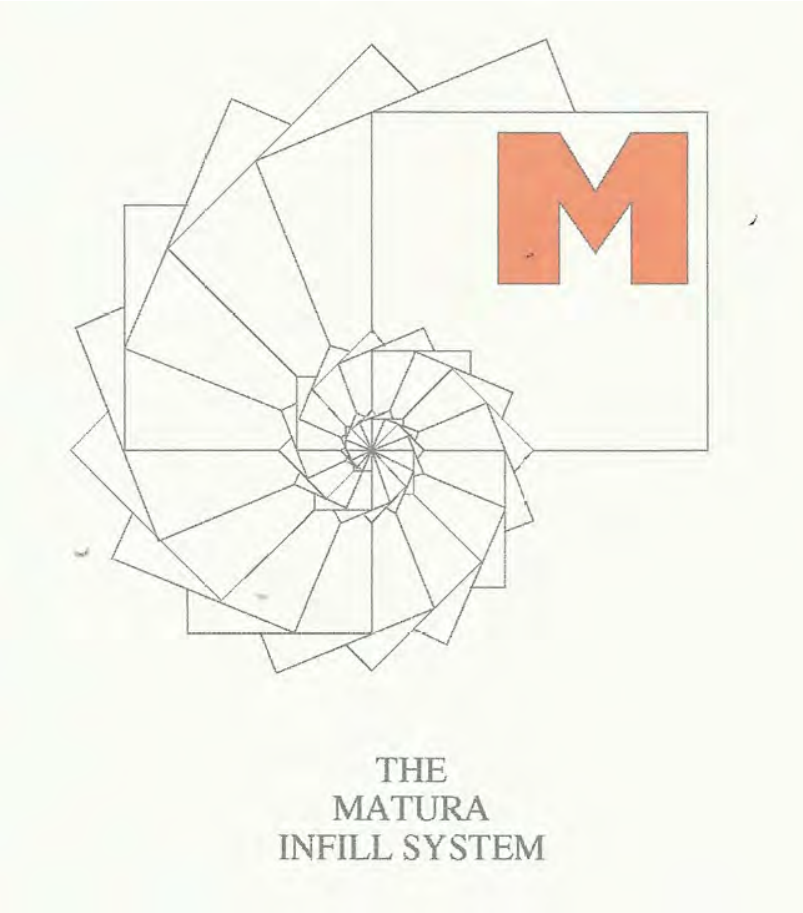
An Oral History of the Matura Infill System Development



Notes on the oral history of the MATURA INFILL SYSTEM

The documentation in this report is an attempt to capture an oral history of the Matura Infill System development effort. Also included as background and context are

1) A time line including key “pre-Matura” developments in the Netherlands and some key “post-Matura” dates
2) The interviews
3) A copy of the English language description of the system and with it some drawings of the use of the system in a renovation project in Voorburg, NL, in 1990 (before and after floor plans, user choices, out-put of the MaturaCAD software, and a few photos)
4) A paper written by John Habraken explaining the basic principles and applications.

The motivation for undertaking the interviews arose from my belief that any historian interested in placing this development in a larger context would need to hear what the key players in the Matura experience wanted to tell about this experience – a story that could only come from those directly involved and in their own words. I wanted to have recorded answers – or at least viewpoints – on what could be learned from the experience of Matura - its conception, its business model, financing and management; its place in the history of innovation in the building industry, and so on.

My intention was to assure that future explorers of open building and more specifically those interested in infill systems would have access to this information, so that perhaps the difficulties – and failures - revealed in these interviews could be avoided. Is it even possible to avoid the difficulties faced in the Matura effort in subsequent infill system development efforts, or was that experience unique? What general lessons for open building implementation can be found in the Matura experience?

The interviews were made in March 2014 and in subsequent months.

These were the questions that served as the starting points in all of the interviews. Some of the participants were not able to address all of the questions, due to their limited participation.

1. What led to the development of the Matura concept in the beginning? What was happening in the industry that provided what was at the time was believed to be an opening for Matura? What made you think the time was ready for a comprehensive system like Matura?
2. What do (did) you think were the strong points of the system’s technical performance?
3. What turned out to be the weak technical performance points?

4. For what reasons did would-be (potential) buyers decide not to invest in it?
5. Why did the partners fail to sell it in Japan?
6. What problems arose with the development of supporting software?
7. What went wrong with the role of Jansen & de Jong?
8. Please describe the various actors and their roles.
9. Where did the name come from?
10. What were some of the key "turning points" along the path?
11. Were there different ideas along the way about how to bring Matura to the market – that is, alternative business plans, marketing strategies, etc?
12. What do you remember as to the publicity and commentary on Matura, within the Dutch building industry?
13. What caused the company to close?

Great thanks are due to all of the participants in the interviews. They read the original transcripts and edited them for accuracy, and agreed that their interviews could be made available without limitation. I most especially wish to thank Karel Dekker and Frans de Vries who helped defray some of the expenses of this effort, provided me a place to stay in their homes during the course of the interviews, made contact with several of the participants and arranged times to meet, accompanied me on some of the interviews, and followed up later with additional interviews after I had returned to the United States. Thanks also to Mieke Oostra for taking part in some of the interviews.

Stephen Kendall, PhD (MIT'90), Emeritus Professor of Architecture, Ball State University
Infill Systems US LLC / http://www.infillsystemsus.com
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MATURA INFILL SYSTEM DEVELOPMENT TIME LINE

INFILL SYSTEMS INITIATIVES, Pre-Matura

1971	Nijuhis Toeleverinjg BV begins delivering 4DEE Infill System
1977	Sterrenburg (used a partition wall system developed by Bruynzeel)
1979	64 Dwellings in Rotterdam –Theoretical Cost Model for distinction Support/Infill (Dekker)
1979	PSSHAK – Adelaide Road, London (used a partition wall system developed by Bruynzeel) Architect: GLC (Hamdi and Wilkinson)
1982	Lunetten in Utrecht (used a partition wall system developed by Bruynzeel) Architect: Frans van der Werf/KOKON
1982-84	Wilma study of infill packages (Frans de Vries)
1983	Schiedam experiment (Karel Dekker)
1983	Two Wilma houses in Dordrect used to demonstrate Infill
1983	Frans de Vries hosts 200 of Wilma management staff about the new of building process - Support/Infill (Frans de Vries invites and meets NJH for the first time)
1984	Stichting Open Bouwen – Open Building Foundation (SOB) founded by Age van Randen, Frans deVries and Karel Dekker
1984	BELAN consultants report for Frans de Vries (just after leaving Wilma and after SOB founded) - title: INBOUWPAKKET
1984-85	ESPIRIT and INTERLEVEL (Harm van Triest and others)

THE BEGINNINGS OF MATURA

1986	The beginning of Matura – Ahrend Group (on the boat named Ahrend) including John Habraken, Age van Randen, Frans, deVries, Jan van Vonderen, Frans van der Werf, Rens de Groot, Dirk Smit. The discussion focused on modular coordination.
1986	OBOM founded at TU DELFT (Open Building Development Model) on the initiative of Age van Randen
1987	Infill Systems BV was incorporated *(from the archives) The first formal contacts between the Infill Systems partners and Jan von Vonderen were around February 1987. On the 6th of February, Age van Randen sent to Jan the second version of the study 'De ordening van het inbouwpakket'. (The Regulation of the Infill Package) in name of John Habraken, Fokke de Jong and Frans de Vries.* *On March 27 in 1987, there was a founding meeting of Inbouw 2000 B.V. with the so-called Arend group (John, Fokke, Age, Frans) and Jan. Contribution of the Arend group: all the knowledge and the rights of the patent application no. 8603201, 'Base Profile' of December 16, 1986. Jan provided a loan of fl. 72.000,-* *On May 19, 1987, the patent application 8701196 'Matrix tile' was submitted.* *Between April and July 1987, Fokke left as one of the founders of Inbouw 2000 b.v. At a meeting on 8 July 1987, John, Age, Frans and Jan agree to establish Inbouw Ontwikkelings B.V.* *On 21 July 1987, Infill Systems B.V. is mentioned.* *On 21 September 1987, Infill Systems B.V. is officially established. Jan provides a loan of f. 60.000, instead of fl. 72.000,-*

On 25 September 1987, John, Age, Frans and Fokke transfer their rights of the patent application 8603210 d.d. 16-12-1986 'Base profile' and 8701196 d.d. 19-05-1987 'Matrix tile' to Infill Systems B.V.

1987 A first trial floor with base profiles and partition walls was set up in an office space of van Vonderen

(From the archives) From a concept document "De ordening van het inbouwpakket" (The regulation of the infill package), the result of a collaboration between the authors (John and Age) and Fokke de Jong, Frans de Vries and Frans v.d. Werf in the summer of 1986 turns out to be discussed about base profiles and grooves (a kind of "trench") in the floor for conduits (gas, water and drain). There is talk about grooves (trench) along the walls, recessed in a normal sand-cement floor-layer. Grooves and the sand-cement floor were covered between the base profiles with a 22mm particleboard floor.

In the report it's also clear that another material than sand-cement, like polystyrene foam in modular blocks, put down and covered with a 22mm covering floor, may offer advantages.

In the grooves there will be vented horizontal drains with an external diameter of 50mm. Each appliance has to get its own drain line. At a toilet, which is not situated next to a stack, a water closet with pump is needed.

In the correspondence with Arnold & Siedsma, May 4, 1987, there is talk about a patent application regarding the Matrix tile floor. The first drawing of a polystyrene tile of 600x600x80mm is made by Van Vonderen Interior Contractors BV and dated the third of June 1987.

Age hired 10 – 12 students at OBOM (TU DELFT) to do research. They researched the arrangement of installations and the disconnection between support and infill. This was the first time the different zones for different installation lines were pointed out: electricity, water, drainage, etc. This was pointing to the design of the Matrix tile.

1987 General system patent submitted as international application

1988 First application of Matura in a for-sale unit in Bergeyk

1989 Second demonstration unit installed in Eindhoven (client was Sociale Woning Stichting)

1989 MaturaCADS was developed (used for the first time in the Voorburg project)

1989 Matura International approached by Shimizu and Haseko

1989 Infill Systems commissioned a marketing study for Matura

1990 Matura Business structure organized – Matura International – Infill Systems BV grants license to Matura International

(From the archives) The contract with Janssen & deJong stipulated that they became co-founders of Matura Nederland and participate in Matura International (like the Japanese interests).

Infill Systems is owner of all the know-how – it gives exclusive, worldwide licenses to Matura International – that gives sublicenses to Matura NL, D (Germany?) and the Japanese.

Ambitions were international. Matura International was co-shareholder of the Matura's in several countries. On the other hand that countries could became co-shareholder for 10% in the mother Matura International. This was intended for the international knowledge transfer.

Janssen & De Jong were involved since the 1990's at Matura NL. They had a majority shareholding in Matura NL. They invested millions of gilders in development of the system, the logistics center, the showroom and projects.

At a certain moment, a problem appeared. J&J was a family company – a few brothers formed the board, a few didn't. These brothers wanted money. To organize that, a few businesses had to get sold. There were liquidity problems at the Vereniging Bedrijven

	Janssen & De Jong, resulting in stopping investments like Matura, regardless of the consequences. Erik Krul came to remediate the business.
1990	Symposium: Consumer Oriented Renovation (presentation of a number of studies: OB decision-making; presentation by OBOM; by Habraken; etc.). Result was approval by the Patrimoniums Woningen Housing Association for the "one-unit-at-a-time" approach to the renovation in May 1990.
1990	Infill Systems was asked to bid for the renovation of a single unit in a housing estate in Voorburg (ERA was not the contractor for Matura; rather, Matura was ordered by the housing association)
1991	Breda office of Matura Nederlands opened
1991	Matura Nederland BV formally established
1991	Agreement with Janssen + deJong for sale of 2/3 rights
1992	Breda showroom opened
1990-93	Continuing Matura deliveries to Voorburg project for a total of 20 Infill system packet
1993	Another order for Matura (14 units)
1993	Infill Systems renegotiates Janssen + deJong agreement (Janssen + deJong activities with Matura Netherlands stop and Infill Systems and Matura International activities continue)
1993 -94	Continued business by Matura Netherlands
1995	Last Matura packet delivered to Voorburg
1995	70 Matura units ordered for Eykenburg project in den Haag (Karel Dekker); MATERA solution developed by ERA and 20 delivered in 1996.
1995	First approach to Rinus Platschorre and TBI Holding
1995	Matura Netherlands negotiates sale of all activities to Matura Inbouw BV (Steinke's new start-up for Germany, Russia and the Netherlands) (Matura stated it could not deliver to Eykenburg due to developments in Germany, except at a higher price)
1995	60 Matura units might have been possible for elderly housing Warmond (Karel Dekker) but because of the problems with Matura the offer was never made.
1998	MATERA was offered to Voorburg (but never delivered)
1998	Steinke withdraws funding – Matura Inbouw goes bankrupt
1998	(March) End of Matura Netherlands

POST MATURA

2004	RENOVATION: refurbishment and Infill systems L.M. Egberts (Karel Dekker's student at Delft)
2007	Karel Dekker attempts to sell all IS know-how to TNO (failure)
2009	New development – CableStud and Matrix Tile developed by Age van Randen as separate products, CABLESTUD brought to the market by GYPROC and PlacoPlatro
2010	KIT-FIT installation using CableStud and Matrix Tile in the United States at Ball State University by Professor Stephen Kendall
2012	ISUS formed in the US by Stephen Kendall
2012	Efforts to sell know-how in China

The Interviews

John Habraken, Partner

Age van Randen, Partner

Frans de Vries, Partner

Jan van Vonderen, Partner

Jacques Janssen, Investor (Janssen and de Jong)

Rinus Platschorre, potential investor

Rene van Riggelen, Technical Director, Matura BV, Breda

Louise van Randen – Crooijmans, Interior Designer / Client Interface, Matura BV, Breda

Wouter Habraken, Matura Cads Developer, Breda

Toon Huyps, Managing Director of Matura BV, Breda, 1990 -1994

Nico Vonk, ERA Contractors (Voorburg project)

Karel Dekker (Board of Patrimoniums Woningun, Voorburg Project)

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

JOHN HABRAKEN

The first question I've been asking is what led to the development of the Matura concept in the beginning, and by way of that question what was happening in the industry that provided what was at the time to be the opening for Matura? What made you think the time was right for such a comprehensive approach? And, by the way, the use of the word comprehensive is important. Other people I've interviewed have called into question such a comprehensive system.
Definitely, yes

Could you speak to those questions?
Well, can you refresh my memory, what was the year that we decided to get together? In the '80s, wasn't it?

Yes. 1986 there was the group on the boat. And that included you and Age and Frans van der Werf, Fokke de Jong, Dirk Smits … there were several meetings during that time. One of them was more general - about OBOM I think - and then the Matura discussions.
I may be wrong, but in my memory it was on the boat trip that we first discussed doing an infill system, and there was this guy from Belgium, what was his name? Dirk Smits. And there was Fokke, but Frans van der Werf I don't know. Frans de Vries was present on the boat trip, I am sure. In my memory at least it was the first time we discussed this possibility. I don't know when was the first time that I did that. Fokke decided not to join us. He felt that the office needed his time, although he never told me, I think Joke also thought it was a bad idea.

His partner?
Yes, and she was right. We must have had a number of discussions and meetings after the boat trip. At a certain point I decided to make myself free and come to Holland for a while to work on it. We, that is Age and myself - started doing some designs. Fokke and Hans van Olphen found a space in Maarssen for us to work and a room for me to stay. Then Frans de Vries introduced Jan van Vonderen into the discussion, and we showed him the first sketches. We needed somebody who was in the real world practice of actual building and also somebody who had some money to help us fund the thing. He became interested, and we sort of bargained about a certain amount of money that he would put into it, I remember. So he joined us.

Your question why did we do it at that time? Frankly, we had a sense that the time was ready. I don't know why in retrospect. I don't know what happened in Holland that made me think so. I think it's possible to check, maybe at that point there was a recession in the Netherlands, a very severe recession, more severe than now, which Frans recalled in our discussion. I don't know whether our decision was when things were picking up again. Frans probably told you that before we got in touch, Frans and I, he invited me to come to Wilma developers and builders, a seminar or meeting of the people in Wilma in Dordrecht.

I think that was in 1984.
'84, yes, and that was because Wilma had decided they had to rethink their policy because of the recession. And Frans was very enthusiastically defending the idea of separation of support and infill, and I'm sure he told you all that. Then he found out that although everybody thought it was a good idea, that job managers figured out that if that would happen they were without a job… were no longer

needed. They did not cooperate anymore. At the same time, the recession was easing up and people went back to their old ways, and he got disgusted and left Wilma. So it must have been in the years after '84.

The work at OBOM had started a little bit earlier, I think.
Yes.

Some of the groundwork had been laid already.
Age was very influential at OBOM at that time. I think he started it and he was sort of the driving force. And you have to ask him about it, but my sense was that he still felt that the thinking was too much caught in an academic setting, and that the idea of a Matura system was to go back to practice, to do real things, and I think that's what all of us wanted to do. So, to answer your question, there was a general idea that after the recession things were picking up again and new energies were available.

Do you remember having read and thought about systems building … I want to try to pull out of your memory the reading that you were doing then or before then about other ambitious systems approaches to, whole system approaches, to building production. You remember the General Panel House and the Lustron house and the Clasp System in England, and so on. There were many heroic, ambitious efforts to really, really introduce new ways of thinking and processes and relationships between supply and demand and so on. Do you remember having those in your mind somehow?
Well, to a certain extent. I do remember that I didn't go very much into all these things, but I do remember I was thinking about the initiative by … was it Gropius and Wachsmann, the General Panel House, and I was reading about it … and I concluded that the mistake they made was that they did not understand that the buildings were the result of a much more complex development initiative of many different parties and you cannot capture it all in a system - in one closed system.

At the time I thought we knew better because we understood that an infill system had many sub systems, all already on the market and all we did was adding two more (the base profile and the Matrix tile) to make all the other ones easily installable and changeable. So our system was to be able to accept new and better subsystems over time. That was an open system that allowed the building. industry at large to develop. I still think that was a sound approach compatible with the recent Long Life Housing Act in Japan.

Still we did two things that challenged the status quo and disturbed the ongoing culture of working and coordination among the different parties: We wanted to do away with the choreography of sub system installers and have the entire infill system done by one team of multi skilled workers. We also wanted the entire Matura system to get on the market whole, rather than let it slowly infiltrate ongoing practice. Since I supervised your PhD thesis I should have known better. So in that respect we made a mistake similar to Gropius and Wachsman, which is ironic.

When did you come to that realization?
When it was too late.

Ah. Okay.
We got carried away by the discussion of the idea of a comprehensive system. We all assumed that was a good idea. The only person who thought differently was Wouter. I remember that he argued that we should be much more pragmatic and start with partial steps, and we didn't listen to him.

Was that early?
Very early on

He wasn't part of the initial brainstorming activity?
No, no. Then we were already on our way. He actually wanted to join us because he was intrigued by the whole thing, particularly the technicalities of it, but he thought we had to be much more pragmatic and move into practice piecemeal, and he was right.

Maybe, but the interesting thing is that the partners and others in the surrounding discussion were so excited about this, okay you separated the whole into support and infill, and now instead of developing one thing for everything, you develop a comprehensive system for the infill. Was it also in mind that a comprehensive solution for the support was just waiting to be found? Or we didn't know comprehensive solutions for supports, that's not a good idea.
Yeah, right. You could do supports any way you want to.

