

Green Design

From Theory to Practice

The Jerusalem Seminar in Architecture

Lecture: Dr. Elma Duriasevic

Opening Remarks: Dr. Yehuda Hollander

It is a great honor for me to introduce today Dr. Elma Duriasevic. Okay. Did I say the name okay? Dr. Duriasevic is an associate professor in the University of Delft, Netherlands, associate professor in the University of Twente in Netherlands and head of the 4D architect's office in Amsterdam. Dr. Duriasevic proposed new ways of bridging the current gap between demolition and disassembly. She indicated that dynamic change in use of building complete with growing issues related to effective use of materials and construction. We require a fundamentally different way of design and construction in the future. Dr. Duriasevic's vision is one in which homes become extensively transformable and disassembly and where configuration is possible at all construction levels, [...] (unclear) and walls as materials. Dr. Duriasevic's design portfolio includes urban planning studies, multifunctional sport facilities, multifunctional public building, office, village, and development of flexible building systems. Druiaasevic advocates life cycle, design approach to design of building and building systems and argues that current ideas regarding the performance and technical composition of both building and construction materials need to be revised. Dr. Duriasevic is author and editor of a number of books, scientific papers and articles, invited speaker in series of public lectures, international conference and universities. We are very fortunate to have you here, Elma, and we are looking very, very forward to the lecture that you are going to give us. Elma please the microphone is yours.

Dr. Elma Duriasevic: Thank you very much for this nice introduction. I want to thank the organizers for inviting me here and for giving me the opportunity to share some of my ideas about future of building design and green design with you and I hope that you will find some of my ideas interesting as well. I would like to address today the issue of green design and manufacturing, or green building construction, which has to do primarily with the way how we use materials in building construction and how we integrate materials and systems while

1 designing. First of all, I will just go through some general issues related to sustainable
2 development. I think you've heard some of the things I'm going to address shortly and
3 you're familiar of course as we are, in the area of global warming and the whole world is of
4 course concerned with the ideas which are related to the global destruction. We are
5 thinking about the consequences related to the rise of sea level and coming from the
6 Netherlands of course that is something that is a daily concern of governments, how the
7 Netherlands are going to deal with the rise of sea level in coming years. So all these
8 problems of course we relate to the carbon emissions and the energy is a very important
9 issue. Energy is a very important issue and then I am just going to show some ideas of
10 architects like for example Foster or Richard Rogers. These architects are definitely very
11 interested in trying to find the technologies how to deal with the operational energy of
12 buildings and how to improve the energy performance of buildings. But however, my talk
13 today will be of related to the materials because I find that energy is something that we have
14 around us, there is a sun, fortunately you in Israel have lots of sun and in the coming years
15 with the development of technologies probably can also profit from it. There is wind. We can
16 create energy even by movements. There is a system developed in the Netherlands which
17 is put in place in a discotheque in Rotterdam on a dancing floor so when people are dancing
18 they are creating energy for lighting. So, it is a question of thinking hard and I think we'll get
19 there and we'll find the answers to deal efficiently with the energy demands and reduce
20 CO2. But material is something that I think we still have to focus more and think harder how
21 to use it intelligently in our buildings and not only in buildings but in all products that we use.
22 And of course, especially in the picture you will see very often these days our planet Earth
23 and the predictions related to the population growth. In 2050, 9 million billion people will be
24 living on the Planet and the predictions are that the exponential increase in the population
25 will increase also hopefully, we hope, standard of most people and will mean that the
26 demand for essential goods and services will increase, some scientists think with a factor of
27 two. That includes transportation, cars, houses, planes, products, water, food. And the
28 planet earth has limits, it is a physical fact. So, the great challenge is how to address the
29 issue of used materials and putting it in an intelligent system that will work for our benefit.
30 This slide I borrowed from a rector from University of Delft, Professor Fokkema. It is one of
31 the predictions of some scientists who were even saying now that if 9 billion people would
32 have a western lifestyle, in thirty or forty years we would need six Earths to provide this
33 progress and to sustain the life. This obviously, there are some physical limits to the material
34 that we have to take into account. General ideas about sustainability I would just like to say

