take the choice of whether to close down altogether and start again.

MR. MICHAEL MURRAY (Metropolitan College): I was very interested in your live-and-work situation. Are there any modern examples of that?

THE LECTURER: I think you find it in places like Islington.

MR. MURRAY: Is any local authority or planning authority interested in overcoming the problem of mixed development?

THE LECTURER: It is a very difficult to get going. In our Aztec West scheme we worked really hard in the early days to get a strip of residential development down the middle. We thought that even if it were only used by overnight executives, or people who stayed there for a year and then went back to America or wherever else, it would have enlivened the site. It would not have lost any industrial potential because the area is so small in the context of the total development. Both in planning terms and in terms of investment funds, they could not swallow that.

MR. MURRAY: I agree. I am converting an old building which had a mixed use, and I am meeting resistance.

THE LECTURER: The point is that people want to go *home*, and 'home' is somewhere different from where they work. If you put in all sorts of sports facilities, they will not necessarily use them; they will go to their local tennis club at 'home'.

MR. MURRAY: However small the minority, there are people who like living and working in one area, whether it is in a back garden, or a shed, or going into small production, but it is very difficult to get this through the planning authorities.

THE LECTURER: I live in Camden, where they have a very patchy record on this. At one time they were trying hard to get nonconforming users out, that is workshops and used car garages and all kinds of little workshops. Now they are actually begging them to come back again and trying to encourage people to put workshop units underneath other kinds of uses. In any rich or active city situation you will find living and working going on side by side.

THE CHAIRMAN: A factory sooner or later is going to have materials or old machinery stacked outside. Is it a problem that our industry tends to be untidy? At Bath you will probably find that the car park fills with materials waiting for dispatch because we have not built enough factory space. However attractive the factory is when built, it starts to look like a used car lot quite quickly. It could be that when providing a factory one of the things you must ensure is enough space for all activity to be within the envelope, and prohibit casual outside activity.

MR. MURRAY: The definition of light industry was enacted to ban offices in housing areas. There are vast areas of workshops in Hackney and various places which nobody knows about, but if you try to get that situation *de novo* you have problems.

SHELIA HAYMAN (BBC TV): I was impressed by your glowing description of how people should be able to enjoy their workplace, and indeed we have seen people enjoying a variety of activities apart from work; enjoying the gardens, enjoying the lunchbreak, enjoying judo and swimming, but only two pictures in the whole lecture of the workplace itself, in one of which several people were standing around a stationary forklift truck, and in the other of which an old man was moving bits of wood around in what looked like a very antiquated production system. In view of your apparent interest in 'social engineering' to what extent do you see your job as an architect as designing the working and assembly part of industrial premises in such a way that the work itself is more rewarding and interesting?

THE LECTURER: I don't think I used the phrase 'social engineering', but management of the working environment is very complex. The value of a flexible background for it is one thing, but actually trying to manipulate it is another. I try to make it as easy as possible for people to manipulate it and then it is up to them. Sadly not enough people are really interested in getting that sort of activity going in the factory, including sports and other interesting aspects of life. I used to say that the country would be a lot better off if people were paid to do their hobbies and they worked for nothing. People would do everything much more enthusiastically then. As the smaller businesses get going, often with a good relationship between employers and the workers they start with, there are signs of hope in that situation.

MR. FRANK HODGSON, MPhil, BArch, CEng, DIC, FIStructE, MConsE (Consulting Engineer): The concept of flexibility may perhaps be tied up with the concept of permanence. Instead of building a factory with the idea of its being there for sixty years, would it not be better to build for twenty years, so that the whole thing could be dismantled and rebuilt or extended? It does not have to be cheap and nasty. Why do we have to build so permanently? The majority of the services,

such as heating or air conditioning, would need replacing or upgrading within fifteen years, so why does this philosophy not apply to the building as a whole?