So what was the collective thinking that made the infill different?
Well, we did not rule out the possibility that other infill systems might be developed and applied. The idea of a small team of multi skilled workers is now proved right I think. Today's handymen already operate that way. But our insistence on a fully comprehensive system, fully computer controlled etc. was not realistic.

I'm interested in the progression of thinking …was it true that from the very beginning of the discussions the idea was a business to deliver the entire package or did that idea develop in the course of time when you brought other people in?
No, I think that we all agreed implicitly that we wanted to produce an entire infill system that you could put on the market. We also discussed, I recall, that in principle you had to use as many as possible existing products, so we saw the base …

The matrix tile and base profile
We saw them as the two subsystems that could pull everything together, and implicitly it meant that a company could do an entire product.

But you could sell those products to another company that could put it all together?
Yes, but that was never discussed. … And so the idea that you would say look we have two subsystems, products that we want to introduce, so that everybody can be more efficient at doing an infill system, never occurred.

So the ambition to deliver the entire package was always there from the very beginning.
Yes, but it was never discussed that there could be an alternative, except as Wouter brought it up from the …

Later.
But we ignored it and Wouter didn't raise it again. Maybe he got interested in the software issue… So, yes, we sort of moved into what you call the comprehensive approach in sort of an intuitive way, and I'm sure that I was not alert enough on that point, I think that is the mistake that I made. Age, by nature of course, likes to control everything, so the idea of a more open approach is not very natural

to him, and Frans very, very much wanted to be the president of an infill system company. He wanted to run a new industry, and I remember that we first had this guy that became the director when Jansen and de Jong took over to finance the thing. That failed, and we decided to do it ourselves, and Frans became the director. He was delighted.

This was after the funding from Janssen was taken back?
Yes

That was the time when alternative sources of investment were being sought?
Yes, and it was also the time when we could have been rethinking the approach, but it never happened.

Interesting because he (Janssen) had confidence, and van Vonderen had confidence, and everybody had confidence that the market would be there, right?
Jan van Vonderen at that time was of course at a critical time. He became ill. I cannot tell you exactly the timing, but I think it was after Janssen and de Jong failed their effort. And I remember that we were sitting around a table in Jan van Vonderen's office, and he became un-well and had to be taken to the hospital. He had a stomach ulcer, and was in very bad shape and out of the discussion for a while. And that was a critical point because he was always very practical and calm. So I think it was very bad luck that that happened, and if he had been in good health and participated, we may have moved differently. I don't know, maybe. He certainly would have slowed us down or given some warning signals. Then his wife died, and for quite a while he was no longer involved. As I was not always in Holland, it was really Frans and Age who both were sort of very ambitious for total control.

But as you recall, there was really no stopping to reflect and say "is our basic premise sound?" The other thing I've been asking people, what analysis was done either by Infill Systems or by the investors on the market demand. On what basis were people investing so much money?
Janssen and de Jong, you mean?

Yes, and you the partners were putting in a lot of money. So it can't be that it was just a belief in the whole thing…
It was. It was. And it was only discussed when we invited potential financiers to come and look at the system and we had to show them the mock-ups…

In Breda, you had the showroom and so on
They came up with a very crucial question, they said, 'look, how does somebody who buys it, installs it, know that you will be around 15 years later when he needs new components? Is there any guarantee that you will still be around?' A very good question…

And what was the answer to that?
Well, we weaseled our way around it.

Did they also ask, 'what's the market?'
No, that was not a question that was asked. It was assumed that the system was technically superior. There was not really a question about whether it could be installed in a couple of weeks. Everybody was impressed by the clarity and organization of the system, but there were two recurring questions, one was the one about the future, and the other was that it would take a major investment, a long-

term investment, a commitment for many years, which is not what the building industry is about. Compare that to the car industry, where they are happy to invest millions of dollars for several years before they make the first penny. You cannot do that in the building industry. So at that point it dawned on me that these were two very crucial issues that we could not deal with.

Even if somebody had said 'let's spend some money doing market research' or 'let us hire a marketing consultant to give us evidence that there's a market for this thing' I'm wondering if anybody would know how to do that if they had been asked to.
The marketing question was never asked.

But if …
I don't think the building industry knows how to do that very well, especially for truly new things.

Does anybody know how to do that, particularly in the building industry? I'm thinking to myself now when these other ambitious efforts from Ehrenkranz back to all the others that have been published in all the books, did anybody ask the question of what is the demand? While I know that Lustron believed that it had government orders in hand that would justify gearing up the production process and so on, that they were assured of a demand by the U.S. government, then when that that disappeared, the whole thing collapsed. So I don't know much - I haven't read this in the literature - about these systems' developments to find out other than that just a passion for it and the belief in it …
Do not forget that after the war anything you built would be used. Your marketing question became important at a later date. I think it comes back to the issue we discussed earlier about Gropius and Wachsmann. All these systems assume that you could propose a comprehensive system that totally ignored existing practice and that for some magic reason people would all say, 'that's better than everything we have done, let's do it this way.' That was a very interesting blind spot that everybody had, and what I find most intriguing is that even though I figured that out before we started to talk about Matura, we made the same mistake.

But not entirely because …
We were right about the replaceable sub systems and the multi capable installation crew.

As a principle you said 'let's use 90 percent ordinary products, no change in those, we don't want to invent everything.' So that was smart. That was recognition that you couldn't change everybody. So … between changing everybody's habits and not changing anybody's habits, which means you're not introducing anything new, you crept up the ladder of control to a certain extent.
We got sort of sucked into it. But you know, what Frans is doing right now, what you are doing now, is what we should have done.

I'm not sure because there's not success in that either. So I'm not sure. I don't know.
You cannot be sure. At the very least, that's the way improvements always occur.

Incrementally. Step by step.
Somebody introduces a certain part of the whole in a better way, and people say 'hey that is smart, I can use it, and I don't have to rethink everything." That's how the drywall system replaced the traditional stuff.

But there are other cases like the iPhone, which was a very large leap from what had been there before, not a total leap… it pushed the boundaries substantially. So there are examples of aggressive

transformations, but not very many and not …
Not in the building industry.

Not in the building industry … so that's another point - everybody points to a computer or something like that as an example of a major transformation, but that's not the building industry.

So the social complexity of the building industry makes this comprehensive innovation impossible. In addition you are comparing very different animals. The iPhone may be a sophisticated and smart invention but compare the number of subsystems it has with that of a fit-out system. And the iPhone cannot be custom produced. The comparison makes no sense nor does the marketing question.

I'm very interested in how that recognition made its way into the strategic planning of Matura in respect to technical development, product development, software, business planning, marketing, sales, all the factors that by necessity need to be understood to move an initiative forward. In every one of those categories, there was some calibration going on….
Yes, I think that in retrospect, the overriding image that was never explicitly discussed, was that of "a infill system as a product" which is different from the idea that you introduce in the building industry certain components that can be used by everybody in different ways. That distinction between those two approaches was never discussed.

But you all knew, you and Age particularly are students of innovation in the building industry, systems and development. I wouldn't expect Frans or Jan van Vonderen or Jacques Janssen to know, because those guys were not, could not be expected to be students of the history of failures.
No, but Jan van Vonderen made his whole company by producing a part of the building, not the whole thing, so he understood the idea that you have your own expertise and you add it to everybody else's.

And you only with great risk try to grab other domains into your own.
Yes.

Jacques Janssen mentioned the other day that they were a holding company, and they had many profit centers that they acquired. So they acquired Remco, a steel building system company.
Steel.

Yes. And he was particularly interested in it, because they delivered a product, a steel frame, made in a factory and offered by way of a catalog. They also delivered the service to erect it, but they were outside of the normal contracting industry because, as well all know, contractors offer capability to build anything you want, and manufacturers offer solutions that they give you if you want to take it. They were very interested in Remco's detachment from the normal contracting business - price fixing or not. And that's what he thought the future was, so he saw Matura in the same way. He said Matura really delivers a solution like Remco delivers steel buildings for warehouses and factories and so on, and he said that's the future. He wasn't interested in the technical stuff - he's an economist. That was his image. They were looking for product solutions like Remco and they saw Matura in that category.
Okay. I see.

So he was enamored of this approach to the market.
But it was still the attraction of a more comprehensive control.

What did you think were the strong points of the system's technical makeup?

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

Well, I think that the interesting thing was that every subsystem, not only the matrix tiles and the base profile, but all the things that go into it - the electric wiring, the piping, and all these things, the many, many subsystems already on the market - the beauty of the Matura system was that these things would be replaced by better products, so in that sense the whole system was open. If you have a different way to make a gas line, or a sewage line, or whatever, or somebody makes another way to make electric wiring, you can just put it in.

And to that extent the ambition was not to control everything, not to control the parts, but to control their location and position.
Yes, I think that's probably why people liked the system when they saw it…you offer something comprehensive, if you like, but every component could be changed by a better one in the future.

By some other company making them…
By anybody. So that if you would run the Matura system, every point when something better was on the market, you could integrate it. That was very powerful.

The idea is powerful, but did you see evidence that for example the matrix tile could perform that way?
Well, it could change too. In fact it has eventually. There were already questions early on. That's why Infill Systems now has a better design because the idea that you had to put the piping and the wiring on the bottom was of course cumbersome. There were people who said at that time, why don't you just close the floor and then put the walls on top? Why do you need all these grooves to put things in? And of course we didn't like it when they said that, but they were right.

Maybe you remember in the first installation in Voorburg, where the floor covering was a big problem because it came up to the base profile, not under it; it was hard to cut; it was loose. So we had to figure a way to hold down the edges…anyway… that's another thing. So the openness of the system was a basic principle. And you think that was one of the most important aspects.
I'm not saying we fully succeeded in the matter as we have just discussed, but I think we progressed to a certain extent, and it was to me the most interesting part. Nevertheless, we still wanted to offer a comprehensive system, and the flexibility that I was talking about was something that was one of the positive points of the comprehensive system, which is different from just introducing components and saying 'do with it what you like.' So in retrospect you can explain these things, but in those days, the differences were very close. And then of course there was this whole issue of implementation, the organization of the company itself with the prefab components and the software, and I remember that I was sort of concerned, uneasy, about the extreme detailing of everything, particularly with the software that Rene van Riggelen was endlessly working on. All the components, everything had to be controlled, and there was no room for any improvisation on the site, and I felt there was something wrong with that, and there should be a point where you say look here, this is where we stop and the guys on the site have to make some decisions, maybe cut off something or whatever; don't try to prefab everything until the last nail.

Rene was trying to cut costs all the time.
Yes, but the background, the way he tried to do that was by controlling everything in full detail. You cannot do that.

So there's an aspect there that matters a great deal.
Yes

It cuts across many of the aspects of the concept. He was under extreme pressure to cut costs, not only to get jobs but to show the potential investors that they could deliver at a cost the market would bear, so even early on I think the costs were a third higher than the competition of conventional infill even with faster, quieter, more control of quality, choice, all those good added values, the costs were still not coming in where they needed to be … so I'm sure Renee was just working very hard to figure out how to make it sell … so that's kind of back to the other question about convincing the investors who were skeptical; if the argument was that if Matura Nederland could go from 100 units per year to 200 to 600 per year and really ramp up the production and delivery, the unit cost would go down … but it didn't happen that way.

This was part of the fact that you could only do it if you were willing to invest long term lots and lots of money, like you do in the car industry. The first cars were not efficient - they cost money. You couldn't make money on them. So, and that of course was the result, you cannot just try to design your way out of the problem, and I think that none of us ever raised the issue that maybe the more efficient way is not to decide everything. It comes back to the fact that if you want to do a system like that you have to find long-term, heavy investment, and then after 10, 15 years, you will have thousands of units, and you will make money.

Or not

Or not. But that's, you know, one of those things that I felt was in your question about the market and that was something that … well, I was convinced that the market was there. We all were. I remember when the television was first introduced by Phillips, and everybody said, 'forget about it, nobody can afford it. Ten years later, there were more television sets than there were telephone sets.'

And Phillips was out of it.

Yes, and Phillips was out of it. I remember that there was a guy … he was a building economist and he was a very controversial person because he told everybody that they were stupid and he was the only one who understood what was going on, and I liked the guy because he confronted the established way of thinking. I remember that we found ourselves together at some symposium or conference or whatever, and afterwards we had a drink, and he said 'look, John, you architects always say that you have to make things cheaper because otherwise you cannot sell them, forget about it, he said. If you make a good product, the market will come your way.'

The whole idea that you have to make a cheap house is a stupid idea. This was an economist who said that…I can't remember his name.

Well, that's backed up in the U.S. home building industry, for example, where data shows that consumers will not go for the lowest price kitchen when given a chance to select; they'll pick above the lowest cost. The same goes for furnaces, air conditioning systems, or other items.

People will be seduced by the quality and the look of the things, and that's why they buy them. That's why they bought televisions. That's why they bought telephones. That's why they buy these things.

So, that comes back …

So his argument was that the economy will adjust to the desire of the market, not the other way around.

So what efforts were being made to advertise, to promote, to create demand?

Well, again, we felt that we could not do that, and that's why we needed an investor who was willing to

take that on. … And then we found out that in the building industry nobody is willing to do that, to think in that way. You're not a car industry.

Actually, that is a discussion Frans and I are having every time we meet, and I'm telling Frans - 'Frans, you don't know how to create demand; you need to find people who do.' … So, we've asked the question, 'how did the kitchen industry detach itself from the grasp of the construction sector and become its own autonomous consumer product?' How did they do it? How long did it take? What bumps in the road did they find? I've been asking people "Who has done such studies?" Apparently no one…

You remember that in the days we were working on the Matura system, there was the Bruynzeel kitchen, and we were in touch with them because we felt that they knew what they were trying to do, and they were intrigued by our system.

Well, earlier, they had a partition system that was used by Nabeel Hamdi and Nick Wilkinson in the Adelaide Road project in London (PSHHAK). It was used in Lunetten, too and maybe in Papendrecht. Of course it eventually failed to take hold because it was too expensive…. It just couldn't complete with the normal practice and products…

Okay, why did the partners fail to sell, to make the deal work in Japan? How did that start?

It started because of Haseko, which you know is a big company.

Did they approach you?

Yes. They had somehow heard about us, I don't know how.

Through Seiji Sawada, right?

Probably. There was this one vice president or director, I've forgotten his name, who felt very strongly that was what they should take on. So he proposed it in his company, 'this is what we're going to do, and we will bring this up,' and he fought hard to get it done. For some reason or other, he failed. His backing …

Disappeared

Yes

They had Shimizu as partners, because it was Haseko and Shimizu together?

I don't know about that. You may be right. But one of the things that I remember was that in Japan you do not start something big unless the government thinks it's a good idea. If the ministry is backing you up, the banks will open up. And in our case our friend, I think failed, or the company Haseko failed, to get the backing of the government.

Backing of the government.

There was a big ministry…

MITI … Ministry of International Trade and Industry. At that time, they…

They were the big arbiters

Not the ministry of construction. That was a different one.

No, no, no. And they couldn't get them on board. That was my impression. So they did not get the

blessing, and if you do not get their blessing, nobody else will put money into it. Of course, they never tell you what their reasons are, but there was a certain point where I found out they no longer wanted to do it. Our good friend who had been fighting very hard was sort of losing prestige; he was no longer calling the shots.

They had already invested some money in Matura Nederland. They were shareholders of 10%.
That's possible.

And they had built a big mockup in Tokyo, and the Matura partners and investors had been there.
Oh, yes, we were working on a contract with their lawyers and our lawyers—don't ask me all the details--and moving very much ahead, and then at a certain point, it sort of evaporated.

Did someone tell you that it was because the government?
No, they never tell you what is going on.

So, Sawada never gave you the real scoop?
Well, they found, they came up with some funny reasons not to move on, and I remember that at a certain point, some one slipped to me a paper on which they had the real reasons or something like that, and then we had this discussion. I let it be known that I had read this background paper, and they were very upset and furious that some one had …

Revealed their confidential thoughts.
Yes, revealed their real thoughts. They were just sort of moving around to find excuses … At that point, I understood we were losing the game … which indeed was a big disappointment. I believe in addition, that in Haseko or in Japan generally, it's a problem if it has not been invented in Japan. I think there was also an issue for people, too, not to embark on an entirely foreign invention. Of course, they never said that. Another interesting thing I picked up too late is that our friend Sawada always stayed at a certain distance. He never came out as if 'you guys, you have to do this.' He was too smart for that. He probably already understood that Japan was not ready to take on these Dutch people.

That's another unknown dimension to the whole thing.
But still, the fact that … if he had been an outspoken

Proponent
Proponent, it would have made a difference. He was a very prestigious, important person. People listened to him. But I blame myself that I did not notice that attitude.

That's so difficult to read. It's hard enough to read those things in your own back yard, much less the Japanese backyard.
Yes.

You should not blame yourself for that one. So, Sawada was trying his best to make something happen, right?
But he was so possessive of the idea and also the contact with me, that he attacked everybody who approached me without asking him, so he was not a really helpful person. It got to a point where he was almost obstructing, because he had put himself in the way of the case.

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

OK. On another subject, what problems arose with the development of the software, or could you recall when the recognition of the importance of software came up, and how things started to develop with the whole software side of the story.
Well, initially it was Wouter who set it up…

But when was it recognized that software was a key to the success?
Well, I think we all agreed that if you want to install an infill system in two weeks' time, you need a very good logistics system, that all the components must be known, and that you have to decide how much you will prefab off site and how much you will bring on site, and so on, and that in order to control the logistics, you need software.

But this was 1985.
Yes.

Software for that was unknown, right? Everything was … that's at the dawn of the computer age!
Yes.

I don't even know if software was a word at that time that had the same meaning as it does today.
Right. I don't know. It was new, yes, but we all felt that the know-how was there, you just had to put it together. And the computers were strong enough to deal with it. Anyway, Wouter set it up. He's very inventive and smart in setting things up and understanding how, but he's impatient with details. And so the moment he feels that the problem is solved and the basic structure is in place he wants others to …

Make it work.
The nitty-gritty stuff to make it really work, yes. At a certain point, he decided that it was no longer very interesting for him or something like that. At the same time, we were already in a situation where it was very difficult to keep things going because Janssen and de Jong had withdrawn.

But you had Matura CADs before Voorburg, because the drawings of Voorburg were drawn with Matura CADs and that was already 1990.
Yes

And what was your role in all that?
Not much. I felt it was important, but I was not particularly interested.

The idea of element groups and elements and the hierarchy of components …
Yes, that is something I found interesting.

Was it a group development, and at a certain point, everybody said, 'okay, Wouter, here's all this stuff, this thinking, now go, go make it work.'
No, it was the other way around. Wouter took the initiative.

He said, 'here's a need.'
With the blessing of all of us, of course. He put a lot of time and effort into it and put it together.

He was here doing his business degree at Erasmus?
Not yet, no, that was afterward. When he left the Matura job, he decided that he better get an MBA.

Okay.
But he was just… he liked the idea. He wanted to participate in this Matura thing, and he felt that he could make a contribution, and we paid him some money, and so that was all okay, but as I said, when he saw through enough to see how the thing worked, he was no longer very much interested in it to polish it to the last detail.

Is that when Ahrend came in?
That's when Ahrend came in and read the whole thing and pointed out that there were all kinds of details that had to be taken care of. And I was sort of irritated by that, not so much that Ahrend was doing that, but I felt we should not spend our time doing these things, we should just move forward. You have to go with it, and this kind of …

Preoccupation with perfection
With details and things that you have to work out in practice, and when things don't work, you have to fix them, and so on … so it irritated me that Age saw a way to bring his son in, and … I felt that we should not have. It's not that I was against Ahrend, but I thought we should not go so much into all those details. And Renee, of course, also wanted to go into all those details.