1 something shortly about that. This is an equation from a researcher from MIT who wrote an
2 equation putting the environmental impact in relation to the size of population, the prosperity,
3 and the impact of technology, which is used per unit or per capita. Basically, this equation is
4 saying that the size of population is growing, hopefully the prosperity will grow as well. The
5 is the only way to bring the balance in the equation is to look for a better intelligent
6 technologies that will help us to provide the balanced environment around us. The graph on
7 your left hand side indicates some general, it is just a statement about material use where
8 the reuse of resources is, actually we are now at this moment rethinking the way how to use
9 the resources. During the industrial revolution the attitude was just to take whatever we find,
10 produce it, dump it, take another material and at this moment we are thinking the way of
11 using them and looking towards a long-term vision where we will have a low resource use,
12 and that to achieve that the recyclability of products and components need to be raised.
13 Going back to the construction, those are just three diagrams showing the progression to a
14 sustainable approach to building and construction. At the moment we can say that the three
15 competitive factors in traditional building process are to optimize costs, quality, and time.
16 Then there was a new paradigm related to the ecological design where we have put these
17 three aspects in relation to resources, biodiversity and emissions. And the direction we are
18 going to is actually towards the balance of three P's: People, Planet, Profit being the social
19 equity and cultural issues, economic constraints, and environmental quality. In order to
20 move towards sustainable design, the design process should go beyond the cost, quality,
21 and time matrix and take into account the whole life-cycle approach, something we have
22 heard in previous speech.

23 Dr. Yehuda Hollander: (Speaks in Hebrew to a participant) Sorry, it's OK.

24 Dr. Elma Duriasevic: So I have here in a table summarizing the strategy for life-cycle phase
25 for the design that will take into account the whole life cycle for building. In a design phase,
26 they should take into account the development of scenarios for building use. Because
27 building is not finished at the moment that it is constructed. Actual building starts to leave at
28 the moment it is constructed then it starts to go through a number of phases. Different use
29 sequences which are becoming more shorter and shorter, so this is something which is for
30 greater concern. Then the optimization of building in each of its life cycle phases is a part of
31 design process and concurrent engineering is something that we should take as an every
32 day practice as designers from the early design phase. In manufacturing use of material
33 saving processes, use of recyclable or reusable materials, use of low rate materials, and use

1 of less energy intensive materials. Thinking about transport and the low rate and volume is
2 an important issue in assembly, the **di-assembly** (ph.) and the **FRL** (ph.) assembly. And
3 exploitation low energy use for the operational energy and design for maintenance and long
4 life. And the last phase, demolition, should actually be turned in disassembly, so the whole
5 structures and buildings should be designed for disassembly. It should be a kind of loop.
6 This life-cycle approach is nothing really new because this design methodology has been
7 present in product design in automotives for about 30 –40 years. Here we have some
8 examples of cars which are designed to maintain, to replace parts when needed and recycle
9 the ones which are being replaced. And a well known example of a chair, cradle to cradle
10 chair, something that we have also, the concept we've heard in a previous speech, where all
11 components are being brought back to the techno sphere or biosphere. And the trend in the
12 products industry is actually, the trend is to change the linear model of use of materials
13 towards a cyclic model. There's the linear model being used of materials, from extraction of
14 materials through production, assembly, use, separation, end of life, ending in demolition
15 and landfill, should go back into the cycles through design for reuse, design for
16 reconfiguration and upgrading of components and materials and design for up-cycling and
17 finally designed for down-cycling something which should be on the lowest levels. So you
18 see the hierarchy on the right hand side, the hierarchy of the most preferred options for
19 sustainable construction will be, first of all, prevention if possible and construction reuse.
20 Someone mentioned yesterday as well, it is strange for an architect to say so, but actually,
21 we should think very carefully and look very carefully into existing structures and try to take
22 most of them in order to reuse them if possible. And if elementary used material reuse and
23 up-cycling use for applications and so forth. So down-cycling , recycling are really on the
24 lowest level of preferences. So what I want to talk about today is actually the transformation
25 capacity of our buildings. Putting some questions to you and still to myself. Can't we just
26 think of a new way of building that is adaptable and why don't we design buildings for
27 manufacturing, why not designing buildings and systems that can serve multiple purposes,
28 why not design buildings that can be utilized as a resource pool for new construction, and
29 why not consider demolition as a design error. These pictures you see here on the slide are
30 actually very common pictures which we see on a construction site in city centers. Our built
31 environment is constantly transforming. And as I mentioned, the synthesis of changes and
32 transformations are becoming only shorter. That means that all energy in transportation of
33 waste materials from the construction site, the landfill sites which are going up are becoming
34 really a problem but also the old energy that we put in use of new materials is definitely a