THE LECTURER: There is no reason why buildings should not be dismantled or changed as often as anyone wants to. I don't think the cost of a twenty-five-year building is very different from that of a sixty-year building, One of the very interesting things about the slide of a portable frame shed building that I showed is that with that type of building often the floor loadings are much too low. The ceiling heights and the insulation values are far too low, and that actually limits the life of the building, rather than the cladding, which probably only cost 15 per cent of the total anyway.

THE CHAIRMAN: You can have two sorts of flexibility, flexibility for the original occupier, or flexibility to change at the end of ten years from a furniture factory into some other sort of factory, so that there is flexibility to accept a new product and flexibility to grow.

MR. JOHN TOWNSEND, ARIBA, FSIAD: When Mr. Grimshaw started talking about brickwork and traditional materials, I thought he might be moving towards energy conservation. I would question those of his buildings which are made out of metal and insulated thin walls. An architectural firm in Sweden doing this type of work for about twenty years has now been forced by the government into completely different concepts of construction. A lot of that is to do with regional aspects of their economic planning. I wonder if you have given any thought to that particular approach, which is fairly relevant to your overall planning ideas of mixing uses in larger buildings. In Sweden I believe they insist by control that to conserve energy and to maintain labour and employment levels articulated brickwork and stonework are to be introduced into elevations, so that more stone is used in a particular region, etc. I wonder whether you like this approach and whether there are or should be any economic factors in the country which would make it possible.

THE LECTURER: It is so much a question of climate, and I don't think people take enough notice of that in energy considerations. This country has an unusual climate with big swings of temperature. It has happened quite often that the temperature on Christmas Day has been the same as on midsummer day. You can get a big warm-up during the day and then you cannot get rid of the heat. You should have a well insulated building which retains heat when you need it but does not have a very big thermal capacity so that you can adjust the temperature quite quickly.

One of the other factors in the energy equation these days is the fact that transportation energy plays so much bigger a rôle than insulating buildings. The running cost, in terms of heating, for a factory which is reasonably well insulated and with good air locks to the vehicles, is very small indeed if it is well designed. So I don't think mass really comes into the equation.

MR. ANDREW SHARMAN: Mr. Grimshaw has talked as an engineer for much of the time. He has talked about energy, about engineering planning, about materials. I believe that we look to architects to show us objects of grace, of elegance, of beauty. Mr. Grimshaw's idea of the man for whom he is creating flexible buildings is of someone full of the strenuous desire to live a complex, productive and reactive life in the community. I believe that we are dealing with an entirely different need in the evolution of towns and buildings now. We have to cater for the whole society, not for the Camden class, but for the entire industrial society with its wide range of users of buildings who want a lot of reassurance, a lot of organization, a lot of feeling of belonging. We need from architects a demonstration that structures can have an effect on people which is not just a reflection of their needs but also leads towards a better life that every generation in the past has enjoyed through happy accidents. If we don't produce something of that sort we are going to brutalize society and ultimately bring about its disintegration.

THE LECTURER: It is true that there are more architects in Hampstead than in India. Possibly architects often have a very odd view of how industry works. I have actually had quite a lot to do with industry over the years, not least in going to plants where people are making things for the buildings, which takes up quite a lot of time.

I meet a wide range of people, but I think it is important not to be paternalistic about it. People who are not on the dole at the moment are interested in what they are doing and in their working environment. They are making interesting and worthwhile demands and should be listened to. We should try to construct environments which will appeal to them. We spend a lot of time with our engineers on a team basis and maybe that is why I start talking like an engineer. I wish they would come forward with more innovative ideas themselves rather than our having to drag ideas out of them. Architects do try to move things, particularly in areas like energy. Engineers tend to lag behind and rather like being presented with a scheme and being told to make it work.

THE CHAIRMAN: We have to make an attractive industrial environment for *now*, and accept that because of the rate of change of industry it will not last two hundred years. Smaller units are going to be necessary and you have to tailor them to fit into communities where people are already, because you cannot move the people. Already we have user-friendly structures

on a small scale which look acceptable and are good to work in now.