Renee was a student of Age and part of the OBOM group.
Yes, and he is not particularly strong in the larger strategies, but he likes to fix things. I felt that this preoccupation with the last details and the perfection was not what we should be doing right at that point, but I don't think that we really discussed it openly sufficiently. I was sort of there only part time because I was in America and I was already feeling we were losing our way with Frans being very much interested in being the president of Matura and … and all that, so on and so on. So I remember there was a certain point when we had a crisis and Janssen and de Jong no longer could really do much, I strongly argued that Wouter should be given responsibility to run the thing.

To run the software development?
No, to run Matura.

Matura Nederland.
Yes, to be involved in that.

Or Matura International…because Matura International gave the rights… There was Infill Systems, and you gave the license to Matura International, and then Matura International gave it to Matura Nederland …
Oh, boy, I forgot all that.

Then there was Matura Inbow, and then Steinka's Matura Einbow. I'm not very clear on all of that.
I felt that we needed somebody who looked at things with a kind of common sense way and that we were sort of losing our way. Of course it was a mistake that I tried to push that because there was no way anybody would accept that.

Because he's your son
Yes. And I remember Marlene said, "Look, John, two Habrakens' is too much for people to deal with…." and I think she was right, of course. At that time already, and also after Wouter had left, the cooperation among the partners (with Jan van Vonderen still not very active) became a

problem. My limited presence in NL did not help. There was a certain point where Frans and Age made certain decisions about the management of the company without consulting me, without telling me. I got furious. I felt that I was betrayed.

Was this after Janssen withdrew the money?
Yes, when we tried to do things ourselves. When I found out, I was angry. We had a meeting in which they went on as if nothing had happened, and I finally had to say, 'look, I want to talk about this. You have betrayed me. You have fooled me. You have done things that you should have discussed with me, and I walked away. I remember in the summer, Age came to Awater to make his excuses … he is not very good at that, but anyway the intention was clear that he came to sort of, he felt he had to …

Make amends?
Make amends. And I in a way accepted that, but Frans never brought it up. So I got fed up with the whole thing, and I remember that Leon Groiser at MIT asked me how things were going, and I told him about that, and he said 'why are you still dealing with these people? That's not your way.' And I said, 'you're right, I should walk out, but I have too much invested.' So there was a low point in our relationship.

Meaning?
The cooperation among the partners did not work well anymore. There was another issue that illustrates this. Long after he had left, Wouter contacted Jan van Vonderen who then did the finances, reminding him that the partners still owed him a certain amount of money. There was a signed contract but Age refused to pay his part, and so Jan did not pay, and Wouter felt that he was betrayed. I did not know; Wouter never bothered me about it. But at a certain point, when I was in Holland, I had a meeting with Jan van Vonderen, and Wouter found out about that. When Jan and I were sitting there, Wouter walked in, and he said 'Mr. van Vonderen, you owe me money.' As a result Jan paid it out of his own pocket.

That's how it worked. Because this …
So it was not the very best situation. I will say that I admired Wouter for the way he handled it.

That has … it's like …what's that Japanese movie - Rashamon - … an event happens, and there are seven different interpretations of it?
Yeah, I'm sure you can say that

That's a hard, hard point.
You probably know exactly what happened, more than I do.

No, no, I get another point of view from others.
Yes, I'm sure.

From the beginning, did each of the partners have a discreet role and responsibility in the development of the concept through its various stages?
You mean from the beginning to the end?

Yes. It was you, and Age, and Jan and Frans … so were you in charge of x, and Frans in charge of y and was it was very clear that each of you had a job to do?
No, but it sorted itself out by itself. Jan was sort of taking care of the finances and the bookkeeping.

Well, Frans said that was his job.

It was his job?

All the way through Frans said he was the accountant.

Maybe he was. I don't know how Jan then could make a written deal with Wouter. They have to sort that out.

But anyway, you each had strengths.

Actually, I think Age and I were working on the system itself, the design, very much.

Together in partnership

Together in the sense that … yes, I sort of had to … Age had very good ideas, and I tried to sort of make them work. We got very much into details together and so on. And I think for a long time there was a very nice partnership that worked. So the problems only came when the hardware was already in place, but we were of course amateurs in terms of business development.

Yes, but one would assume that's why Jan and Frans were on board because they were both business people.

That's true, and that's what happened. They took the initiative to make the mock ups and to find the parties to talk about things and so on and so on, and Age was also very much involved in that too. I was not because I was not present all the time. I was there from time to time. I had no longer my little apartment in Holland. I went back and forth.

And you had been away anyway for 10 years …

Before we started …

Yes you were at MIT from '75, so your close contacts with the people …

In touch with people in Holland in the summers, and for one or two years, I was in Holland for long periods, and developed actual designs. But when that was done, I did not stay that long.

And then when the company was started, Matura Nederland was started, you hired Renee and Louise and there was a crew of 10 people on the payroll at a certain point. So when the business was started, Renee's job was to hire people and make the company work and deal with management …

I don't know how much he was expected to do. I saw him more as somebody dealing with the logistics part and setting up the company, how it would operate, the details, the technical part, the sequences of things and of course the software, using the MaturaCADS. I'm not sure he hired people or had a say about that; that's what Frans and Jan did.

It's a question that I've raised with Frans, and I'm going to do it with Age, but there seems to be some lack of clarity about role distribution and responsibilities assigned.

Absolutely.

It sounds like it was rather organic.

Frans at a certain point was the director or president. He could not really tell people what their roles were: 'you do this, you do that …'

Nobody was doing that.
Nobody was doing that. Everybody was moving individually. That's why these kind of controversial issues could come up like Age's son coming in …

And who hires who to do what …
And Jan apparently making a deal with Wouter because he felt it was real, and then he couldn't pull it off because the partners did not want to pay.

Well, Ahrend went off with everything and started another company.
Yes

The question of roles and responsibilities …
Was muddy

That's interesting to me because of the business acumen that both Frans and Jan brought.
Yes. Again as we already discussed, Jan at that time was out of commission because of the death of his wife and his own sickness. It was a very crucial time when we needed him more than anyone else, and he was not there. He did not meet with us. He had his own problems. So it was only Frans who was formally in charge, but he did not, could not tell Age and me what to do…there was no clarity.

Okay. That connects to the story I'm getting from others. When Janssen became a key investor, they brought in their management people
One of the things I blame myself for is that I accepted the person they appointed to run Matura. I felt that he was not up to the job, but there was nobody else, and Janssen was paying the money, and what could you do? But I was right; he was incapable. But then of course you assume that people like Janssen know what they're doing. They're running big companies, so who am I to second guess them?

But actually, they weren't running the companies. The companies were running themselves as profit centers, independent entities. The holding company, consisting of Jacques Janssen and his brother, I think, they weren't in the trenches, so…
So when the economy went sour, they lost out.

Well some of the companies in their portfolios were bleeding. So Jacques said the other day 'we have to stop the bleeding,' and that meant Matura was one of the things that got cut off. But their role as managers of a business enterprise, it's just interesting.

Where did the name Matura come from?
Oh, we agonized about it for a long time. Finally, we came up with it. Maybe I did; maybe not. It seemed to be a name that could be pronounced and understood in many different languages and sounded sort of mature. It's probably still the best thing we invented.

You still have the trademark of it.
Yes.

What would be some of the key turning points along the path from the time you first met and decided let's do this thing until the company closed? What I'm trying to say is, along a path of more

than 10 years, there are certain points at which recognition comes that you need to make some decisions to go this way or that way … course correction points, you could say. Do you recall course correction moments when there was a fork in the road?
Well, that that did not happen. That's exactly what the weakness was. We sort of slid into situations because of a lack of cohesion among the partners. It was very difficult for all of us to accept that the thing would not go, when the first problem signals came in. I do remember that at a certain point we were sitting around a table and Frans was telling us the situation in terms of available money and plans and so on, when Jan said 'do we really want to continue or is this the point where we should maybe reconsider?' And I think at that point we should have said, 'Yes, let's close the shop.' But we just couldn't accept for ourselves that we had failed.

This was when Janssen withdrew the funding …
Yeah, but also long time after that. Jan was back. I think it was after the Japanese had pulled out. Anyway, Jan I think had already decided that it would not work out. You have to ask him, but the way Jan was, when he found out that we were not yet ready to stop, that we moved on and put in more money, he went along. So we failed to make a real discussion about it.

That was a big one.
Yes

Were there some smaller forks in the road so to speak?
Probably not, because that is exactly the weakness of the system, that these things were never clear. We sort of moved along one way, then somebody did something, and somebody else did something, and you got into situations that nobody was really in control of. This was all based on the mistaken strong belief that we had something that had to succeed, could not fail, had to be done. If you worked hard enough and so on and so on.

It's perfectly understandable that that feeling should be there, and I'm not sure that you could have gotten as far as you did without it.
Right, but at the same time, we all should have known better.

No, because you never did it before! How could you know better?
Well I must say that Frans was not, had no leadership, let me put it that way. Really. He was very motivated, he was inventive, but I think it is because he probably could not - because neither Age nor me nor anybody else had said to him 'you make the decisions' - we all felt that common friendship would solve things, and I think that was a mistake, or at least it worked as far as it did, and then at a certain point it didn't work anymore.

Were there different ideas along the way about how to bring Matura to market, i.e. different business plans, different marketing strategies?
I think at a certain point Wouter made a business plan, in an earlier stage.

Well, his thesis was a bit of a business plan.
His thesis?

At Erasmus University. It was his final paper. It's in the archives. … so there were business plans, very big ones, because investors wanted them. But the numbers were all made up. And that's really surprising that it appears to be either impossible or extremely difficult to get credible numbers on market

projections for something new. There's no comparable. How do you get the numbers? … So all these spread sheets were developed, with lots of projections, all the figures of depreciation, etc. all come out of the formulas of the spreadsheets…
I think he also did projections before he went to study at Erasmus U. when he was still with Matura. You have to ask him. You know, I stayed away from it because I don't understand these things. I cannot remember that I had any opinion about that. I don't think I even understood it.

I don't know that anybody can do that. It's a crapshoot.
All right. Our business experts should know that.

I don't know that they know how to either.
No, but that was never raised that they say 'we don't know how to do this.'

That's just a very interesting part of this story …
So we all engaged in something we had no business doing … we didn't know …

But the point is, not that, but there was nobody to ask because nobody knows how to do it. How do you project a demand for something that nobody knows about it?
You keep bringing up the question of demand, and there was no question at that point.

Nobody raised the question?
No, because we all assumed there would be. Even the people who put their money into it - were not questioning the fact there would be a need for an infill system. Nobody said 'we don't need an infill system.'

Nobody ever said that?
Nobody said that.

Really? I thought that was why they did not invest.
No, they did not invest because of the two reasons I told you: How can you ensure that you're there 20 years later? And how are you willing to put in massive amounts of money for long-term investment that will only return itself in 20 years, like the car industry is doing.

They all believed the magnitude of investments to carry along to success was so big that they were incapable of doing it.
Not even that, but as people in the building industry, they are not used to do these kinds of things.

Well, yeah, I don't think that's true though.
But nobody ever questioned that there would be a need for infill systems. Everybody agreed that there should be infill systems…that this was the way to go.

But back to the Ramco steel building system, I don't know the answer, but somebody in that sector who conceived it had to make a judgment about the demand. How did they do it? What information did they draw on to give them confidence?
I don't know. Did they do long term investment? Did they offer a comprehensive system? Did they propose to entirely alter the way of working on site? Are you sure it is comparable with Matura?

… Not having that knowledge is a real deficit. So we say that in hindsight. These are the things. I'm interested in at least asking the questions.
You're asking these questions because you have to push the system in America.

No, aside from that, I'm very interested in how building innovation occurs, and aside from whether I'm trying to push Cablestud, put that aside, because I don't have a great confidence in my ability to do it. More as a general question, we'd better learn from these things.
In my recollection, no one ever asked 'do we need infill systems?'

OK I understand. Now, what do you remember about the publicity and commentary about Matura in the Dutch building community?
I don't remember that we ever made a coordinated effort to spread the idea of Matura.

You made the videos.
Yes.

There were articles published about Matura in various glossy trade publications.
Yes.

Presumably that was a job for Janssen. But aside from whether the partners or Janssen made an effort to publicize, do you remember any of the commentary. What was said about Matura?
My feeling, my sense is that everybody who learned about Matura was very much impressed by the concept and the logic of the organization, the systematization, the new components, everything. Everybody thought this was the future. This was very nice.

Consumer oriented, all those things
Yes, particularly the technical solution of subsystems, the invention of the clickable parts was very much admired. I don't think there was ever a discussion about that, because everybody said 'This is the future.' And how do you get there?

Nobody was saying 'bad idea' or this can't happen…
Yes, this is the way it should go.

Do you recall from what sources that commentary was coming?
Architects

What about the contractor's world?
I can't remember that there was any attempt to make them aware of this. You have to ask Age and Frans. There was of course the company Nijhuis which was already from the beginning participating or contributing to a new open building system, but other than that, I cannot remember a conscious effort to sort of sell it to building companies, because we indeed had decided that the building companies were not able to do this. There was a contact with a large building contractor. That was an interesting thing, what is the name (in Rijswijk), not the BAM but the other one

HBG?
Yes, there was this vice president whose task it was to do new things, to find out new things, and he toyed with the idea of setting up an infill system.

A separate division?
An Infill System division, yes. And we discussed it with him that this is what you have to do if you're really serious about, that's what you should do. Again, I forgot his name, but my impression was he was seriously interested and saw the potential, and although he had been charged with coming up with new things, his colleagues shot him down. This made me decide to forget about building industries, they're not capable to make the move to adjust themselves because there are too many vested interests to reorganize the management. And actually one of my classmates who was also in the year of the fraternity that I was member of became at a certain point the top man in this company, and I remember that we, I met with him, maybe Age was there also, but I don't know, to at least explain to him what we were trying to do and see if he would be willing to subscribe to it, and he took us to a very fancy restaurant, and we had a very good meal, but there was no response later on. We followed up with emails and whatever. So the conclusion for us was if these guys don't see it, forget about it.

You don't imagine there was any stealth strategy to kill Matura by any party who thought it would be a big detriment to their business interests?
No, because I don't think anybody felt that we had power.

Yeah, but everybody thought it was the way of the future and that it would be successful.
When we started the SAR the architects said 'we have to do this, but it's not our generation that will do it. It's for the future.' And that's how everybody could admire the Matura system: "It won't happen now. It's the future. Of course, that's the way we should go. Just don't ask me to do it." So the real discussion about the reason why it was a good idea, what the market would be, these things were only discussed much later, I think.

OK…do you have other thoughts that have emerged during our conversation that you'd like to share?
It was great fun in the beginning to do Matura, and in retrospect, I am sort of amazed by the motivation and the belief that we all had in doing these things, so for me it was a positive experience. I didn't know how you run things, but finding out that nobody knew was a good lesson, so, and I think that in retrospect of course, we managed to get along for a long time. That was good. And I think the nice thing about men cooperating is that you forget and forgive, and this is what we have learned and practiced, that you move on. It is very good to put that experience on the record, particularly because it is so very much driven by beliefs and ideologies and the particular mood of the time, that people don't ask questions about things, that they have assumptions, but at the same time, everybody moves in the way the forces go.

Thank you for this conversation. I have a kind of hypothesis that the generation of individuals who took this initiative came out of a period of belief that big things can happen in building, in architecture, and that's why I earlier put Matura in the context of those other developments that had such hubris and such large ambitions.
You're right. It may be the last one.

Maybe, maybe not. But there's a legacy that this belongs to, so maybe. That's kind of a hypothesis.
I think you're right. Because of the experience, I'm still amazed that when I was studying Gropius and Wachsmann, that I actually found out what the problem was and nevertheless with Matura made a similar mistake, which is very interesting. I have come to appreciate how built environments work in that way. Possibly the writing of the Structure of the Ordinary was influenced by that experience of built environment as an uncontrolled organization that has as its own roles, and everybody moves in the way that the forces are pushing, and that this still allows for innovation, but in a totally different way.

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Different than we think we understand. This was happening when I was doing my PhD with you, and I still remember in our last discussions that the diagramming tool that I, that you helped me work out, the kind of conclusion of thinking it through was that technical developments, no matter how rational and logical and well thought out, will not succeed if they disrupt the organizational or social milieu in which they're seeking to become a part, and I think that that's really important.
That's a very fundamental insight, and I think that your thesis deserves to be known. It's a really fundamental study that couples technical innovation with social structure, and it's amazing that nobody ever picked that up. I think sooner or later, somebody will come up and recognize what you did.

But what I did was make a little diagramming tool, and it doesn't necessarily produce that answer, but it allows you to examine things that could result in that answer.
Yes, but because of the diagrams, a link is made between the social structure and the technical, and that's fundamental. That's never been done before.

Nevertheless, when new things do emerge and take root, and some shift in the social structure occurs as a result of it, we want to figure that out.
That is what your thesis has contributed to. This is something that many other people can do PhD studies on, to begin to work with the tool that you invented to find out new things, and it is the poverty of our field that we refuse to learn. There's no other profession without a formal body of knowledge where people do not know things and forget things or do not notice things, and are unable to place something in context if they see it. It's amazing.

So the story of the Matura development falls amongst other stories, and I'm not the scientist of the science of technology and culture to figure it out, but it's good to get these stories told, and it may be that someone will have … that someone with real historian's credentials will have the interest to …
The difficulty is that of course science and research now separated the social science and technical things. The two have become totally different worlds.

Yeah, but there's the society for the history of technology and the journal is called Technology and Culture. They're the people that hopefully will want to explore the building industry.
I wonder what people they are? Are they historians?

There's a mixture, but there are very few whose attention goes to the building industry. They're mostly studying typewriters and computers, guns, machines, dams …
You know the same is true with the idea of industrial design. In Eindhoven University, they have set up a new department of industrial design. But they don't deal with buildings!

But some of the guys at Delft and Eindhoven in the architecture building technology department are inventing new products that are industrial design. They don't talk to each other.
Well, they may talk to each other, but the Eindhoven Industrial Design department doesn't see the link. They're still thinking teapots and other things.

It's amazing
Yes it is!

Thank you very much for this conversation!

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AGE VAN RANDEN

Age, thank you for meeting with me and with Fran de Vries, to reconnect with and to recount the Matura development as you recall it. I have a number of questions. To start out, can you help us understand the starting point of the Matura development process.
I was inspired by John Habraken and absolutely convinced that the building industry needed overhaul because of the enormous cost in mistakes made during the building process. My diagnosis was that it was because of the difficult interdependencies between the many different systems in building, and housing especially. And that made me think that if we could offer a solution for that, that that would be a way to mostly change the building industry. During our work at TU Delft, I had made some sketches and some proposals how to do that. An important insight was that specialty installations of different kinds were the difficulty. So that meant - and I stated that already in my inaugural speech in '72 or something like that or maybe it was in '69 - that they should be separated from the building process producing the Support, which meant that you needed a way of building in which those installations could be added later. Not only for the reason of easing the building process and avoiding all those mistakes but also for the reason, the most important one at least in my inaugural speech, for the reason to be able to change the infill. So basically John Habraken's idea of support and infill lay at the bottom of it. So then from there on, I stated in my farewell speech some possible solutions. Okay, so already in my farewell speech, I gave a rough outline of the Matura concept even to the point that when I had finished, the Dean said: "My goodness, this man is only beginning."