1 problem. Now I have this slide just to point out how the life cycle of building in operational
2 terms looks like and actually we that should also realize that each building has three life
3 times. It has a functional lifetime, technical lifetime, and economic lifetime. And if you have a
4 building like on your left hand side in the diagram which can last 80 or 100 years, after some
5 20 years new requirements will come or new technologies will be required, the architects will
6 look at a building to see whether this can be met, if not the building will be demolished or
7 parts of the building will be demolished. Each change will require new materials and it will
8 also require new investments. The faster these changes are happening it means that the life
9 cycle costing of the building is also going up progressively. I have also this slide just starting
10 to point out that change of our environment is something that is very common and actually
11 that we as humans are passing through a number of life phases and each life phase has
12 different requirements on our surrounding and what we tend and [...] (unclear) to do is to
13 move. Average family in the Netherlands moves every seven years. Approximately, in each
14 phase or second phase, they need to move to another building because the previous one
15 will not accommodate the second life phase of the family. And the question is why can't we
16 just think of buildings that can change with us and that can be adapted to our needs and
17 newer lifestyles and that is a concept which we call now "extended living". There are even
18 people who get sick, why do they have to go to the nursing homes, why can't we change
19 and adapt their buildings or apartments so they can stay longer? That is a discussion which
20 is now very much going on in the Netherlands - Looking into the possibilities of designing
21 and adjusting the existing buildings to this concept. Just some extreme slides related to the
22 need for change which can be from moment to moment that may need the rest from hour to
23 hour or from morning to evening. We have again different requirements regarding the lights,
24 the protection from elements depending where we are, from season to season, for example
25 of a roof top in Vienna where the kitchen can be open in the summer and closed in the
26 winter. But those are also some hard figures, diagrams representing market research
27 conducted by the biggest housing corporation in Amsterdam. And they ask their attendants
28 how often they change their apartments and if they do change their apartments which parts
29 of buildings or apartments do they change. So the diagram on the lowest part of the slide
30 shows actually the sequences of change of the number of rooms and basically within 20 –
31 25 years, tenants tend to change whole apartment and changing of partitioning walls and
32 services starts even after five or ten years. And of course, this all has something to do with
33 the whole lifecycle costing of such trends. Just to go a bit further, the issue is as I mentioned
34 that the buildings do change quite frequently although they are designed to last for 100