MR. SHARMAN: But when people have the option and sufficient wealth it is not these structures they prefer. Why, therefore, should we not concentrate on the whole range, not merely the utilitarian response to creating structures at minimum cost, but also producing a heritage? We are getting more short-sighted in architectural terms.

MR. G. P. ROBERTSON, RIBA: My mind has gone back to the previous two lectures in this series, and I have come up with two Hs, Heritage and High tech. Bearing in mind what we heard in the first lecture, I wonder what Mr. Grimshaw can see that high tech could offer to the preservation of the heritage we have in this country?

THE LECTURER: I have no objection to an architectural heritage. I am sure any architect would be glad of the updated budget of Wells Cathedral and to be able to design a building costing that amount of money and taking however long it took to build. But I don't believe it is the age we are living in. People may need symbols and monuments around them, but I think that is going to be a very small proportion of the construction we basically do. I am in the field where people want more and more for less and less. You can say that is wrong, but it happens to be where I find myself, and that is a question of industry and sports and leisure buildings. I think it is simply a wrong approach to say that every architect should try to design buildings as part of the future heritage. We should be designing buildings which are expressions of people's activity and not monuments.

MR. ROBERTSON: But we have been left these buildings – call them monuments if you like – which are an *asset.*

THE LECTURER: If you mean fine old warehouse buildings in Liverpool and so on, I absolutely agree. I find it hard to think of factories built between the wars in the same way. There is a difference in quality of construction and in the value and intensity in which things were done. The first job I ever did was what I call a service town, which stood behind a row of Victorian houses, and it provided all new bathrooms and plumbing and everything else in a very high tech way and gave the row of houses a new lease of life. Interestingly, it has now been pulled down. The houses have been turned into a hotel, but it served a useful purpose for fifteen years.

THE CHAIRMAN: People don't want to go to work in a renovated warehouse.

MR. FRANK HAWES: One of the problems is that our buildings last longer than we intended. Buildings that rely on paint and similar external finishes tend to spend a lot of their time looking in need of another coat of paint. Much high-tech architecture cannot go long without looking tatty. It is going to grow old – people are not going to take it away and put something else in its place. It is a worry for the future, especially if we start moving into the centres of towns and trying to live cheek by jowl with the places in which we work. I think that then industrial buildings must become part of the fabric of the town.

MR. MAX COMFORT: I work for a large commercial company of architects in London. A lot of our clients are coming round – and perhaps more importantly the funds are coming round – to the view that there is not a great deal of difference between industrial and office space. Many of our industrial buildings are designed with the possibility of either use. Getting back to your point about the three functions, recreation, industry and housing in the same space or area, how long do you think it will be before the funds will come round to that concept, because it has taken a lot of effort to get them to see offices and factories as interrelated?

It seems to me that people living and working in the same space are more likely to be creative, craft-oriented people, and less likely to be working on a production line. I think production lines will be with us for some time, so there is a hole in your argument that the workspace should come nearer to home and vice versa. There are people who need to get away from the drudgery of boring everyday work. Creative people are more likely to live and work in the same place.

THE LECTURER: I think it is a question of degree. I am not advocating for a minute that people live in a community, all living and working in the same complex. I should like to see a lot of interchange going on. I walk or cycle to work and in terms of energy consumption, being two or three miles from where you work is of enormous benefit. I am just saying that if there could be a slight nudge towards greater integration, everyone would benefit. I think, as an example, that the Pompidou Centre in Paris works incredibly well. It gets tatty and as they start painting at one end it is beginning to peel off at the other; but as a piece of active and vital urban life it is very successful. You will not find many Parisians who admit it, but they all use it and love it. One of the interesting things is that it is not visible from the rest of the city; you come across it as a surprise and one block away you are not even aware of it. To do that throughout a whole area of a city, or even in every other block, would be wrong, but I think you need a mixture.

THE CHAIRMAN: Nicholas Grimshaw has given us pointers to the way in which he is thinking and the way in which we all ought to be thinking about factories, workspace, playspace. We have to thank him for a stimulating and thought-provoking talk.