So the thinking about it had already started, even before that, but I can't remember exactly the timeline. Maybe we already made some models but I don't remember whether that was happening.

You mean in OBOM?
Oh, yes OBOM was an important inspiration for my thinking. Especially Dirk Smets. He was a very clever and persistent man.

What did you think were the strong points of the system's technical performance?
I don't even remember how the Matura system works. I only remember the floor.

And the base profile; the bottom fit directly into the groves in the top of the matrix tile.
Oh, yeah, that was I-shaped. Oh, yes.

Do you remember that I was part of the installation team in Voorburg?
Oh, yes. I will never forget it. That was very special.

There were four new buildings in Voorburg. No, actually more because the small apartments on the ground floor were all new construction when Matura went in. But let's go back a little bit. You created OBOM at TU Delft before Matura started, or was it at the same time.
I don't know. I think before, but …

And do you remember other reports or studies by industry associations who were talking about open building, talking about separation and giving you the idea that your advocacy of infill systems was timely … People would say "I understand, okay sounds like a good idea."

Yes, but not to the point of thinking of separation of installations. That went too far. I do remember talking with Rinus Platschorre. He was the director of one of the concrete prefab industries. He mentioned what an exciting time we had about separation of infill, support and infill, only one of his strong points of his product was he thought that they incorporated the installations in their concrete elements so you could say he missed the point; changing afterwards was made totally impossible by that. But we had a lot of discussions about it. I don't remember when that was. I think Platschorre was one of the members of the group that founded OPEN BUILDING FOUNDATION. It started with 11 people … his background of installation of prefab installations.

When was that?
My memory says it was founded in the early '80s. I was one of the managing directors. In 1984, it was of course OBOM. That was the outside organization of open building, but quite a few members of open building provided money for OBOM so that we could go on with the work.

SAR was nearing its end about that time?
Yes

Can you recall some of the developments that supported open building…the discussions in the industry, the government reports, the governments supporting the industry, and so on?
Frans was one of them, and I think that I played an important role in that happening, and I knew a lot of people, Frans also.

Was OBOM already started or did that come later … because you were at Delft.
I think it was already started.

What turned out to be the weak technical performance points of the Matura system?
Well at the time we started on the system, as I now see it, the piping underneath the tile - that that was a weak point in the organization of the whole thing.

You thought that was a weak point from the beginning?
No, but later I made it different.

But from the very beginning of the Matura development, the drainage pipes were on the bottom. At that point you thought that was not a good idea?
No, no, only after some time, after we had used it in practice, I thought it was not very practical because you had to lay out the pipes first, you had to measure things. So that was the main reason for the changed tile that I developed later and that Frans and you know about.

Do you remember when you realized it was a bad idea? After the first installation at Voorburg?
Now, that goes differently, when we started to think about renewing the system because one of the things was also the wiring in the base profile under the wall, because you had to go around it at the corners. You had to go through it or whatever. And also the top, when you had to send a wire up into the wall, you had to make the hole in the top of the base profile and that was messy.

The Base profile
So that was another point, had nothing to do with the floor tile, and because of that I started thinking how do we do that? That led to the CableStud that you know about.

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During the first mockups at Jan van Vonderen's place, the base profile was already there, and then the Voorburg installations … so already at that time, did you say something's wrong here or you were so clear, so sure, that you continued to move ahead.
I think I didn't allow myself to think that anything was wrong because then you cannot go on with conviction. So I think that I started to think about that seriously when the possibility of having another system arose (years later maybe in 2007). But it was because the Matura system failed. We stopped. … Because Matura failed, we had to make a new start, and that was the point when you could allow yourself to rethink and to accept the bad points of Matura.

During the development from the early prototypes in Eindhoven first, then Voorburg, it is possible to change something if you think it's not quite right, but even then you didn't see the problems.
No

But during the Matura time some people began to question some of the technical details, but the train was on the track, the certification process was underway, the logistics center was there, the training of the crew. You believed it wasn't possible to make technical adjustments.
You just couldn't do that. You had to go on.

How did the business start in Breda?
The starting point with Breda was signing the agreement with Janssen and deJong … and the agreement, the scheme of the agreement was shareholders and starting a business based on our business profile. We spent a lot of time making business plans for Matura Netherlands. And in that plan was foreseen a logistical center, showroom, etc, etc. And I think perhaps Janssen and deJong looked for the possibilities of a logistics center and I think they found Breda because … is not far from the center of Netherlands for their offices.

What turned out to be the weak technical points? One thing is it was indeed the too-strict placement of the separation walls.
Again, you recognized that early, but there was no way to change mid-course. Certainly not me because I was totally convinced of modular coordination as we had developed it.

Let's go on. For what reasons did investors decide not to invest in it.
Uncertainties about the market, perhaps

Uncertainties, yes, potential buyers are not lining up
No, the question is when Janssen had to withdraw their money, there was a big effort to find other investors. Not to invest in Matura, that is the question. Well I would say because we hadn't proven it to the building industry, and again that meant a complicated … that the building industry is too complicated to introduce a system like this. That meant that the main contractor had to decide about it while it mostly was about the installations, so those who do the installations - electrician, plumbers, ventilation, etc. - those are in the old system, the people who are responsible, so that is now also the main problem, that it is very difficult to break through that separation, and it still is the great difficulty.

But at the time when additional investors were being sought, your feeling was…?
That I don't know, but I would say that they also thought that was a difficulty that couldn't be overcome.

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So in the early '90s, production was going on in Breda, infill packages were made, and then Janssen had to withdraw their funding … other investors were sought, and your feeling is that it was difficult to find investors because they all believed the contractors would not let go and open up the process?
Yes.

The other possible reason …
Wait a moment, also because the subcontractors thought it was much too complicated and expensive.

Matura was too expensive and complex.
Yes.

So the contractors and the subcontractors decided to be against it. How did you find out the subcontractors had that view?
Oh, we were confronted with it time and again.

But in that time, Matura would get an order from a development company, please deliver 15 infill packages in containers. So why would the subcontractors even say anything because they weren't part of the deal? How did you find out that the subcontractors were unhappy?
(Frans) The subcontractors were not part of the deal, but the clients always compared the offer of Infill Systems with the conventional approach, and when you make your decision to use infill systems or Matura, the developer would ask the contractor to give back the money you calculated for example electricity and for all the installations … and when the client asked how much money they would give back, they offered 80% or something like that.

The other investors who were approached also talked to the contractors and the subcontractors. The other perspective that people are saying is that there was no clear demand for a comprehensive infill system.
There was no clear demand for future change.

For Matura in specific. It was a product. Janssen was advertising it.
No, no, there was no demand for future change. Nobody wanted to invest in future change. And they thought this was an investment that never would be used, and that's an important point because that was one of the main reasons to develop this system. It is so difficult to imagine that you ever will change. This is good, the architect will say, the contractor will say. It's almost attacking their integrity. These are …

Barriers.
Yes, quite difficult

Please describe the various factors that arose.
I have already. Installers.

No, no, more. The partners. You, Franz, Jan van Vonderen, John Habraken, the question was, you four created a company; and in some companies, each person has a specific role or job or task. You develop the business plan, you develop the software … Do you recall in the beginning discussions about Matura Nederland that each of you would have a specific responsibility?
We didn't want to be so formal.

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Others have said the same.
That has a great advantage because it means everybody speaks out freely and inspires the others, especially if you see my role to develop the system and now I say it already too strictly, it was developed as it became because of many remarks, etc, and exchanges, and that was, I think, our strong point if you can say that of a system that failed.

But then Janssen and deJong came in and they had a specific responsibility. Right?
Of course

So they hired Renee.
Oh did they?

I'm asking. I assume that their job was to run the company.
Who was director? That was Toon Huijps. You have to remember him. He was managing director. I have to go back and think very deeply to see what was his role, and the only thing I recall is that we fired him several years later in the shareholder meeting. He was responsible for the marketing … and Renee was responsible for the technical side, the logistics center, etc, etc, and did a lot of work with certifications, etc. After finishing with Janssen and deJong, we took care all four of us for almost a year going on with Matura Nederlands and we looked for other solutions, and we found Steinke, we had discussions with TBI, and we met Steinke and he started a new company Matura Inbouw, and from the beginning Renee was managing director, he was responsible for the whole operation. We had nothing to do with Matura Inbouw because our relation, the relation of the systems, Matura Inbouw this was based on a license … with shares. That was complicated, and then Steinke just disappeared to Germany. What an adventure it was. A big part of our lives. Absolutely.

Where did the name come from?
My memory said that Matura don't say anything, that's nature in English, mature in English is grow up. In Switzerland, matura is the diploma…, in Japanese, it looks like a Japanese word, but it doesn't mean anything. Because of that, we said marvelous.

What were major turning points in the development process and the company?
Well, Franz, he has told them all. I wouldn't know any more. Technically there were no turning points. Software…

Was the idea of software an important part of the original discussions?
I don't remember. But software was aimed at designing, and from the design running the production facility.

Who started with the basic ideas of software in scheme or theory?
My memory says John Habranen. I did not. John gave some clues. No Wouter, I think he started it…

What do you mean by clues?
John gave some clues of what the advantage of software would be. That I can recall. I think Arend was already there, and they couldn't work together, so that didn't work out. So Arend took over, and Arend later had a software company. Whether different ideas along the way about how to bring Matura to the market, that is alternative business plans, marketing strategies, etc, I have no idea. Frans certainly had.

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No, during Matura, before, well so far the answer has been no. And it was the responsibility of Janssen to do the marketing.
And what was his name? Toon Huijps, he was part of the Janssen team; was managing director, hired by Janssen for Matura Nederland affairs.

(Frans) What we learned until now is the importance of creating demand, how to create demand, and we never thought about it.
That was my fault. I was so convinced it would simply go its way.

(Frans) Jacques Janssen says exactly the same; exactly the same. We all thought it is so clear. So obvious.
That was a big mistake. That is what happens with technicians, what caused the company to close.

No demand. No orders. That's what caused the collapse
Good point. And lots because of debt. Bleeding.

There was a period then when Matura closed, and that was 1998, then there was a period, and then in 2007, you began to think again about the matrix tile and the wiring
With such a big gap in time.

What is your memory about that?
It doesn't say anything. I can't imagine that was so long because 2007 is very close to now, and I would say I had been busy thinking about it already earlier, making sketches.

Before we do that, do you have any other insights or reflections on the Matura experience other than what we've already discussed? Any lessons learned, for example?
I wouldn't have thought of this point if we didn't think about creating demand. On the other hand, I don't agree. I think we have thought a lot about how to create demand. How to open up companies to buy and to … I'd done a lot of visiting around the country, and it hasn't helped, that's another thing. Maybe I had the wrong attitude toward clients, the client being mostly housing associations, but also contractors.

(Frans) What I mean with creating the demands that has nothing to say about our contracts with architects or contractors but it has to do with the demand of the user and to try to find the end user *a*nd you can compare it why the kitchen industry is so successful now; that is because they make advertisements not for contractors, not at all, but for you, you and for me. And the same is more and more for the bathroom…not for the contractors but for you and me.
But now that you say that, I remember that I always made a strong point of the kitchen industry as an example of how infill systems should operate.

(Frans) Up 'til now it is a very important question even for you and me.

There exists more than one theory about how the building industry changes. One point of view is that it is possible to change the building industry by large comprehensive developments like Matura. The other theory is that the building industry only changes in small, incremental ways. So I believe that Matura is part of a legacy of initiatives that believed that the building industry could change only if there was a large thing happening. So we could put Matura in the context of Gropius' General Panel House and Ehrenkrantz' SDSD and other systems approaches to the transformation of the industry. I think it's good

to ask is that a legitimate juxtaposition, is it right, to put Matura in the same category as those system change initiatives. The other one is that the building industry resists those large-scale changes and only accepts little changes here and there. Some historian will have to look at it.
Look at the kitchen industry. In the beginning, it didn't even give any attention to the building industry. It immediately focused on the user. They have been in the beginning not very successful, but slowly they have won the battle.

A significant market share and they've become autonomous, right?
Now those who sell new houses will always say you can choose your kitchen. You can choose your bathroom. You can choose yourself. That's a major breakthrough. Arend has an interesting theory about that. He says it is not a technical problem. It is a problem of attitude, and what technical solution you use, you first have to change the attitude.

Thank you, Age!

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FRANS DE VRIES

Thank you for agreeing to this interview. What led to the development of the Matura concept in the beginning? What was happening in the industry that led the partners to believe there would be an opening for Matura? What made you think the time was ready for a comprehensive system like Matura?
In my memory, we started the development of the Matura concept in the mid '80s. Since the '70s, there was a lot of conversation in a theoretical way. We all thought, like many people thought at that time, that the theory was very nice, but how to make it in practice? And I think there was an initiative of Age van Randen and John Habraken to start working on it. In the summer of 1986 we had several brainstorming sessions. At the end, we had a kind of solution, and the next step was, how we can show it in practice. We started the first dwelling infill using our idea in 1988 in Bergeijk and afterwards one Eindhoven and one in Voorburg to show that it works very well. And I remember we did it all by our own: Age, John, and Jan van Vonderen, who did a lot in his factory, and I did some items in my place.

What was happening more broadly in the Dutch building environment that made all of you think that it was a good time for a comprehensive solution?
It was a reaction of the crisis of the '70s and the beginning of the '80s.

And what was happening in that crisis?
At the end of the '70s, the interest rate was 12, 13 percent. The inflation was 10 percent or more. At once, the society, we all, became very afraid of what happens in that time. There was no demand for new building, new houses, rental houses, etc. It stops, in my memory, from one day to the next. Of course, it took three months or six months but suddenly … and the building industry stopped, not entirely, but it basically stopped. It took a very long period before it recovered.

Please connect that to the sense that this was a good time for an infill system to be introduced?
That was the theory of the knowledge about support and infill. At the end of the '70's and beginning of the '80's, I was one of the managing directors in the big construction firm Wilma. Thinking about the crisis, the board realized that we did not do anything with marketing and new developments, etc. Research was not an issue in the company. Marketing was not an issue. Because we came upon big troubles in the company, we had a re-organization. That was not the end. We realized that we had to think in basic ways about the next steps. We decided to start with a marketing department, and to start with research and development efforts. Both are very important. In that time I got knowledge about the theory of John Habraken. The translation to practice was very helpful for us because when you think about the separation between the support and the infill, then it works very well regarding our marketing strategy (identifying demand). It helps with our research and development to increase the balance between price and quality of our products. Not only price, but price and quality.

Were other companies exploring the same theory?
I think so, although not a lot. At that time I had contact with for example, Nevanco and Grootel. And some other companies had the same feelings at that time. In 1984 Karel Dekker, Age van Randen and I established the Open Building Foundation. Among the 13 men who signed the Open Building Manifesto, dated 8th of May 1984, there were three representatives of construction firms.

Is that the time when Esprit and Interlevel were being developed and considered?
I don't know exactly. I think it is about the same time.

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One thing that people interested in innovation say is that it's helpful when there's competition for a new idea so the market will see alternatives, not just one introduction. So it's interesting to know if the Matura concept came up and began to be developed at the same time as competitive solutions for infill were being developed, or if Matura was the only one.
I think in that time Matura was the only one with 100 percent knowledge of separation between the support and the infill, with all its consequences.

So you had the first meetings; you had to discuss the opportunities for a comprehensive system, and then it developed into more technical solutions and business plans over a period of years …
For me it starts with giving an answer on the theory of disentanglement. Separation. The ordering principles, I think that was the starting point for me.

Your participation in the initial development was by the invitation of John and Age?
Yes, but I was quite well known by both of them. And also to a lot of others, architects etc, because I was one of the founders of the Open Building Foundation. Before, within Wilma as managing director, I was, in the beginning 80's, a supporter of the new ideas.

Did the Open Building Foundation itself help to set the basis for the development of Matura?
Not all the members of open building helped with developing the new ideas, because there were a big variety of members, with different backgrounds. There were not only the technical people, but also architects and people responsible for social housing societies. Some of them were very interested in the theories.

By that time, by the mid 80s, some open building projects had already been built, right? There was one in Dordrecht, and earlier in Lunetten and in Papendrecht and so on. So there was experience with building supports, and Bruynzeel had developed a partial infill system of partitions and wiring, so if my memory is correct, the open building group said, now we understand how to build supports … *Bruynzeel* tried to make an infill system, it was incomplete, too expensive, it was too complicated … now we really need to put our attention on the infill, so let's work hard on that.
Yes. My memory said that afterwards we called those that you mention open building projects. Afterwards. Not in the beginning.

OK, they were called support/infill projects
Yes, we called them support / infill projects, for example in Lunetten, a project of Frans van der Werf, with Wilma as general contractor and Bruynzeel doing the infill. We called it in that time also a response to entangled building. I think in the beginning it was starting with thinking about "levels" and the role of the user. Sometimes the user was in the position to say "my floor plan, I like such a floor plan or such a floor plan."

Bruynzeel's infill system came before Matura, right? It was in the 70s, as I recall. They used that system in London in the Adelaide Road project that Nebeel Hamdi and Nick Wilkinson did when they worked at the GLC (Greater London Council). So there were attempts to figure out infill partition walls, wiring, and a raised floor only in the bathroom for the piping and so on; there was some experience with more sophisticated infill. Do you remember anything about them?
Yes. We did the same, but there was a big difference between Esprit and Bruynzeel that happened in my period at Wilma, and the Matura infill package approach. All those systems did not have 100 % separation between support and installations. In the projects in Lunetten - it was my firm that built it - my memory says there were a lot of installations in the support as well, not 100 percent separation. But

we thought about central pipe shafts in other positions than we did before. So architects thought about where the location of the pipe shaft should be in such a way that more floor plans are possible in a very easy way.

That was already happening?
Yes. That was already in the end '70s and beginning of the '80s. We looked for solutions to develop new separation walls. In the concrete floor slabs we installed what we call a network of conduits for electricity - a lot of empty conduits. We called it a spider. And that was a nice solution. We installed much more than was necessary, and because of that, it gave some flexibility. But no solution at that time was available for the 100 percent separation of the electricity from the walls and floors, etc. I think Matura started it.

In those original meetings, when you met with the others and began to brainstorm, at that time there was no economic analysis, there were no market studies, there were no investment scenarios, you were focused entirely on what the technical solution could be to the complete comprehensive infill system. Am I right about that? …
The name of the boat where we met was Arend. Because of that people called it the Arend Group. It was John Habraken, Fokke de Jong, Frans van der Werf, Age van Randen, and me, in the summer of 1986. We brainstormed during several days about modular coordination in that time, not yet about Matura. I think we discussed also about the principles we need in starting up the Foundation for Open Building, thinking about levels of decisions, etc. We started the brainstorming about matters that eventually lead to Matura.

Jan van Vonderen?
No, he participated later. We started in the office of Fokke de Jong with brainstorming sessions, and as a result, we created the principles of the Matura concept.

And that followed the Arend group's broader discussions?
I think the Arend group discussed items such as modular coordination and what it means for the society, etc, etc. There were I think at least 8, 10 persons on the boat, several with complete different backgrounds. Matura started with a smaller group with only one interest - how to develop a working system, a technical working system.

And that was in Fokke de Jong's office?
Yes. At that time John spent a lot of time in the Netherlands, but he was still somewhat active at MIT in the U.S. He stayed in the office of Fokke de Jong.