1 years, they are being demolished after 15 or 20 years, primarily because they are not
2 designed to be adapted and their materials cannot be recovered and so forth. Now
3 this results in general into some very clear statistical numbers regarding the environment
4 and that is 40% of energy consumption in Europe is building related. That's 50% of material
5 resources taken from the nature are building related. But also some economic services like
6 50% of investment is used in the modifications of existing buildings or 42% of new
7 construction is used in replacement of existing buildings. Some general slides how we deal
8 with our structures at the moment and what we tend to forget when designing buildings and
9 actually when looking into reasons why we demolish buildings is that we tend to forget that
10 buildings are made of thousands of parts and materials. They all have together the life span
11 and durability of from five years to 100 years - All these different materials. And all these
12 different materials have also the functionality and the functional life cycle of these materials
13 is also different. But we just ignore this fact and we put all the building materials together in
14 creating one very fixed configuration. And the diagrams on the right hand side present a
15 typical house in the Netherlands from the 70s with all the installation services going through
16 the concrete slabs. And the diagram below shows the relational diagram of all parts in this
17 building. What you can read from this diagram is that basically all of the building parts in this
18 building have number of relations. That means that if we want to remove one of the
19 elements, we have to cut number of the relations. That is very often time consuming and
20 labor intensive and we damage the components so that is the reason why actual buildings
21 have been demolished. So what we want to look at is how we can simplify this very complex
22 relational diagram which a professor from Delft called the Spaghetti effect because in order
23 to take one element out you will really destroy everything. So the question is: How can we
24 simplify this diagram towards more systematic structured approach to construction and can
25 we look for the approach that will recognize that different parts of buildings have different
26 functionalities and different use and technical lifecycles. So basically the diagram on the low
27 part of the slide shows the possible direction of presenting let's say an ideal model, how we
28 can create configurations which are more open and whose parts can be easily recovered
29 and taken or replaced to another position. An ideal model or approach to such a let's say
30 ideology, we can say at the moment, would be to design a 3 dimensional transformation
31 capacity or 3 dimensional transformational building that would mean that buildings should
32 have spatial transformation, meaning that the space would be reconfigurable and [...]
33 (unclear). The second dimension of transformation is the structural transformation that all
34 components and systems are reconfigurable and the third dimension of transformation is

1 material transformation that means that at the end of life of the material it can be brought
2 back to the biosphere or techno sphere. The key to such three-dimensional transformation is
3 the design for disassembly which will make it possible to recover elements or systems in
4 order to replace them within a building or replace within a system or reconfigure a system
5 into another configuration. And another important thing we have to keep in mind when
6 looking into and designing buildings is, as I mentioned that materials brought in building
7 have functionality that they have, each material has a technical life cycle and it has a
8 functional lifecycle. On this diagram you have a blue line which shows the technical life
9 cycle of materials in a typical house in the Netherlands and the purple line is the use
10 lifecycle of flexible house [...] (unclear) which has been defined by this housing corporation
11 in Amsterdam. I have listed that all components within a building and when you look at the
12 difference between the technical and use lifecycle that is where you will find the reuse
13 potential which is interesting looking at the places where we find the hugest proportion
14 between use and technical lifecycle of materials, that means that they have a huge reuse
15 potential, we should think more carefully, “ How do we deal with these materials or these
16 functionality? And how do we make it independent and exchangeable so it can be really
17 reused.” This is one example of what can be called emancipation of these physical levels as
18 a result of study of life-cycle coordination of technical and use lifecycle. On the left hand side
19 is a diagram showing the functionalities within a building and in a typical housing project in
20 Amsterdam. All these functionalities are creating this fixed structure and when you put on
21 top of that the new requirement of the housing corporation asking for more spatial flexibility
22 within housing, and this is a project that we have been working on in order, with a question
23 from the housing corporation, “What kind of system would you then develop in order to
24 provide this flexibility?” So first, we had to figure out which elements should become
25 independent in this whole structure. On your right hand side, you see the hierarchy of
26 elements which would be defined as new components which need to be developed and put,
27 inserted into existing structure in order to increase its use quality and extend the lifecycle of
28 this building. Basically, it became this system which is a flexible wall system with integrated
29 electrical installations in it. On the left hand side, you see the state of the existing apartment
30 with the existing sockets and on your right hand side is the assembly procedure of the
31 electrical parts in this wall. To provide this spatial flexibility in housing what you have to think
32 of is the separation functionality, of separation of space, and the surfaces for data and
33 electricity which you need in each room and those elements, and doors and openings, and
34 those are elements which you want to make independent, flexible, and moveable. And those

1 are the elements which we were focusing on and making the system which is called the click
2 system which uses no screws and only you can click each component on each other. The
3 question is how do we define the independent levels which will become independent
4 physical levels within a building and this is a project and answer to that question would be
5 first of all to have a serious talk with the clients about their mission and vision and about
6 possible use, concepts, and new scenarios for the building, and to define together with the
7 client the possible flexibility options. Now this is a project in **Osaka** (ph.) developed, finished
8 ten years ago and it is a project which was based on the specification of flexibility
9 requirements developed 21 independent component and systems in order to provide a
10 structure within which six different apartments can change totally their configurations. And
11 even the facade can enclose the balcony or can become a balcony again. It is also a
12 building which has a solar panels on top of the roof and a water treatment in the cellar and
13 which integrated the green on all levels of the building and became an [...] (unclear) for the
14 birds. But it is very dis-flexible structure which was also developed in a way that two
15 architects designed a structure, the load bearing part of the building and six architects
16 designed the independent apartments of the building. This, once more going back to the
17 question, taking into account that the building has a number of functionalities. These
18 functionalities can be defined through sub-functions and ultimately we will look for the right
19 technologies and techniques to provide, to find the answer to these functionalities. So, we
20 can basically break down the building to its levels. And it is of course very confusing issue
21 but the point goes back to the beginning of design phase and is asking a great deal of
22 attention of the clients which really also have to be able to create a vision about their real
23 estate and what they want to have in the future - This kind of vision and the search for the
24 right configurations that will fit possible number of use scenarios in the future. We can find
25 back on all building levels or technical levels of the building from the material level to the
26 building level. So a short summary would be that each specification or each use scenario,
27 flexibility scenario will result into a different number of material levels and different
28 hierarchies and configurations of these systems and those are four different hierarchies of
29 different buildings which all provide different types of flexibility in the long run. So the five
30 steps in this approach would be the definition of the performance indicators with
31 specification of the long term and short-term use scenarios and the lifecycle coordination
32 matrix which will look for the reuse potential and disassembly sensitive parts of the systems.
33 And based on the specification of these use scenarios, the hierarchy of fixed and
34 changeable parts can be set up. Design of physical connections between fixed and variable

1 components can occur and finally we have to provide evaluation by use of knowledge model
2 or any other assessment model in order to match the design solution with the desired
3 performance indicators. And I may say something about this model in the end. I would just
4 like to show some examples to make it maybe more clear – it all can look and sound rather
5 complex. So the major issue is to define scenarios what we can do with the building and this
6 is an apartment project in the Netherlands, built in the 70's, and it is a building or apartments
7 which can have different spatial configurations. Everything can move even kitchens can
8 move from one place to another, so when you have these requirements than you think of a
9 system in which you need to develop in order to make it possible and then you come to the
10 systems like on the right hand side which is [...] (unclear) in a plate of 60 by 60 centimeters
11 perforated, which is used for the distribution of water, sewage pipes and electricity. So, this
12 system in the middle has been put in place and provided the flexibility. But another
13 important issue I'm going to mention here is that what we have to look for is a separation
14 between the fixed, more durable parts as previous speaker mentioned of a building and
15 flexible, more variable parts of the building and try to look for the separation between the
16 load bearing parts which will last longer and surfaces for which the different technical
17 solutions can be found. And we would like of course to go away from this tradition of pouring
18 concrete over all different pipes which are being damaged during the process sometimes.
19 And once you fix it together, you can just forget it and after fifty years you can decide or to
20 demolish your building, or to put in place another system over it. But even on the upper side
21 you have a small detail showing the flooring, the heating in the floor, which is also a
22 demountable system which is developed in Japan and is being used in housing. But even
23 concrete, the load bearing structure can be demountable and so to know a way structure, of
24 making concrete structures, was something that was very common in the Netherlands in the
25 70's, and on your right hand side, you see a system which was used for a number of offices,
26 which has stainless steel ends of anchors on columns which fix the stainless steel parts of
27 the concrete slabs and whole buildings can be raised within two days of let's say three
28 floors. And I'm just showing this picture to show that even brick can be the demountable,
29 and stone can be demountable, and this is the project of Frank Cipiano (ph.) in Paris and on
30 low detail is an [...] (unclear) building across Pompidou Center, which is only a matter of
31 attitude and being serious about materials and the way they use materials. One of the best
32 things when trying to develop these kinds of structures is to try to do it yourself. So this is
33 one of the projects I did myself and one of the first building I designed was in concrete and I
34 had to use a concrete system of panels of 7 meter twenty wide, long and 360 high and I