So, can you remember how the discussions progressed in the development of the technical solutions? Did the idea of a matrix tile come right at the beginning? Do you remember the sequence of thinking? Or did Age or John simply propose something immediately that was complete?
I think the most important thing was our goal to finish with complete separation between support and infill, and because of that we took out all the installations of the traditional support and then asked "now what?" I don't know who suggested the idea to locate the electrical wiring at the bottom of the separation walls - I don't know. I think Age or John or both. But a very important point was the idea of the zero-slope drainage pipe, and I don't know who was the inventor of that.

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Did it come early?
I think so. I found in the archives that there was a report titled "De Ordening van het Inbouwpakket" ("The regulation of the infill package"). It was the result of collaboration between John, Age, Fokke de Jong, Frans van der Werf and myself, in the summer of 1986. It discussed the "base profile" and "grooves in the floor for conduits" (gas, water and drainage). It talked about "trenches" along the walls, and pipes recessed in a normal sand-cement floor. The sand-cement floor was to be covered between the base profiles under each infill partition wall with a 22mm particleboard floor. In the report it's also clear that another material than sand-cement, like polystyrene foam in modular blocks, put down and covered with a 22mm covering floor, may offer advantages. In the grooves there will be horizontal drains with an external diameter of 50mm, "aired." Every appliance had to get its own drain line. At a toilet, which is not situated next to a stack, a water closet with pump is needed. In the correspondence with the patent attorney Arnold & Siedsma, May 4, 1987, there is talk about a patent application regarding the Matrix tile floor. The first drawing of a polystyrene tile of 600x600x80mm is made by Van Vonderen Interior Contractors BV and dated the third of June 1987.

And what about the software?
It came later. But knowledge of the need to spend time on that item was there from the beginning.

Okay. What about the idea of the multi-skilled installation worker team, and the containerized packaging and the distribution center…did those come later?
Yes. I think people in that time were busy with these items. It was a marvelous period. How do we say that? Creative, and what we did gave other people a lot of enthusiasm.

You would meet as a group and then go off and then do work individually and come back and report and discuss?
Yes. At that time, I think John and Age spent most of the time.

From the first discussions until the first full-scale mockup in van Vonderen's factory, do you remember was that several months before you could actually build the mock-up with the polystyrene matrix tile?
That is a very important date. I think from the beginning we invested in the matrix tile mold. That means that we had an absolute knowledge how to do it because when you order molds, you cannot easily make changes afterward. I will look in my files and find what time we ordered the first mold. The first drawing of a polystyrene tile of 600x600x80mm was made by Van Vonderen Interior Contractors BV, in June 1987. That drawing was the starting point for the discussions with the EPS supplier HSV-Ede. The order for the first so called example mold and production of 600 tiles was started in May 1988. The tile had a density of 25 kg/m3 and was white. Then in 1991 there was an order of 270 tiles. In the period 1991 – 1993 the design of the tile changed. The mold was re-designed. In 1993 there was an order of 2750 tiles, with a density 30 kg/m3, color grey.

The base profile took several versions. There was a metal one, and a wooden one …
Yes, the versions are already in the concept report "De Ordening van het Inbouwpakket" I mentioned before ("The Regulation of the Infill Package"). You have to understand the base profile - the baseboard profile was not difficult to make. It was simple. I could do it in my shop. The problem was the matrix tile. Of course, there were also problems with the air ventilation regarding the base profile and matrix tile, etc, but I think afterwards the first dwellings we made had traditional solutions for ventilation, and for hot water central heating. From the beginning we started with the base profile with the Wieland electrical connectors, I think.

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The core team developing Matura was Age and John, you and van Vonderen?
No, at the starting point, it was Age, John, Fokke de Jong, and me. Later, Fokke de Jong decided to withdraw as partner in the new development. There was discussion in his office that it wouldn't be their opportunity to be directly connected to a development like Matura. I think because of that he made a decision that he had to stop with the partnership in the development. It was at the same time (1987) we made a decision to start a new company and to invest a lot, not only time but also money. We were very sorry about his decision.

The decision that he had to step out
Yes. And at that time we asked Jan van Vonderen. He was a good business relation of mine.

So that's the time money was invested by the partners?
Yes, starting a new business, thinking about business models.

Did you define roles for each of you? You were responsible for this area of development, John that area, etc.?
No.

Everybody was involved in doing everything?
Yes, but John and Age did the most work. It was necessary for all of us to discuss how to run the new company. We discussed about limited partnerships, shareholders, etc, etc, business plans, cash-flow, balances… I think also van Vonderen had a big part in that discussion because he was a man with a lot of experience about how to do it in practice, to make the translation from paper.

At that time, you each agreed to put some money on the table? At that point, things became formal, right? You had to make contracts and agreements?
Yes

Did the roles evolve over the next few years, so it was not everybody doing everything, but Age had a certain responsibility, and John had a certain responsibility and so on? Did roles become separated and clear tasks associated with each of you?
No. I think it is more who spent the time with what items. I think Age and John had frequent discussions at the table with paper with making sketches, designs, etc, and I think in that time Jan gave his input, and I gave my input. The center of the activities was John and Age. John was more the man sitting at the table making sketches, drawings, etc, thinking about the consequences of doing this, doing that, and Age was more the man how to make it. He also had contact with suppliers, and he looked at catalogs asking for information about how it works for example with the electric installations and ventilation. I think he did a lot of thinking about drainage. It must be, at about that time OBOM was founded at TU Delft, instigated by Age, because he was a Professor there. There was a lot of exchange between what OBOM did and what we did.

As I recall, the early work of OBOM was focused on developing alternative models for the full separation of support and infill. They built physical models and drawings. They also had roundtable discussions with various "players" in the building industry, regulators, and so on. That was a phenomenal platform for the development of Matura.
I think so. I think OBOM was started about that time or a little earlier. The paper written by John and Age that I mentioned before was published in the context of OBOM activities, as I remember. I think someone of the OBOM group suggested the idea of 0-slope drainage, and now my memory says there

was contact with colleagues of Age in another department, and he made a report about the possibilities of and the consequences of horizontal sewage.

As we were speaking a minute ago, the idea of an innovation group working together in a seamless way, everyone doing everything, and then later specific roles could be defined for specific aspects once the concept was clear … you mentioned that John was mostly involved in the software development at that time.
Yes, the principles leading to software.

And Age was mostly focused on the hardware development, but not entirely.
You have to ask Age about the OBOM group. I think it was quite a large group.

Yes, I remember seeing pictures of the group sitting at a big table, and they had many meetings … and researchers paid to do work. And they had many industry partners, bringing people in, regulators and others.
So there was a kind of structure within OBOM.

Let's skip the discussion about the strong and weak points of the system for now. So the next question is what were the reasons potential investors were reluctant to invest? We've discussed this a little already, but do you want to give your own thoughts now about why the many potential investors decided in the end not to invest?
Let's start with the cooperation with Janssen and De Jong in 1990 and why Janssen and De Jong invested a substantial amount of money.

They were the first large outside investment party, right? Up until then, each of the partners was investing their own personal funds?
Yes. We made the first infill by our own, at our own costs. We spent time, a lot of time, but also a lot of money. We had the knowledge how to go on at that time, and the knowledge said we need a company with one goal: to develop and produce infill packages. We made a business plan quite early of what the consequences are. In the beginning we could handle 1, 2, 3, 10 packages, on our own. We did it in my shop and in the shop of van Vonderen. We had a very strong feeling that when you start a real infill industry, well, that is another step. So we made business plans. The business plan said that we need a lot of money because you have to start a showroom, distribution center, etc. You have to spend a lot of time on logistics, and the cost of software development, education of multi-skilled persons, etc. We looked at who may be interested in being partner of research and development. I don't know who had the first contact with Jacques Janssen of Janssen and De Jong. At one point there was a contact between the partners of Infill Systems and Jacque Janssen in a personal way. That is very important. And the result of the meetings was that he was prepared to be a shareholder and to invest a lot of money.

You had a good relationship and shared enthusiasm, and he had money and was willing to invest.
Yes

And then as you said before, their company began to have financial struggles.
Yes, a few years later. We started with Janssen in February '91, and they had struggles in the second half of '93. A new agreement was reached on 23 December 1993. We finished our relationship in June '94.

Up until Janssen's investment, all the money was coming from the partners?
Yes.

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Is it possible that you remember, or are you willing to tell the amount of money invested by the partners before Janssen came in with his money?
I have to ask the partners, It is not only money, it is also a matter of a lot of time. For example: From the beginning, I did the administration and the legal affairs, etc.

When you began the discussion with Janssen about investing, did you stop discussions about investing with other investors?
I have no memory of other investors interested in investing in our business at that time My memory says we started for the first time with Jacque Janssen, and we agreed with him.

And there was no need to search for others?
My memory said not.

So when Janssen and their money became uncertain, and you had the negotiations, at that time, someone began searching for replacement investment, then Steinke came up?
That was later. Very important in the beginning was our legal position. From the beginning, we tried to protect our intellectual property by patent rights, etc. It is a hard job to do that in a good way, and it cost a lot of money and it took a lot of time. That was the responsibility of Age and John. They had the discussions with the patent authorities, etc. Now, back to your question, at the end of 1994, we had the strong feeling that it goes wrong with Matura Nederland. The cooperation with Janssen and De Jong started in '91. At that time (1991) we had Matura, we had Infill Systems and we started with two other new entities. Matura International took care of all the international developments, working on the rights, patents, etc, looking for possibilities to agree with other parties all over the world, based on the idea of licensing. And at that time we started Matura Nederland. From the beginning, two-thirds of Matura Nederland was owned by Janssen and De Jong and one-third by Infill Systems (the partners). During the second half of 1993, we saw by our observations that the business went in the wrong direction. There was not enough funding, not enough marketing power, etc. We complained and we had shareholders meetings, but it goes on, goes on, and at the end (December 1993) we said: We stop with the activities with the shareholder Janssen and De Jong because it was clear that there was no more money to invest. And the marketing force decreased and was too low. I think we saw no technical problems, but the marketing efforts and the funding were not enough. Based on our agreements made in '91 with Janssen and De Jong, we were in a position to say, 'we have an agreement and the agreement says this and this,' we were in a position to renegotiate the whole. It was an opportunity for Janssen and De Jong as well to look for solutions of those hard problems in that time.

And you sought other investors?
No, that took another year.

During that year, what was happening with the company?
Matura International ran the company. Infill Systems got back the shares Janssen and De Jong held in Matura Nederland on 24 December 1993.

Were more personal funds invested then?
No, but more personal effort; Age was in Breda all the time. I was, as managing director, many days per week in Breda. Jan van Vonderen, too and John as well; all of us were busy running the business in that period. In the period January – June 1994 we ran the company while Jansen & de Jong paid the

expenses. In the same period we negotiated a quite big lump sum payment with Janssen and De Jong for the period after June 1994. On 24 February 1994 we started with 14 dwellings in Voorburg.

That was the agreement to keep the company running for that one year?
It was enough at least going on one year but not to extend. You have to think about a large amount of money. But from the beginning, we immediately looked for solutions. It was not the goal of the partners to run the business. We knew financial advisors. They recommended some people who might be interested in investing. At that time we had, directly or indirectly, some contact with Steinke, Rinus Platschorre of TBI, etc. We (Matura International) started discussions with Jurgen Steinke / Eureal Holding in January 1995. Earlier, in March 1994, Rinus Platschorre of TBI joined in some meetings. In March and April I made several draft agreements, based on business plans. We talked about a total amount of the balance of Fl. 6.600.000. Eureal and TBI and perhaps another third party would pay Fl. 1.800.000. In the middle of April 1995 it was clear that TBI had problems with the proposals and increased their demands. The negotiations with Rinus Platschorre ended. In May1995 we reached a first agreement with Eureal. Eureal bought the activities of Mature Nederland for Fl 250.000. Matura Nederland finished their activities and Matura Inbouw B.V. (owner was Eureal) continued, with a license from Matura International / Infill Systems. On the 18th of December 1996 Matura International and Matura Inbouw reached a license agreement for Matura Einbbau GmbH, which was established shortly after. During a whole year we had a lot of discussions with Steinke about marketing strategy and finance matters in the Netherlands, Germany but also the Czech Republic and Russia; later also for Switzerland, Austria, Hungary, Poland and Italy. At the end of 1996 and the beginning of 1997 the negotiations became more and more complicated. In February 1998 Matura Inbouw went bankrupt. Because of the license agreement of 18th of December 1996, all the know-how etc. came back to Matura International / Infill Systems..

When did the discussions with Japan enter into this story?
We started in October 1989 with a so-called "Feasibility Study Agreement." We agreed with the two biggest Japanese companies, Haseko and Shimizu Corporations.

And did they approach Infill System partners with a proposal or did you approach them?
John has a lot of connections all over the world, and I think in that environment, in that network, the solutions of Infill Systems was discussed with Mr. Takeji Uchida and Seiji Sawada.

Part of John's network.
Yes. Perhaps he was the in-between person.

The bridge, the link …
To Haseko and Shimizu.

Do you remember why the partners failed to sell or finance the deal with Japanese?
Let's start with the experience with the Japanese. We had a lot of contacts, discussions etc. in Japan and in Holland as well. The Japanese people came several times to Holland, etc. It was a marvelous experience. We had a Feasibility Study Agreement. It was well known and well documented. The exchange of information, etc, was perfect. We had a non-disclosure agreement. We spent a lot of money of ours to make it in a good way and Haseko and Shimizu did the same. We had a time line and at the end of the time line, Haseko and Shimizu asked for a new period. We made a memorandum of understanding. They did a lot of work, they built prototypes, etc, but at the end of March 1992, their decision was not to introduce Matura in the Japanese market.

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Why did they decide to stop the development?
I think there is a formal reason, and that must be in the files, but we had the feeling that at that time it was even for big companies like Haseko and Shimizu, a hard job to survive in the Japanese construction market. I think that was the reason. But my memory said that a very important point to decide not to introduce Matura in the Japanese market, was that they compete for a part of their infill activities in a traditional way. That was a reason. Another reason, I think, was the matrix tile system. You have to understand that when Japanese enter apartments, they take off their shoes. So they walk through their dwelling in bare feet. On the top of the matrix tile system, are two layers of strengthened gypsum board. It feels a little bit soft. When you compare it with the heavy concrete constructions they use to resist the earthquakes, I think this point of consideration was the "feeling."

Was that communicated to you from Japan?
Not with me, but to John. You have to understand that the matrix tile feels "soft" when you take off your shoes. In that time we visited Tokyo there was the big earthquake in San Francisco. That had a big impact on the daily life of the people in Japan. They watched television the whole day. It was overwhelming. It is not in the papers, but I'm sure, it was an important point in their decision.

At the same time as your discussions with Japanese, Haseko and many large development companies were using raised floors, so I'm not sure about that point…
I don't speak the Japanese language. The internal conversations with the other divisions of Haseko and Shimizu may have been going on, and their relation to the authorities, governmental ministries, etc. It is all very intricate. But again based on our agreements, we took all the knowledge back; we had the complete study, 100 percent documented, unfortunately in the Japanese language, drawings, pictures of the mock-ups. In March 1992 Haseko and Shimizu wrote to us: "The two parties (Haseko and Shimizu) regretfully intend to give up the further proceeding of the Matura development in Japan, in view of our new management policies, required human and financial resources and inclination of the government policy at present and in the coming years, specifically regarding technology innovation in housing industry."

Are you limited to use all the Japanese prototype documents, photographs, drawings, or are you allowed to use them as you choose?
I think we can use them as we choose.

For example, if we want to make a publication of this period, could we use those drawings to illustrate the studies of Japan?
I have to see in the agreement, but I think so. Normally I negotiate, that when the cooperation ends, all the know-how comes back and we can use it freely, but I have to look in the papers. A point of interest is that the cooperation was quite close. One point of the deal was that they became a shareholder of Matura International, so their share in Matura International was 10 percent.

And the rest of the shares were from the partners?
Yes, the partners. And what was the idea? The idea was Infill Systems has all the knowledge and doesn't do anything more than take care of the knowledge, patent rights, licenses, etc, etc. At that time Infill Systems gave worldwide license to Matura International and allowed Matura International to supply licenses, for example, to Matura Japan, Matura Nederland, Matura Germany, etc. Our idea was that Matura International not only was owned by the partners but also by partners who are interested in starting business in, for example Japan, etc. So in our opinion we hoped that say five partners join

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Matura International as shareholders, each with 10 percent. So at the end Matura International would be owned 50 percent by Infill Systems and 50 percent by, for example, Japanese partners, German partners, Dutch partners. Japan happened because of our agreement with Haseko and Shimizu.

Were patent rights protected in Japan at that time?
Yes

And the status of the patents in Japan, they've expired?
Nowadays, yes.

There is a period of ten years?
Twenty years.

And protection is impossible after that time?
It is possible when you develop new ideas, new systems, and ask protection for that - the same as we did afterward, after the 20 years. Nowadays Infill Systems has worldwide all the rights, regarding all the know-how, certifications, but also patents. But these are new patents now, not the old original ones.

Do you remember where the name Matura came from?
I'm sure Mature was an idea of John, perhaps in discussion with Age. Mature is mature in Dutch philosophy; Mature in your language mean adult, grown up. In Switzerland, Matura is the end of when you are educated at gymnasium. At the end you got the mature - Diploma. And mature or mature (pronounces it two ways) is the opposite of …

Childlike?
Yes, childlike. It sounds like a Japanese word, but it means nothing in that language. So it was a name with a link to grown up … diploma, etc. What we did before was "not mature," an English word for that when you are not grown up, when it is not completed, when it is not 100 percent. In our opinion we were at the point in the early 90's, Matura sounds international. We asked protection for that name but the protection is ended. When you Google the name Matura International, you will see the site of a company established in 2005 that create jobs and a better life for our children.

Well the next question … we talked about it before, the various actors and their roles at the beginning. You said that the various players worked all together in a seamless way with no sharp distinction, but later the role distinctions became more clear. For example, Rene had a specific job description, and Janssen De Jong had a specific job to do, and Louise had a job and so on. During that period, did the partners kind of withdraw into specific roles that differentiated from the others? I remember John, his job was to look over the international development … and Age was supposed to take care of something … can you describe more of that?
We have to split the time from the end of the '80s to the end of the '90s in several periods. All the developments happen in that time. John in general was responsible for the contacts internationally; also he did a lot of work thinking about principles, etc, etc. Age's interest was to be busy with the technical side. He had to contact with the delivery industry, installation firms, etc. Let's talk about my position. It was mostly during that period to discuss with the partners about solutions, agreements, negotiations, etc, from the beginning up to now. I wrote it down and made it into good agreements, etc. I did it all the time; my responsibility was the administration of Infill Systems, Matura International. Matura Nederlands was the responsibility of Jansen and deJong. They did it on their own. Yes, and sometimes we had meetings trying to get orders from contractors or from building associations, etc. For example,

regarding contacts with developers - sometimes I went to the development companies because I knew them and knew the people there, but in general the activities here in the Netherlands were the responsibility of Age and John. And John and I had the international contacts, but not all the time, and it was necessary.

What about certification of the system?
Yes, certification is very important. At the end of 1989 or beginning 1991 Age started with activities regarding certifications. Toon Huijps, managing director of Matura Nederland, reported October 1992 the actual situation. He said that the whole certification of the 0-slope drainage, the matrix tile, baseboard profile and electricity as well as the matrix tile covering would be finished by 1st of May 1993. But it took a lot more time. On April 1, 1996 Matura Inbouw B.V. was fully certified for the complete infill system including the Matrix Tile and Baseboard Profile. The certification in the Netherlands for the entire electrical system was given on June 16, 1995, and certification of the 0-slope drainage system was given on August 1, 1995. In Germany, the certifications came later: On 16th of January 1997 the Entwasserungssystem (zero slope) was certified on behalf of Matura Einbouw Systemen GmbH, Berlin and on the 30th of September 1997, the Matura Matrixplatte was approved on behalf of Matura Inbouw B.V. Breda.