1 think the PhD I did in Delft came out of frustration of that design process, realizing that
2 actually you can do very, very little with such kind of industrialized products and trying to
3 look for other ways of using industrialization in its full and real potential. This is a project
4 which came out after my PhD research, which was dealing with the timber construction
5 where all parts actually came together in one **knot** (ph.) which was connecting six different
6 parts and of course all elements can be easily taken out - the assembly sequences have
7 been looked at, the hierarchy and then you see that the diagram showing the relations
8 between the structural frame, the facade frame, roof structure for example, which have very
9 controlled and linear relations. This slide summarizes the design for disassembly aspects
10 as I figured out that would be that would be the very important one when we wanted to
11 design transformable structures which are based on disassembly scenarios. Design in
12 general deals with functional, technical, and physical domains, so these aspects are listed
13 now one by another but they are very much integrated during the design process. But start
14 with this we have to deal with in the beginning, after defining the brief with functional
15 decomposition then we will look into the clustering of elements according the lifecycle and
16 defining what is more permanent and what is more changeable. Then we will look into the
17 possible hierarchy trying to provide the configurations where elements can be easily taken
18 apart and we will look for right interfaces and base elements in order to make it removable.
19 Assembly sequences will be also an important aspect which comes in very often in detailing
20 of connections, but if we don't take it into account in the beginning it can change our whole
21 design somewhere in the middle of the design process if you really are serious about
22 changing the elements, interface, geometry, and type of connection and lifecycle
23 coordination of use and technical life style coordination within systems.

24 Functional decomposition I think I will just go over very briefly through these aspects,
25 because these diagrams need actually more time to describe what it really means - but it is
26 thinking about what functionalities we are dealing with, how we are going to put them
27 together, are we going to put them together or do they need to be separated and the
28 hierarchy. Just the buildings, these buildings, can be defined through this relational diagram,
29 relations showing how are components integrated and related to each other and this pattern
30 of relations will tell us something about transformation of the structure itself. We can define
31 structures from structures which have close hierarchies which are difficult to adjust, to
32 structures on the other hand which have open hierarchies, elements which we would like to
33 remove are easily removable. The base elements and interface which can be found on

1 different levels, on a building level, or it can actually, we have to look for the right base
2 element and interface on each of the levels of technical composition from building level to
3 the system and component level. Then the assembly sequences, of course we would like to
4 have more parallel sequences, that means that we can in parallel replace components and
5 instead of having sequential sequences, that means that if we have twenty components put
6 in sequence in order to replace the first one we have ten disassembly sequences to deal
7 with and the number of disassembly sequences is of course very crucial when it comes to
8 final count. The life cycle coordination is also related, can be related to the sequences and
9 whether we have put the element which have a short life cycle that use a technical life cycle
10 at the end of the sequences, for example shown in this detail. If you would like to change the
11 window on this detail, then we'll be able to replace part of the roof and it will take us lots of
12 time to take the window out and of course taking the roof out means that the building will be
13 partly exposed to the elements, so that's also something that we don't want. So basically
14 also looking into these relations we would not like to have for example in this detail they
15 would not like to have a direct relation between the roof parts and the façade parts. A
16 **geometo componentage** (ph.) obviously is an important issue. Putting all these aspects
17 together this we could define structures from being more fixed to being transformable and
18 totally open. And as I've mentioned the design process would be an integrated one where
19 we have a constant switch from what are we designing and how are we designing on all
20 levels of design from building to the component level, and the basic design cycle would just
21 integrate, would look like this. I think I have to speed up, I understand I have ten more
22 minutes. But the basic design cycle would have to deal functionality, technical and physical
23 components, from a more abstract level to the end - from the conceptual design phase to
24 the end and this is one, I don't know if you can read or understand everything which is on
25 this slide, but it shows the optimization phase of design of one system. There are a number
26 of issues as assembly and disassembly sequences and dependencies have been looked at
27 and optimized in the next phase and this is also an optimization phase where the geometry
28 and topology of connections, have been looked at to improve the performance. The
29 aspects I mentioned, I'll just say shortly, they have been put also together in a knowledge
30 model and on your right hand side you see a net graph, which is assessing the
31 transformation based on disassembly potential of three different types of walls, fixed walls to
32 very flexible walls, I have shown here two which have been considered. All these
33 parameters have been put together and kind of narrow fuzzy system has been developed to
34 deal with weights and impacts and so forth, in order to come in the end to a number saying

1 something about the disassembly potential of the system. For these systems, we have done
2 also the environmental life cycle assessment in order to figure out if there is a relation
3 between the disassembly potential verities in terms of life cycle impacts, and we figured out
4 that, you see on the upper diagram, that wall which is flexible which is the yellow one, it can
5 be interesting to use this one, this wall only if we plan to replace it two times. So in this case
6 comparing three different types of walls, if the wall would not be replaced two times then it
7 would be also good to use just a block wall, it would have almost the same environmental
8 impact. So those are just things that should be taken, of course, into account. Something
9 about the economy of this concept. For example the project in Leiden, the medical center
10 has been recently finished and the client himself wanted to design flexible building, investing
11 8% more into the construction. Why they decided to develop a flexible systems which they
12 can reuse, is because in their history of using the medical center they figured out that they
13 replaced or reshuffled ten percent of the floor plan, per year and if they would do that and
14 they did it in conventional way terms then it cost them a lot of money. They figured out that
15 with the flexible system they could get return on the extra investment within six years. This
16 study has just been published. I would just like to go through one project from the beginning
17 to the end, actually showing the first matrix which we discussed with the client in order to
18 define ambition and to define the main criteria that we will have to deal with. So, we
19 developed a criteria and strategy matrix on a number of main aspects. In this case, in this
20 project the four main aspects were multi-functionality, flexibility, energy efficiency and
21 comfort. This matrixes then being filled by all advisors from structional engineers to
22 installation advisors, putting into matrix the strategy also, "How are we going to achieve
23 that?" And then going back to the spatial and the design parts, as the flexibility was an issue
24 a number of options have been put in place and a number of systems have been defined
25 that can help us achieve the flexibility and at the same time oversees the position of
26 installation services and support are being looked at in order to provide the necessary
27 flexibility, as it was multifunctional building. Then for the comfort reasons we didn't want to
28 have radiation. For the flexibility reasons we didn't want to have beams so we just had
29 columns and that was consensual, part columns and slabs. No low ceilings because the
30 building was very deep. So all together, those were all issues which were defined at the
31 beginning of the discussion with the client. So all together you come with a system which is
32 put in place and a building which fits these requirements which have been defined in the
33 beginning. So it is flexible, it has conferred aspects in it, and all these aspects have been
34 discussed from the beginning of design phase even before the first sketch has been made.