When the agreements were made with Karl Dekker on the Patrimoniums Woningun project in Voorburg, the discussions were principally through you?
In July / August 1990 Infill Systems and Matura International made the first try-out dwelling in Voorburg. The discussion was how to do it. We all worked on it, but mostly Age, but also John and Jan. You also worked on the installation team, as I remember. Renee was an employee of Matura Nederlands from September 1992. From the beginning he was responsible for the technical development. One of my jobs was to negotiate and to put the agreements on paper.

And Jan van Vonderen wasn't dealing with those things?
We always communicated all we did, put it on paper and sent it by fax to the parties. There was open communication from the beginning to the end.

Was van Vonderen very active at that time, or was he more of a background partner?
When it was necessary, very active. There was a time he was managing director; even John was managing director of Matura International during a certain period, and I was managing director of Infill Systems, but in the period at the end of end 1993, beginning 1993 I was managing director of Matura Nederland. We took over the responsibility for Matura Nederland from Janssen & De Jong. Jan van Vonderen was for a year managing director of Infill Systems and I managing director of Matura Nederland

Roles changed.
Yes

Do you remember anything about the publicity and commentary in the building journals or the industry networks in the Netherlands about Matura during these years?
During these years, there were a lot of papers, publications, about Matura and about the separation of support and infill.

Written by, not the partners, but industry commentators?
Yes I think a lot of them I have in my archive.

Were some of them very critical, saying this is terrible, it won't work?
I'm not exactly detached, but I never read a paper with a negative report about the Matura system. They always said it is state of the art, nice, etc, never critical, also in comparison with other system in that time. I have publications where the Matura system is compared with other systems, in reports from TNO, for example.

When the business closed, what was the publicity about that?
You mean Matura Nederland? No negative publicity as far as I know. We did it in a good way.

Was there a big headline in the magazine?
No. We slowly, slowly stopped with the activities. We had an open discussion in that time with the clients. That is, what our activities mean for Matura International and Matura Nederlands. In 1995 there was activity in Germany with Matura Inbouw. But it stopped in that time, and I never heard about negative publicity about that. That is because I think they did not do projects in Germany, so there were no obligations in Germany regarding when you stopped the activities, when it might have given a negative response. In the Netherlands, Matura Inbouw was not a responsibility of Infill Systems or Matura International, so Matura International had its own shareholders. Steinke and another investor stopped their activities, and as far as I know, it had no negative publicity, etc. because you have to understand that at the end of Matura Inbouw, they got the license agreement of Matura International and Infill Systems and based on that license agreement, again, all the rights, the know-how, etc, came back to Infill Systems. Even in that time, we negotiated with the authorities to take over all the equipment of Matura Inbouw, what they have in storage, old files, all their files, etc.

They were still operating out of Breda, right? The showroom was in Breda, the production facilities …
Yes, they continued the business of Matura Netherlands.

Just under a different name
Yes, under a different name.

With different investors
Yes, with different shareholders

Were the partners still shareholders in Matura Inbouw?
No. The only connection between Infill Systems and Matura Inbouw was based on the licenses.

So the shareholders of Matura Inbouw, was it 100 percent Steinke?
Yes and later another investor.

A Dutch investor?
Yes

And that other Dutch investor only came in when Matura Inbouw was formed. Is that right?
I think it happens at the same time, from the beginning. And it is not Matura Einbouw, it is Matura INbouw. The Dutch word, it is a Dutch company. And Matura *Einbouw* is a German company, under the German law and rules.

But it's just a shadow company, right, they didn't do anything?
I don't know exactly. Perhaps the certifications of the Matura systems in Germany had the name of Matura Einbow. But perhaps it is possible it is Matura Inbow, the Dutch company that owns the rights in Germany, certification rights, etc. but …

The partners, the investor, stockholder who came along with Steinke, was that investor approached only after Janssen had to withdraw? That's when Steinke came in with money? And Janssen and deJong went out? And to find new money, Steinke was found and the other one, there were other potential partners, and they decided not to invest, and so only two remained?
Yes. At that time we had discussions with the group, at the same time, at the same table. It was Steinke -- the other investor, we never met him -- he was in the background. So we met Steinke, and some other people of the organization of Steinke, some other people from the investor side, but in the same time, at the table was TBI represented by Platschorre and that connection was because I think one of the advisers we gave the order to look for investments, knew Platschorre and TBI. There were no restrictions to discuss with TBI because we did the project in Voorburg and we did other projects with one of the companies of TBI, TBI is a holding company, but we were well known with them.

But were the partners involved in the negotiations with Steinke and TBI?
Yes. Our advisor was, too.

You were there?
Yes, at the table. It was based on business we developed in 1994, I think.

But TBI wanted 51 percent control, but then Steinke said no?
No. In our view and according to the business plans at that time which said that we need a lot of money, and if you're prepared to give for example one-third or 49 percent and at the end we are prepared to sell our shares in a new company in the Netherlands - to sell one-third up to say 49 percent of the shares in the new company to the party which is willing to invest a lot of money, that was the starting point. We discussed this with Steinke, with TBI, Platschorre, and others, and at the end, TBI said no, and it was not only 'we need the majority of the shares;' there were other reasons for them not to do it, but at the end Steinke was prepared to start a new company, 100 percent shareholders, with another party investing in the new company and the only connection between Infill Systems and the new company - the new company was founded with the name Matura Inbouw - the only connection between Matura Inbouw and Infill Systems was a license agreement. And so in the license agreement it said when you produce infill packages, etc, you have to pay royalties to Infill Systems.

Do you remember feeling that that was a big compromise to you?
No. We had a lot of experience during all the time, and we were quite opportunistic; when it is necessary to do this, we do it. We have to be.

Take the opportunity when it comes.
Yes, we had to be in that time.

You had very little choice.
We were at the end.

Well, this has been a very, very good discussion. Thank you very much.

MATURA ORAL HISTORY INTERVIEWS
Interviewers: Mieke Oostra and Frans de Vries (questions in red)

JAN VAN VONDEREN

How did you get in touch with the idea of Open Building?
In the 1980's a lot of people were busy with renewing the building sector. The time required to build had to be faster and smarter. For example, we built a house with a steel support. That was in line with the idea of building faster. John Habraken and Age van Randen had solutions for the installation of electricity and data in the (baseboards or) skirts. John wanted to put it in the floor. Frans de Vries introduced me to Age van Randen and John Habraken. The first time we met was at the office of Fokke de Jong in Zeist. There was a model of a skirt (baseboard) and I didn't like it. The second man in my business, Piet Sleddes, thought he had to look into it. Then I decided to go for it and deposit my entrance fee – committing money to the development of the idea. In that time we had a lot of problems with the cables and tubes and the partition walls in our business. The time that subcontractors spend for their work had to be shorter.

What do you think were the strong points of the Matura system's technical performance?
It was the organized conduits in the floor and in the base profiles. We had many problems with the tubes in normal buildings. The second advantage of Matura was fewer subcontractors at the building site giving less building time. Because of the lower number of subcontractors, there was less finger pointing when something went wrong. We had made money in the years before that time, so we were searching for activities in which to invest. In Belgium the Franc dropped by 30%, so I wanted to invest.

I have always been searching for new things. My grandfather started a painting business. My father was more a specialist then I am. I'm more interested in renewal. Before I knew of Matura, I started with the spackling of ceilings, something new at that time.

At about this time, metal studs for use in partition walls was being introduced into the Dutch market. Wall systems were developed and produced for renovation of dwellings. My business was a subcontractor business in the traditional way. We wanted an independent position with the clients.

Did you see development of an Infill industry in the future?
I was very enthusiastic about this. You can break through the building process with the support/infill concept.

Who came up with the horizontal gray water sewage idea?
One of the alternatives for the conduits (pipes and ducts) was to make grooves in a sand-cement layer on top of the structural floor slab. Disadvantage: You were dependent on the one who made that floor. John suggested to place the central heating pipes in the space under the finish floor. First we put in a plastic raster (grid), and then we put the conduits in there. John had a drawing of the floor heating system and we could put all the water tubes in it. John, Age, Frans and Fokke originally had the base profile system and later on the floor tile for managing pipes was added.
What turned out to be the weak technical performance points?
Probably three weak points: First, the quality of the covering floor – we never found a really good cover and this is the point why a lot of our demonstrations failed. A second disadvantage was the high base profile. Third, it was not possible to have lighting in the ceiling.

In 1989, we installed a floor in our own new office in Bergeijk using one layer of 20 mm plasterboard. Later, we changed to one layer of multiplex and one layer of plasterboard. It leaked water a few times; then you really have a problem. Later we used two layers of fiber-cement board, 2x12,5 mm

thick, put down with overlapping edges, screwed and glued together. It seemed a good solution. Later we thought of putting the base profile on the floor, which would have spared a lot of cutting of the floor layers.

The system had a skirt (baseboard) of 11-12 cm instead of the usual 7 cm. The market found that to be a problem. In the BENELUX and France, people want a maximum of 7 cm, because a lot of cupboards have a little notch at the back near the floor that exactly fits over that 7 cm cover, for example the famous Billy cupboards of IKEA have a notch like that. It was also a problem that there weren't connectors for light fixtures in the ceiling. But there was already a trend going on to not put the lighting in the ceiling. But in the social housing, people wanted a lamp above their table.

For what reasons did would-be (potential) buyers decide not to invest in it?
It deviated too much from the traditional way of doing things, and the price was a bit higher than the traditional, because there was inadequate market. The marketing efforts were focused on building entrepreneurs and housing associations. The housing associations thought that something had to change, but the frontline employees have the mentality of a contractor. The support will last a hundred years, and the infill only 25 years. We thought that would be a reason to work with them.

Why did the partners fail to sell it in Japan?
This is guessing. The Japanese that came here mainly had a technical mindset. I think that we had too little influence on their research, which is why we could not disprove their criticisms. Also, the director of the development department at HASEKO and Shimizu was being changed. In the end, they saw so much of our system that they could do on their own. I went to Japan with John Habraken, a lot of professors and a few entrepreneurs. One time, Piet Sledders from my company also went to Japan.
A delegation from Wilma went for the first time to Japan in the second half of the seventies, for the congress "Increase Productivity". The distance was a problem. You have no personal contacts and that is needed to stimulate them, even if the influence of Habraken was big in Japan. The Japanese gave us the reports of their Feasibility Study. HASEKO was afraid for their reputation. The floor made of Matrix tiles doesn't feel completely solid, compared to a floor made of concrete. People might think that this construction is not earthquake resistant.

What about the German investor?
Jurgen Steinke, a German from Berlin and a shareholder at the big Dutch General Contractor Ballast Nedam, put in a lot of effort and money to make Matura a success. But he left when he had all the details. Steinke wanted to work with Matura in The Netherlands and Germany. He didn't want surprises from the history of Matura in the Netherlands. That's why he wanted to establish a new company, Matura Inbouw B.V. Production break even in the Netherlands was not realized. That was projected to be between the 600, 700 and 1000 infill packages a year. Also Matura Einbau in Germany was established. Matura Einbau/Steinke did everything for the system certification in Germany. In Berlin, Steinke had big projects. He was property developer. In the end, it didn't work. I don't think there was ever any building with Matura in Germany.

Were there other contacts overseas?
There was also contact with a timber framing company in the US - Bensonwood Homes. Also there were contacts in the UK. In the end, neither went anywhere.

What problems arose with the development of supporting software?
Software was very important. I don't remember more details now.

MATURA ORAL HISTORY INTERVIEWS
Interviewers: Mieke Oostra and Frans de Vries (questions in red)

What went wrong with the role of Janssen & De Jong?
Janssen & De Jong wanted an industrial package on the market and participation in further developments. Eventually, there was a management buy-out. Erik Krul was also there. Matura Nederland did get enough to search for half a year for a replacement of Janssen & de Jong. The four partners of Infill Systems did the business operations by themselves. But they didn't have the intention to go on with it commercially. That is when the first negotiations were held with Rinus Platschorre and his company TBI. Steinke from Germany was also discussed. It would have been a combination of Steinke and TBI, but in the end it was only Steinke. Jacques Janssen has been on the Board for a long time at Van Vonderen I.C.

Please describe the various actors and their roles
John had the overview and the international relations. Age had the relations in the Netherlands, development and detail solutions. Frans was in charge of general affairs direction, marketing and finances. Van Vonderen – implementation of pilot projects. In 1988 Jan bought a premium dwelling in Bergeijk and ignored the conduits in the support. Then we built our first installation package there. Later, the house was sold. This was the only project without loss. In 1989 we installed an office with the Matura system. Not the base profile (it was not in our time line). We didn't have to do a lot with the rest.

Where did the name Matura come from?
The only thing I remember is that the name had to sound a bit Japanese. Maybe John came up with the name. Mature is an English word. It also looks like Swiss: Mature Pruefung and the Italian Diploma di maturita, which means proof of adulthood. The Matura system was *mature.* The word looks Japanese but doesn't have a meaning in that language.

What were some of the key 'turning points' along the path?
We tried to get the whole system on the market a lot of times: the lower system (Matrix floor, base profile and all the conduits) and the upper system (partition walls, kitchen and bathroom equipment). In the end, it might have been better to bring pieces on the market, for example only the lower system. We focused totally on the building world and the housing corporations. We didn't do a market research on how the system would be accepted by the users. Maybe the result was that we had to split or that we were too early. Looking back, it was all or nothing, the integrity of the system was sacred (under – floor system, upper system, the logistics, assemblage, and software). Others were not allowed to change anything. We all were too much involved in the developments. That was not good. It was the spirit of the age of renovation, but we were also focused on new buildings and offices. We were extremely busy with the development of the system. We spent less time with the plans for marketing, business and financial. Afterwards, we should have asked for professional help. The acceptance on the market should have been better if we had done that. We were busy with the technical operation of the system day and night, with the four of us. We had a lot of fun. We did have detailed business plans, also logistic reports (Price Waterhouse), and software (MaturaCads). But we never asked ourselves: how do you create demand? And we focused a lot on traditional players on the market. We had to go to the renter and buyer. Maybe it wouldn't have worked, but we never asked ourselves. We should have talked to IKEA. We, the four partners of the Infill Systems, had become 'our own system'. This was our world and we forgot the rest of the world.

Were there different ideas along the way about how to bring Matura to the market – that is, alternative business plans, marketing strategies, etc?
No. Infill Systems did come to an important point in 2000. The question was: do we stop? But Frans was not ready. Were there more possibilities? We have not renounced the traditional support. We've had enough of it. We searched for direct contact with the renters, but that was on a small scale. We never reached the market on a big scale with for example an advertisement on the back of

the national newspapers or via the television. The kitchen industry was at that time full of self-esteem and made advertisements. They didn't go to the contractors anymore. We also didn't ask the building companies what they wanted to have or what they thought of the product. We were just too focused. But we did work with ERA and Stam. Even now it is a hard question; you have to have a big party that for example, wants to invest in a television commercial after the national news. We even tried to introduce on the market via Gyproc, but it's so hard.

What do you remember as to the publicity and commentary on Matura, within the Dutch building industry?
I don't remember. There was some publicity, but we didn't do a lot with it.

What caused the company to close?
Matura Nederland was liquidated after the bad ending with Janssen and De Jong. Steinke went on for another year with the name Matura Inbouw and Matura Einbau. These companies declared bankruptcy in March 1998, but Infill Systems has nothing to do with that. Matura International was liquidated soon after that, because there were no activities anymore. In 2000, the partners were tired and there was too little response from the market. We were the three of us, reaching the age of 80, and we thought it was enough. It kept costing too much money and raising too little possibilities. We were happy that Frans wanted to take over the activities in 2000. John, Age and Jan transferred their shares to Frans. In good harmony the business was completed. After the completion we had a luxurious dinner together.

Thank you!

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

JACQUES JANSSEN

Thank you for agreeing to meet and discuss your experience with the Matura development. I hope you agree that we need to learn from this experience, capture the knowledge and transfer it to the next generation.
I hope you are aware that I am not a technician.

Yes.
I'm an economist. For technical questions you will have talks with others, I suppose.

Yes, however, there's a certain point that technical things may come up
Okay let's see

Did you get the questions already?
No.

But it doesn't matter. Now it's fresh. I'd like to hear your understanding of other developments in the Dutch industry, at the time that the Matura development was beginning in the early '80s and when you became involved in the '90's. The building industry was going through transformations, and there were perhaps other developments that encouraged you to believe that the Matura idea would have a good opportunity.
In our group - that is the Janssen and De Jong Group - we were much interested in the industrial building as opposed to artisan-based and traditional construction. Traditional construction is vulnerable to mistakes, too many costs because of mistakes and …

Human error
Human error, correct, the labor costs are higher than necessary. Efficiency advantages are less than those possible in industrial production. In traditional building much work is done in situ, at the building site. Our group was interested in the advantages of industrial design and production.

Janssen and De Jong
Yes. We thought we could, to some extent, make the difference by focusing on modern building techniques. We had been quite successful with an industrial steel building company, Remco. This company produces steel buildings for industry, warehousing, logistics firms, etc. They did so quite successfully; it was an attractive strategy for the group. In '86 we did another acquisition of an industrial building company, a producer of buildings in concrete instead of steel. This company however was not successful.

Factory produced concrete elements.
Correct. It was our intention then to transform part of the company into modern industrial building, commercial as well as residential. In that period, a few years before Matura, we engaged ourselves in interior construction.

Transform the Janssen and De Jong Group, or a separate division doing interiors?
We pursued a separate interior division within the umbrella organization of the group. We thought it was not possible, nor necessary, to implement industrial building in existing traditional companies. The

ways of thinking were very different. To change the profile of the group from traditional to industrial building we intended to grow by acquiring companies with industrial building concepts. The mix of the group would eventually change to system building.

You acquired them.
Yes, we acquired some companies that would change the profile of the group in the preferred direction. In 1989 we made a trip with Age van Randen and John Habraken to Japan, an excursion of Open Building. Japan is industrial building. It strengthened our idea about the future of the building industry. We were quite impressed by the Japanese success.

But you were also looking for opportunities in the interior field?
We were looking for acquisitions but also to develop ourselves industrial building applications in order to move in the direction of a modern building group.

And other companies like yours in the Netherlands were also doing the same, asking the same questions?
Some did, but only some of them. The majority were not occupying themselves with these kinds of questions, or they were just not convinced. We spent more effort in that direction. We thought in those days the future would be in that direction. Moreover, we had been successful with some related activities.

The steel building system?
Yes. We were successful there, which encouraged us to move on in that direction.

And you went to Japan with an industry group?
It was with John Habraken and Age van Randen and several others of Open Building. We had an excursion with a group of building suppliers, in 1989.

What was it that was so interesting and convincing to you? What was it about the Matura idea that made you so interested?
Again, we primarily had economic considerations, which were to be realized by modern techniques and modern ways of organizing. We were quite impressed by the prospect of reducing labor costs by prefabricating many parts much more efficiently.

Parts? Components? Elements? … Reducing time on the site?
Yes. That was an interesting prospect. We also thought that the flexible building we could deliver would be appealing in the market.

How did you know that?
We didn't really know that. We expected it to be the case.

You were guessing?
We were guessing from a different perspective on the future of the building industry. We thought the future market would be interested in flexibility and individualized demand. The labor cost reduction would help. Some market development would be needed which was no problem because we would start at a small scale anyhow.

Labor intensive. Labor costs were going up but not necessarily quality at the time.
Yes. We expected a flexible demand in the market to ask for a flexible supply.

So, as you looked at the sector, you were already involved in interior work, competing with Jan van Vonderen? And others, and your own experience of the market potential, your guess about the market potential came from your analysis of the possibility but also your own experience in the building industry?
The experience we had thus far covered a slightly different territory because steel building is not the same as Matura. There is some similarity only in that you can avoid complex in-situ circumstances for doing the job that make it hard to be efficient. If you manage, to a considerable extent, to prepare components outside the construction location and you can manage to do that in an efficient way and in sufficient quantities, then, we had the belief, it could be profitable and more efficient.

And find a market?
That was, in fact, our most important consideration. We too believed that flexible applications would have the future. Flexibility would be an important feature. We did not expect residential and commercial markets to show quantitative shortages but merely a need for new ways of utilizing them, so for flexible use. We expected renovation to grow and change in that direction. In those days our group did quite a lot of residential renovation.

Old buildings.
Yes, existing buildings. In Limburg, Amsterdam, Rotterdam, and several other cities, we were engaged in renovation of houses. In the process the plan of the house had to be adapted to the changed dwelling functions. Flexibility then was a plus, although we could not quantify it. It was considered an advantage also for the proprietor of the houses, the landlord. There were no marketing reports. We didn't have that. Our advantage had to be in the renovation costs.

But you're an economist, so you watch the economic trends in a society and the demand side and the supply sides, so you must have been quite aware of the condition of the market, even without precise studies. I really am very interested in your …
In those days we had the belief that the building industry as a whole was about to change. From traditional to industrial, from artisan to prefab, from static to flexible, from long term oriented to short term oriented, from building and renovating for the mass to allowing individual demand, from traditional organizational patterns in the building industry to new integrated ways of organizing, etc. From hindsight, we were too optimistic about the speed and power of the change in the building industry.

Did you think consumer-oriented?
Yes, that was seen as one of the drivers of the change. A change in the sense of more consumer-oriented and change in the method of producing, the supply side. As a group, it was more or less our mission to take part in the modernizing of the industry as a whole. We wished to be in the forefront.

Lead users
It was a bit like a mission. Not just to do our job but also to make money by finding more suitable modern entrepreneurial methods, along with the direction in which the building industry would evolve. This mission fit quite well in the idea of the founders of the group back in 1939, my father and his

associate De Jong. They were involved in road construction, building, and the supply of some building materials. They saw chances for improvements in the existing building practices.

In the beginning?
Yes, they thought: We can do a better job and make money as well. They were focused on finding new, modern ways, which were distinct from existing practices. Their spirit remained. System building fit very well in that mission.

Do you have a degree in economics, or experience from working in the family industry?
I graduated at Tilburg University in economics. I am not a technician.

What I'm trying to find out with you, you were clearly reading many economic studies about the Dutch economy, the society, it's future prospects. Do you remember key reports or government research or academic studies … that began to paint a picture of the future in which consumer-oriented building became important … in which industrialized production became clearly a future goal.
I have to disappoint you. We did not have such reports. I am not sure whether they existed at that time. What we did have was our own strategic sessions with the board, issuing business cases and business plans, based on our own observations. These strategy sessions were organized in cooperation with a university professor, quite sophisticated for those days, especially for smaller building companies. Preparing for the future, we should not put our money on traditional building organization. We were to proceed in prefab, fabricating offsite.

Offsite.
Offsite and relatively high tech like Remco.

What is Remco?
It was a builder of steel constructions. We acquired the company in '84. They were already successful then with an annual growth rate of 10 to 15 percent. Cost reduction and earning capacity were impressive.

Gains in efficiency, too?
Yes. But there was the second feature that attracted us. Their marketing power, the way of acquiring projects in the market. Traditionally, there was some such mutual protection between contractors.

The way of acquiring a project by the supplier? The contractor?
There was competition between the contractors of course. In those days some parts of the building industry engaged themselves in mutual consultation prior to the tender (offer or bid) for a job. It was a government-approved system of price regulation. Sometimes however this system was misused for illegal distribution of jobs among the contractors. For that, tenders were not about being well organized and cost-efficient, but about deals with other contractors. That was illegal and very frustrating, as you can imagine. Nowadays it is absolutely forbidden by law.

The steel industry was not operating in the same tender procedure. Why is that?
Steel builders were not members of the association of contractors. Only members had to apply to internal rules of price regulation, the compliance of which was imposed by the association of contractors. Remco did not take part in this tender procedure or in the illegal practice of job distribution.

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These tender / bidding procedures had existed for a long time?
Yes. But Remco could renounce membership of the association because they were not a contractor. Remco typically designed its own buildings and offered them turnkey to the client. Remco sold a turnkey predesigned product, not the capacity to erect a client designed (or architect designed) building. An architect each time again designs a new building 'from scratch'. A contractor typically sells the capacity to erect the building in accordance with a unique drawing, differing from case to case.

To deliver the building
Every time it's a different one. In the system building industry, it is the other way around. The system builder sells one product, be it in a limited number of varieties.

Mainly one product with some variations
The system builder does not offer the capacity to build some or another building. He sells a product like this teacup. The system builder is not a contractor but the seller of a product with a service component, but tied to the product.

And services?
Yes, in the sense that the building is designed, sold, and delivered on a turnkey basis. The client only has to bring in the building lot, the location. On that lot the system builder erects his building, his product. His effort and organization are totally different from a contractor's.

Did the market appeal to you because it gave you the opportunity to go out and find your own jobs?
Yes, to the extent that you could approach end users directly, instead of architects for example. The main difference is that a system builder sells a product; he is not offering a capacity, a building capacity in the form of a group of people, knowledge and machines. A traditional building company can say to a client 'I will reserve my capacity, or part of it for 6 or 12 months to erect the building you want me to build, according to the architect's drawing. It may be a church, a restaurant, a hotel, an office building, residential, whatever. I reserve my capacity exclusively for you to do that job. In system building, on the contrary, you have a single product to sell, may be with a little variation, like in a shop. When the client does not like the product, he has to go somewhere else. He would not have come in to begin with. The system builder prefabs everything at home, transports the parts to your lot, and assembles them there. He may have prefabricated some parts or held them in stock. Not unlike Matura. Cost efficient, no cost of waste and mistakes, at least, less.

(Frans de Vries) I think it is a very important thing to recognize what Jacques said - that it is a traditional way; it is the first time I hear it, but I recognize it, that the traditional way of the construction industry is to offer capacity. And I will explain later what the consequences is of offering capacity … it means in short that I need an organization as smooth as possible and when I get the big job, then hire I can the team. The only reason to add subcontractors is price. Because of that, it is not a nice activity. There is always fighting.
And there is one more thing, which Frans may be implying also. A traditional contractor, offering capacity, has little chance to improve the building process because it has to be invented each time again. Why? Because the process is always different as the building is different. In system building, you produce the same product at your own place, under conditioned circumstances. You can improve the process over the years because it is similar for all your products. The process is the same. You can apply Japanese quality circles; you can improve your product and the method of producing it. The traditional contractor hardly can. In Matura it can be done. It is a totally different philosophy on several points, the

market, the (absence of the) tender procedure and relative competitor independence, the cost efficiency, the applicability of quality circles. All this was appealing for us to try to make a difference with the traditional industry branch. Matura fitted in that strategy.

With the steel building, the product was the whole building, and with Matura you just get the end part, and the contractors are building the building, so there's a relationship there that isn't in the delivery of a steel building. So there's something special there.
Correct. It is not the same, yet it is comparable. Matura is a part of a building; it is not a complete product. We could only reap part of the advantages discussed earlier. Yet, it appealed to us for reasons already mentioned. We estimated by our own strategy deliberations, that *open building* -separating construction and infill - would steadfastly proceed. In due time the advantages of Matura would increase and Matura would be more easily applicable, so the success of open building was also of much importance to us, one of the success factors for Matura. However, our strategy sessions in the late '70s and '80s miscalculated the speed in which things change in the building industry. We were too optimistic. We saw some nexus; we saw some lines, trends that hopefully and probably will continue as yet.

(Frans de Vries) How did you create the demand in that time? In a traditional way is to ask the local authorities, ask the social housing corporations, ask them to give me - send me - the questions to offer the project. That is, we know what the demand is, are the clients well organized. You move to system building, who are your clients at that time? And who created the demand?
In case of Remco's turnkey steel buildings the market was already there. In the early 80s traditional contractors were engaged in steel buildings as well. They did it their way, mobilizing their capacity to go and make the building designed by an architect. Remco, in prefabricating their own products, could do this cost efficiently, selling turnkey some 15 to 20 percent cheaper. In fact the market was already there. For Matura, we saw cost efficiency as well on the one hand, and pull demand from end users and pull demand from social housing corporations on the other hand (their houses becoming flexible and better suited for future adaptions).

As part of your shift to a systems approach, did you change your company organization to increase the selling?
No. Our group consisted of a financial holding company and a number of subsidiaries. These were themselves accountable for their own sales, production, personnel, technical equipment, etc. They operated independently. Matura was to do its own marketing and sales, based on its own unique selling points.

Their own profit center?
Yes. Matura, as the others group members had their own director, place, commerce, etc..

And their own marketing?
Indeed.

So Remco had its own operations, its own profit center, marketing strategies, so on.
Absolutely.

Did you observe that their marketing strategy was different from other group companies?
Fully different. Black and white.

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So they went to knock on the door of the architect or the client to get clients.
Remco did not approach architects, as they were direct competitors. Remco approached clients directly by advertising in the different magazines to create demand. They used photographs, or an artist's impression of their product and enumerated advantages like price, speeds, turnkey. Their convincing marketing concepts were unknown in traditional construction. The differences in marketing were big. Different worlds.

(Frans de Vries) Open Building says the client is the user who pays for the house, who pays for the infill package, not the contractor. That's okay, because if Matura has to sell its products to other contractors, then there is a big problem.
We tried to sell Matura to contractors, to project developers, to social housing corporations, to architects, but never to end-users.

So when you took an investment interest in Matura *Nederland,* you had in mind it was similar to Remco, a system approach?
No, not exactly. We knew it was not really the same, but there were similarities. Some of the advantages we had realized in Remco could also be realized in Matura. But it's not the same. We were aware of that.

But in terms of the advertising, did you recognize the importance of advertising Matura?
I think we underestimated the importance. We focused on the technical side, the supply side, without really pushing the market, the demand side. We felt that we had to wait with that and first push the product development. Only then we could strengthen the marketing to decision makers and end users. We needed to be more confident.

More confident?
Matura had to prove itself in the market, by pilot projects, to be appealing and cost efficient. We had to wait till the product was really 'mature' in that sense, you know. When it is not yet fully developed and market approved you must be reluctant in saying too much in your marketing.

Be careful. Don't oversell.
Right. That was a part of it, but at that we did not have a good touch with the marketing side. We postponed the issue.

When did you realize that? Just now, or during the time of your involvement.
We were aware of it but preoccupied with the technical development. We were inventing, investigating. The team worked out the technical problems, the software problems, the logistics, the assembly, the delivery … and the marketing was on a hold. We postponed it until we thought we could present the 'mature' product and logistics.

First you have to get the product right, then you can sell it.
Yes. We considered the projects we did in Matura as pilots.

Prototypes.
I cannot say all of them or to the same degree, but as a whole we did not yet have the feeling that we had left the development phase.

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Did you find yourself frustrated in making the technical development improve quick enough?
We felt frustrated about that, yes. All the more as it turned out to be very costly.

Can you remember specific aspects of the technology which you thought were immature.
No. I was not aware of it in those days either. It was and is too technical for me. My attention was focused on budget control and financing the development.

Who was telling you that the technical development was too slow? Someone in your organization was watching it and saying 'we're having problems'?
The only instance that could judge that was the market. So we were focusing on the question: When will Matura be able to really sell itself in the market? We did not single out marketing as a separate priority apart from getting the product mature.

And you now realize that.
Yes. More than we did in those days. We considered Matura as a product development, so we really didn't say it had to be such and such by that date. We were sympathetic towards the concept, and we hoped and thought it would develop itself shortly into a mature product.

(Frans de Vries) In those days, Matura Nederland was focused on the technical aspects and they used to go on and on the technical aspect and forgot the marketing aspect.
Looking back, it's my feeling that all of us had more attention for the technical development at the expense of the marketing attention. There was some effort, of course, but generally speaking we should have spent more effort on the marketing side.

(Frans de Vries) We were not successful to create the demand.
That's right.

How to create the market … for something no one has ever seen before.
That was *our* problem. But we can talk now about the future, maybe learning from the past?

(Frans de Vries) Your explanation said we all are believers. We all have hope. We hope that the whole environment will change in the direction open building … we never discussed such items but it was so important and until now no discussion about the theory about support and infill. No discussion. The discussion was about how we can reach the buyer … direct communication between the buyer, the user, like he and she do today buying a kitchen … It is to some extent dangerous to have a group of believers.
Well said. As you know, we belonged to that group too. But the more you are a believer the less you may see the problems. And the less critical you may be about the parameters that are important.

That's why I asked about the evidence you could find as an economist. You said there weren't any studies, because you believed in the validity of the idea.
There was not yet much written evidence on the subject at all, no reports. Matura was too new.

They did their own reports.
Matura had no marketing reports either, as far as I am aware of. Maybe, at some university it could have existed. Information about the demand side was absent.

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I've been a student of other systems building developments in the UK in the 30s and the US in the 40s and so on. All of the published literature focuses on the technical wisdom or the smart technical solutions, etc. The understanding that these things need to live in a socio- economic reality is ignored again and again. But some systems approaches like the steel building, they're very successful, and this is a system building here, right? So we do see systems increasing in their scope and complexity succeeding in the market. Now how is that possible that they succeed? For example, façade systems. We now have complete façade systems for buildings. You take down the old skin of the building and put up a new one. Those are very successful systems, and they're very profitable, so how do they do that, and with infill systems, comprehensive, total, they're struggling to succeed, even in Japan. At the moment there is only one company in Japan that is struggling to deliver a total infill. It's called next infill. I've visited them many times. So there is something about the market that is not yet receptive. We've talked before also about the kitchen industry … just kitchens. Very successful. Many competitors. The market understands the kitchen. I don't think the market understands infill.
Correct.

So are we crazy to keep saying infill, or will the market eventually get the idea? And so … how do we create the demand for something so complex? Maybe the complexity is a disadvantage.
Yes

The kitchen industry has been successful in creating a market for itself. How can we do that? What can we learn from them? Do you know of anybody who can speak to that?
No. We can have some speculations about it. But I do not know.

That's the closest thing to a total infill. It's different to ask why steel buildings have become successful.
In the case of kitchens, you have to realize that the consumer wants to distinguish himself.
A kitchen is a …

Status symbol.
Right. It's really a consumer thing. People don't want to have the same kitchen as their neighbor. They want to have some luxury and distinguish themselves. That is different from Matura.

Because?
Fundamentally the consumer cannot distinguish himself with Matura products that nobody can see.

They're invisible.
Yes, and they are designed to be invisible.

So maybe the market for infill systems is not the consumer market because they don't get it. They don't understand it.
But the idea of Matura was to sell to the consumer, the end user, and maybe that's a problem. The consumer is triggered by something visible for himself and his neighbors.

Then we must say that the markets for Matura can only exist for those persons who have an interest in
There must be a financial or organizational interest in applying Matura. There can be a logistic interest, speeding up processes.

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If marketing is applied as Frans suggests, first one has to think what are the unique marketing points. Why should anyone like to apply Matura? It is not the consumer.
Several potentially interested parties, yeah, but not just and not first of all the consumer.

No. Right. But in the end, it IS the consumer. In between there are people and interests and decision makers who have their own agenda.

When Jansen and De Jong began to withdraw, can you explain why that happened?
We had financial difficulties in our group then.

In other divisions?
Yes. Major problems.

Why were there problems? The competition was beating you and you were losing the edge of your competitive advantage?
You know, the group consisted of independent, self-supporting units, so there was not one single item that went wrong. It differed per unit. If you ask what was the overall problem, perhaps we had not enough attention for cost awareness, cost control, managerial focus.

You mean at the high level?
Yes, but the same lack of focus prevailed in some subsidiaries.

It wasn't because of a lack of commitment to the Matura idea?
No, there was no lack of commitment. Yet, Matura was not contributing to profit and cash flow of the group, it was a bleeder. We had to sell, or to close, to stop the bleeding as the group could no longer afford it. If Matura had earned money by then there would have been no necessity to stop our commitment.
It is quite peculiar that you mentioned that in the 30s and the 40s the way people worked on the system building is not very different from now, that is having the focus on technics. Which makes it only more relevant to have a marketing concept. If marketing connects to existing interests of decision makers, whoever they are.... It is the decision maker who determines to go along with Matura. The decision maker may not be the end user but it is not always the end consumer who decides, it may be somebody in between.

Who is capable of helping to think about it? Not the name of the person, but … what instincts and insights are needed to think about that question? Not the automobile manufacturers.
Architects.

No, I think architects are the worst problem. They're so out of touch. Architects live in their own world. Well maybe, but maybe a special architect couldn't, but …
Today, there is a market of one million square meters of empty commercial space, unrented space. Maybe the marketing effort has to go to the owners of the buildings, the empty buildings, not residential buildings.

At this moment, the price of empty buildings is extremely low. And I know that there are one or two companies in Holland who are engaging in transforming these offices into residential. If you could locate them, if you could locate those companies, you might investigate how they're doing it now.

Yes, exactly. And whatever are their problems, what does it cost, how could Matura make a difference to such a company.

Do you know their names?
No, no. I saw it on television

These are the owners of the buildings of the people filling them in?
Yeah. It was a news item on television.

More or less
I could imagine that studying how they manage the transformation from office to residential could disclose how you could do better with Matura. You could go to the local authorities and government and you could go into the market to have also a pull demand.

Push.
Not only push.

Thank you very much.

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

RINUS PLATSCHORRE

Thank you for taking time for this meeting today. I'd like to start by asking you about your understanding of the efforts in the last 20 years to change the Dutch building industry, including the Matura effort.
I remember I started with thinking of changing this construction industry when I was responsible for the cement and the concrete industry. I started in the ready mix concrete industry in '75. I was responsible for the cement, including prefab concrete and also the ready mix concrete, in the early '80s here in Netherlands. Later on, I went to the board of the Belgium cement industry, CBR, it was on the stock market, and owner of the Dutch division. We then started regional expansion in the USA and Calgary in Canada. We were the first in the eastern European countries, Poland and Hungary and Czech. They opened up in the late '80s. Then China. … and later on it was Indonesia and so on. It is now Heidelberg Cement, number five. We brought in at one time in '93 all our businesses into Heidelberg at that time. And then I started with TBI in Rotterdam. That is the time that I was responsible for the cement and concrete, we started a lot of conversations about changing the construction industry.

What were the main changes that you thought should come about?
Well, you could see the market developing, A growing influence of individual needs of people. We are not supplying the product people really wanted. We are not even building for the people, no; we are building for a corporation or somebody else that rents the houses. There was no access directly to the user.

To the families
Yes, to the families. We did not find out—in my mind—what they want, and that we could have a product that is fitting their needs also in the future.