1 In this one, this is a sport complex, this building is being built in the place where they had
2 started to build a sport center and they never finished it, like 20 years ago, so it was old and
3 you had to put a new one. Since they never used it, some components were very good and
4 the mayor decided that I should reuse part of these seating for the football club, the local
5 football club. So that was the first part of the work that has been done, and then some other
6 issues relating to energy and the material used and so forth, have been put in place. Now I
7 would just like to mention this particular development which has to do with the development
8 of a new system which is going on at the moment aiming at extending the life of the existing
9 housing, buildings in the Netherlands. On your right hand corner there is an existing building
10 block, a typical one in the Netherlands and we were asked by the housing corporation to
11 look into this building because it is a repetition that comes very often as you can see it very
12 often, and it has very poor energy performance and when we looked in of course it has very
13 poor use performance and quality of space is very low, small and so forth. So in order to
14 improve the whole performance and life of the building we are proposing and working on a
15 number of technical systems that will be put on flexible models which will be attached on
16 existing structures which will help us at same time to improve the energy performance of the
17 building but also to extend or improve the flexibility of the inner space of the building. This
18 development has just started and is a project which is really being done with the industry
19 and manufacturing companies from the beginning in a very open and transparent process,
20 and what I want to mention at the end is the educational part, which aims to educate young
21 generations to look at the buildings in a different way, to look carefully into design of parts of
22 buildings and eventually systems, and putting it all together. So what we are doing is
23 organizing an international masters studios - this is the result of the last one. These are
24 developing flexible, adaptable structures which are being developed with the companies and
25 industries and this is the building spot where it is being constructed. This year we are
26 starting with the second part, aiming to develop a series of pavilions which will be developed
27 for the municipality of Istanbul for the year 2010, and in order to push this development
28 further, I've just recently set up a tech park at university campus in [...] (unclear), where we
29 are working together with industry and the researchers in development of this new concept,
30 use of new materials, and actually integrated new building concepts. I think I have passed
31 my time so I will finish with this one.

32 Dr. Yehuda Hollander: Any questions? Yes please. You have a microphone here please.

1 Participant: We don't have really that problem here because we don't demolish buildings.
2 We reuse them again and again and again.

3 Dr. Elma Duriasevik: That's very good

4 Dr. Yehuda Hollander: Depends where

5 Participant: What?

6 Dr. Yehuda Hollander: Depends where. Never mind, continue.

7 Participant: But I have a question about the Netherlands building because I know the poles
8 are very difficult to make. If you make another building in another 20 years, do you use the
9 same poles? And what construction materials do you use that it's easy to demolish? I don't
10 know...

11 Dr. Elma Duriasevik: That's why I showed some examples even in some concrete systems
12 which are totally demountable. So, the issue is first to figure out the functionality of the
13 building and its use for life cycle, and based on that functionality to pick up or to define the
14 design system that will answer the particular functionality. So it depends also on the context
15 that is why I also showed also the brick system showing that even brick and stone can be
16 put together, innovated, they can easily be reused and removed. So it's not so much a
17 question of material, basically almost all materials can be designed, thinking about reuse of
18 these materials in a second life phase. And of course the high-scrapers for example, are
19 buildings which by definition we believe will last longer so their load bearing structure will be
20 made of more durable material and that is usually concrete and very often, more often steel
21 as well. And all other components which will fill in this hardware or this framework can be
22 designed to be easily removed. So, you can have different infill systems which will provide
23 this flexibility of apartments or offices or facades and so forth. I don't know if I have
24 answered your question.

25 Dr. Yehuda Hollander: I think yes. OK, any very small question please?

26 Participant: It's a very small question. The person who will build the building will do it 50
27 years later, two generation from now. So how will this person know what do with these
28 techniques, this material. You have some documentation left for this future generation?

1 Dr. Elma Duriasevik: That is basically the idea, or something we are planning to do with this
2 project, we have just started development of a system which we are developing for the
3 housing in the Netherlands. Basically the discussion we have is that each system should
4 have a menu attached to that but now you have also tagging technologies, in which you
5 have chips you can put into the components with all information you want to provide further,
6 so that is definitely an issue that needs to be looked at. Some kind of manual or tagging or
7 something like that is necessary.

8 Dr. Yehuda Hollander: Okay, thank you very much. Dr. Elma Duriasevic, thank you very
9 much. It was a very interesting for us and we really expect to hear from you more in the
10 future.