Between the manufacturer and the consumer, there were too many barriers to communication?
Exactly. And as a producer, I started a confederation of the construction industry in the '80's. I was chairman, and from that point, we developed the idea that this should go to a complete concept. Try to find out in an area what people want, and you make it, complete, together. Parts of it happened, but still it is a struggle for life.

What were some of the early successes in … finding a direct link to the consumer? Bathrooms? Kitchens?
That area, yes, of course, but those are parts of buildings. I think in Holland, and not only Holland, the mistake has been made with the so-called industrial housing. The industrial housing companies thought 'we have a concept.'

Do you mean mass housing?
That was dictated by technique. Variations were not possible. It was a mistake with a lot of technical failures, but the main problem was it was not a concept. It was a construction they wanted to supply. That's it. No choice.

And government?
And the government interfered. They prescribed - and still they do a lot - exactly the sizes. Terrible.

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So then the production could just replicate a given solution and make thousands of the same thing.
Indeed. In the meantime there are some of these new concepts going. There's our conceptual building with Pieter Huybregts. He had written books; we made a club around his ideas. So we see progress, but slowly. And I thought at that time when the Matura Infill system came along and I learned about it and I thought that could help us to make a breakthrough to conceptual building. Let us support it!

You mean the separation between the support and the infill?
Yes, because at that time we were thinking also that we should completely change our view of the world we have built. It should be more flexible. You have to be able to use a school for completely different purposes in the future. From that idea came Flexible Building Solutions but that was again, most of them are all technically driven. That's the point. I tried all along to say "no, it should be economical, it should be socially driven." We still don't build for that user, for the end user.

More market sense if I understand you corectly
Then I was in TBI, then ERA. ERA was our and still is one of the builders in housing who is thinking in that way.

They have an open eye for new developments.
And Ko Blok was CEO at ERA at the time. He had what I think was a renovation-project in combination with a new building in Voorburg.

(Frans de Vries) I saw in my notes that the first meeting with TBI was with me personally with Koopmans. It was 1990. After that, silence for more than three years. We started on two ways to connect with TBI. One was the construction company ERA - because of the project in Voorburg. We offered the first dwelling, the first infill package, in 1990 to show how it worked, and did that first dwelling infill. We did it by our own forces because it was the first full infill package, the housing corporation said now we start with renovation by one-unit-at-a-time. They did a lot of work to prepare the people when they moved; we came in and in four weeks, a complete new infill, separations, etc. was finished. ERA was responsible for doing the outside work, elevators, staircases, façade, etc. – preparing the support. We did dwellings, most of them in renovation, high-level renovations, but also four new buildings in the for-sale market on the demand of the people buying the dwellings. Then we started the discussion about cooperation between TBI and Matura International infill systems. The start is I think an important role in that time, Peter May Swantay, he was founder and owner of Optimecks and very successful funds, and I don't know who knows him—John or Age - but Peter May Swantay had discussions with a lot of people to ask them "are you interested in investing in Matura International and in Infill Systems, etc." For those discussions we provided a Matura International business profile and Matura Nederlands, and marvelous books. We were very good in making such books…such business files. But the question was we need six million guilders in that time. We had worked together with Janssen and deJong from the '90s up to '94 and they spent millions of guilders in the development of offices in Breda, making the dwellings, for example, in Voorburg and somewhere else, but Janssen and deJong came into trouble because they have no strength to finance more and more and more. And let's not forget in the '80s, we had also a crisis in the construction industry in '85 we had 25 percent reduction of building volume. But after '85 it was coming up very fast. But a lot of people were suffering from that era, from that crisis.

When Janssen had problems, was that a general decline in the building industry in '95?
No, there was a management problem.

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(Frans de Vries) I think they lost a lot of money, etc. But based on these business profiles, Peter May Swantay has talked to you, has also talked to Steinke and other people. We asked him are you interested in finance or to cooperate with Matura International and Infill Systems. In my files, there are letters at the beginning of 1995 and they said that we discussed the following scheme. We are prepared to sell shares to investors, and of course it was our advantage the less amount of shares becoming the highest amount of investment, so that we were in negotiations, and in my papers I see we had a scheme and it is the following: We start, we continue Matura Nederland and outside shareholders can invest, and we ask…I can give some more details - can you invest the maximum is 50 percent, 49, 50 percent, and I see in the papers, you were willing to think about investments by TBI, but you immediately said in that time 51, we never ever invest in companies 50 percent or less than 51 percent; we will come in the driver's seat.

Do you remember that?
That was our position, our general policy, yes, because we had a big problem in the years before when the TBI-companies still were a part of the OGEM- group. It went bankrupt in '82, and Mr. Koopmans saved a number of companies from the bankruptcy of OGEM at that time through a connection with ABN. So, when I came in in 1994, I had 54 companies in TBI Holdings with a good track record in the building industry in installations and also in industry.

And they were all in for more than 51 percent?
They were all over 51 percent. At that time, they had previously had minorities, and that was completely disaster, so all over 51 - most of them 100. For me it was a good time to say yes to that offer to be the chairman of the board of TBI, and I started, I gave all those people one and a half year time to make a plan. Where do we want to be in 10 years' time? We had a very decentralized system. I said, okay, you're all 100 percent from us or over 50 percent, but I will be a member of the supervisory board for you. We never have meetings in the main office, the office was very small, fit just a couple of people. You have to do it. And once per three months I come to you; we have controls, of course; you have to report every three months. How far are you? You are the boss. You have to do it. You have to deliver. And it was a real success. Of course we had a good economic situation after '85 with growth. I had promised to be there for seven years, so in 2001, I quit. At that time TBI had 120 companies doing very well, and still it is one of the total concerns in the construction industry that have black figures, because of the decentralization. TBI does not have a big central board and staff, like, for example, HBG.

What is that?
It was the biggest construction company at that time, international. And they had a centralized organization.

Was Ballast Nedam and BAM organized in the same hierarchical way?
Still are. Still are. That is one of the problems, that there is not a breakthrough. There are a lot of young people--I've seen that in BAM--who really want to do it differently. Now, they got a little bit of room to maneuver, but when the crisis in the Dutch building construction had come and still is going on they went back to the old policy again with no room for innovation.

(Frans de Vries) When did you enter in TBI?
'94. But I think the main point was I left it to ERA. ERA should prove if it was an interesting idea for the breakthrough and conceptual building.

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But at the same time you were looking for other breakthrough opportunities, so the discussion with Matura was one of several others.
Yes, it was one of several others. But there were not that many breakthrough systems available at that time. My problem was at that time should it be a part of an existing company or a completely new one. But the prefab concrete business was in bad shape all over the place in the Netherlands, after the 80s they were all in bad shape. Didn't make money. It was of course not so easy to decide 'let us start up a completely new one.' I should have of course the backing of companies that are going to use it in practice.

The market was …
The market should be open. I was looking to ERA to do something.

To open the market?
Let's say to give me the guarantee that when we are going to be a shareholder there and to make a success without reducing profits.

There's got to be a market.
There should be that market. ERA was the only one in our organization who could do that. They were thinking conceptually … so it was not only the 51 percent, there was also how can I have the assurance that there will be use in the market because there were also some doubts, and that came out afterwards. The main thing was that the extra costs involved in having this Matura system were not paid back by a flexible use of housing in the future. If they did renovation, the place of the kitchen was again in the same place where it had been before. Why, I don't know, but it is not only the construction market, it's also the architects, let's not forget that…who are still not conceptual thinking …and clients and the corporations … that's what came out of it … okay, you are flexible, but this flexibility has no use in the future.

(Frans de Vries) No demand?
They thought there should not be any demand because renovations made still show fixed places for kitchen, bathroom, whatever. In my opinion however we should have a much broader look on our duty; our product is creating a world where everybody is happy every day and can live, work, and be happy in that environment. That is our goal. That is far from what's happening. I see some of those things happening, but very, very little. Then we got involved in the big discussion about competition affairs in the Dutch building industry.

So you were negotiating with Matura, Infill Systems, and Matura International, so were Steinke and other potential investors. You were interested in 51 percent control or more, but I hear you saying you still weren't convinced of the demand for Matura. ERA was doing some projects in The Hague, Voorburg, etc.
There was not hard proof saying this would be a success. That was my main problem. We were hesitating to participate anyway if there was not a hard demand.

What could you have done to be more certain about a demand? What kind of investigation or marketing program … what would give that assurance?
We tried of course. But since we were decentralized, I played that role. I left that to ERA to do that. Of course we had our discussions, and I pushed back; I did all the time, but I cannot say 'you are going to do that.' His problem of course was that the way of thinking was not only by the construction industry

itself, as I said, it was by the other corporations - until today. By the government - they interfere in the building market. That did not change. So then we came to the conclusion: the total culture of the building market should change. That was the beginning of 'how are we going to do' – the UK did it – they introduced "Rethinking Construction" headed by Sir John Egan. He came from the automobile industry – he has got a task to change the culture of the building industry in the UK.

But that didn't work either.
At that time we still believed it was going to work, so we started in the Netherlands to do the same. But the government didn't get the good chairman. The one they wanted didn't like the job, and it never happened. It still is slow, slow, slow, even now. As I said, half of the members of building industry in Holland don't want to change. There are some very big ones in there. They still believe we did it well and we continue to do it well. They are not willing to take responsibility to supply a concept where people are happy. No, they go back to their corporations, and they still try to get a project at very low price and try to earn some money during the construction-phase.

You could say the kitchen industry escaped the control of the construction sector. What other sectors or clusters are escaping?
You see this with people who make complete facades and roofs and so on, but they are not the builders. That is the supply industry. I believe strongly that innovation has always come for the most part from the supply industry. And there I see more progress than the contractors, but it should be a combination, they are still separated worlds.

(Frans de Vries) Is this because of the big task we face now with redevelopment of all the empty spaces? The structure is still there, the location is good; the structure is there then the façade industry can do it without the contractors, and the infill industry can do it without general contractors.
It has been developed for new buildings. They started thinking, always developing new buildings. If you see during the years, that was all based on new construction together with energy saving and other things. And the flooring industry did a very good job. So you see it is still not combined to one concept every time. There are parts, very important parts, and very important directions, but it is not the breakthrough we had hoped for.

A comprehensive breakthrough
Exactly.

Would you, looking back on Matura, I don't know if you looked at the technical system, the software, etc.
Not all the details, but of course I know the system.

At that time did you identify any technical problems that you thought would make its acceptance in the market difficult?
No, I thought the system was very good. Only what I--at that time--figured out - but I didn't interfere too much - was the additional costs, at that time, were such that you could default. If we could convince the owner of the buildings to pay that price, to say, 'hey, that gives you the maximum flexibility.' This is the same discussion with introducing a couple of years ago by saying we are going to build the "green" house. Not a greenhouse, but the "green" house, which is not using any energy; we can do it technically. We tried to convince our government to come out of this disaster in the building industry by building those houses because there is one law in every country and over all the ages: the housing market is

getting the construction market going; the construction market is getting the general economy going, and if that is failing, we are in trouble. Now we are in trouble, so we as a supply industry, we had to use this type of – we promised in Europe each other that in 2020 we should build this energy-neutral housing, but we do nothing to get there. Well, a little bit. It should be a complete concept, but then the government was looking at this, and didn't accept it. We had a plan that they could finance it through the Value Added Tax. And for the house owner, you could easily calculate the benefits of the extra costs of 13 thousand to 15 thousand euros per house.

You could see the return.
Yes. And with the Matura system, that was my experience, it didn't. They did not succeed in having the good return situation, because there were doubts of the use of the flexibility. Is that necessary? Architects said: "wow," perhaps I don't know the percentage anymore, in a small percentage of the market it is interesting, but not over all.

It's the timeline over which the flexibility is useful. Is it true that a building's stock remains useful for 20 or 30 years before its value declines, and you have to do major turnover. So the flexibility opportunity of Matura, you don't see until 20 years.
That's the problem.

Okay, there's another question. Because the output from Breda was very few units per year, the calculations were to increase the output by 50, 100, 600 … so, one would think with production increasing, the cost per unit would go down and then come into balance with the conventional, but that wasn't convincing? ERA wasn't able to …
ERA couldn't provide me the figures to prove it

What could ERA have done to prove it to you? What kind of proof would you accept? Because who can see 20 years in the future?
Yes…I also doubted if ERA was big enough to develop the necessary number of houses needed for the successful introduction of the system. Big numbers of housing and ownership in our country is the task of housing corporations. There you can make your numbers, and then you can make it. And course there was resistance, and still I see that. We do a lot of those renovations, but it is so seldom they change the total layout of the floor plan. They make it available with more than materials installed and outlook and a little bit room changing, and that's it. Let's not forget that in the '60s, we built a lot of those apartments, but they had – this was prescribed by the government - but they had one big advantage with very big living rooms, a living room that is still today very, very desirable. And of course the kitchen will be open or closed, but the place is unchanged, it's no problem ERA turned more to not only to renovate the buildings (houses) but to renovate the total area, including the street; they were successful at that. They had a little bit another direction, and I think they lost a little bit their interest in Matura because they didn't come any more.

It seems to me that a comprehensive solution such as Matura is always going to cost more at the beginning. First costs are going to be higher … it's so difficult to get the first costs down because so many other parties are fighting you. Are you saying that comprehensive solutions cannot succeed?
Oh, no, they can, because I did some of them, and you take into consideration that we had a lot of companies and we had a very good income that you can afford to have some of those developments that are going to cost money in the first five years. We did it, as an example, we developed the first

housing for older people who could need some help in the house after a while, not at the moment. And that has cost us a lot of money five years on, but then it was a success.

Was that a transformation of the industry? Matura was proposing a radical transformation. The success you found over five years in housing for the elderly was different.
I could do that still with normal ways of building. That was not a breakthrough in a construction concept. We made a complete concept as a project including parking, safety, and everything, but from the point of view of construction of the building, it could be done in an old-fashioned way.

So, thinking over the last 50 years in the U.S., Britain, Germany, in the Netherlands, in Scandinavia there have been published initiatives that claimed radical transformation of the old ways. They're all in the history books. None of them are in the market continually, so is it telling us something?
Yes, I think perhaps you and everybody has tried too much to do it from a construction point of view; perhaps we have more success if we do it from an installation point of view, because the "installations" are still growing.

By 'installation' you mean pipes and wires?
The wiring, the ICT, everything … and that is making so much progress. The younger generation, I didn't succeed with the older generation, but now they learned, and there the demand from the user is I think more available than before; they want to be free in having all kinds of communications everywhere, and that in the old system is completely inflexible. Now they try to correct it with cables and corrective devices. I thought perhaps that was a better introduction to the market, hey, flexibility is not so much that you can put your toilets or your kitchen everywhere you want it after a while, no, you can live the way you want with all access for your systems and apparatus everywhere in the house.

But that in my opinion doesn't constitute a comprehensive overhaul of the building process. It's just fiddling with one little subsystem, making it more consumer-oriented, but what you spoke of earlier, you said the construction industry is living 30 years ago, and you wanted a real transformation. Maybe that is not possible.
If you look now at offices with the so-called computer floor; they know they have to switch. They know when they started in that office with some bare desks that will not stay that long.

So something happened in the retail and office markets that didn't happen in the housing market. Why?
I think, as I said, solutions are available for individuals in housing to overcome this problem because they have a personal problem. They all have too few connections to be made.

But something about the nature of the office market, the supply/demand communication, the size of the parties involved, and in the retail shopping centers, and now in hospitals even—I'm doing work in flexible hospitals for the U.S. government—the clients are so big, they can make things happen, and unlock the knots that were previously there. So in the housing market, the end user is a family of a husband, a wife, and two children. In aggregate, they have power, but they're never aggregated.
Exactly, I see in the corporations sadly enough, a reverse movement. We had concepts there for renovations, and nowadays because of cost reduction, because of huge problems with our government they are down to the silly work of repairing single defects. We had good contacts for years with the big corporations in the neighborhood of Amsterdam. You have thousands of houses, ten thousand, will last for the next five years, during this contract, we take care of that, we do everything to keep the house in good shape. But now the corporations are going back into the system. They just answer calls from the

people, and they ask, "hey, what is failing today?" They go make a repair. So they go backwards. It's terrible.

Do you think the hubris, the belief, that the building industry needs to be transformed is a product of this generation of people, and today nobody is worrying about that anymore. Maybe the idea that the building industry needs transformation in some important way, that came out of your generation, my generation, Frans … Age … John. Is there another generation of people in their 40s, 30s, seriously involved in the industry who also believe transformation is needed?
They do. In the bigger companies, which are on the stock market, they don't get the opportunity now because they are all trying to survive the next quarter again through cost-savings. But by cost saving we can never have a good future. We have to control costs but at the same time we must invest in innovation. In a family-owned company where I am president of the supervisory board, we developed a special concept for housing for students. We did the same now for older people and so on. It is ready. It is fixed. We started years and years ago to make building components in one big factory. It's not the brick anymore, but building components. As a kitchen is a component, as a bathroom is a component. That size. They are prefabricated. They go to the building site for assembly.

When you were training and beginning your career, were your senior people to whom you reported also, among them, were there people interested in the transformation of the building industry?
No. Not at all

I'm wondering if the idea that the industry needs transformation is a rather modern, a 20th century dream? Your predecessors were just happily making money …
But then they went into this discussion we mentioned before about competition, the rules of competition. And after that, they had to do something different. That is why: It is something they HAD to do to show they learned from their past, but they were not really willing. It is not a belief.

I'm watching open building developments all over the world, and I'm seeing that the energy to change the industry is coming from strange places, and not from the supply side generally. That those of us – I'm an architect, builder, supply – the real changes are happening not from our initiative … but from some other places.
Yes, yes, if you don't change in one sense, the housing of the future is coming from the airplane industry or the ship building industry or something like that.

Or Amazon. Then we'll serve that, but …
But only I think if the pressure from the USER of the house (the individual, the consumer) is high enough.

Well, Franz is part of a discussion group with bankers that looks very interesting. They're seeing something.
That is necessary because we have a huge task in renovation for housing, offices, industrial buildings etc. We already have the system that you can completely switch the housing interior by another one, as a complete model. We've got that but there is no financing for some; that could be a good initiative. I think the world is changing. That could give them the ultimate situation because it's not coming from the construction market, as I said. It is not coming from the individual house owner as you said because they are not organized together. Of course the wishes are there, but the pressure is not enough. It's not coming from the corporation because we have to solve the problem of the task of the corporation.

There's a financial problem. There are solutions, but our government did not accept them up to now. The European Federation for Living helped us make a combination with Germany and so on with a lot of housing. Because of all the problems we've got in the market, the activities are very low at this time. But the ideas are good. There we developed a complete renovation system for housing. What we do with bathrooms and kitchens, you can put them in, you can do a complete interior; it is technically already possible, of course.

Technically possible
But there we should make the progress with this system as well. Also in the office market, there are so many outdated offices not fit for their use of today and the demand of being flexible in your workplaces with all systems available.

So the big question, though, is how to create demand? That's what we are learning. How is demand created in the building industry?
If we really are going to build those energy-neutral houses, we know you cannot do that simply with just insulation materials. That's not enough. A new concept is necessary including calculations for costs and savings in the future.

The return on investment
These houses are fairly sophisticated, but they do their jobs. They are energy-neutral. We have several projects here in Zeeland. People are willing to have an extra payment of let's say 13 to 15 thousand euros per house – normal houses - because they calculate that is coming back. They can see it.

Yes, it's interesting because this item, the demand was created for the iphone. There's no clear return on investment. So I understand the calculation of return, but it's more complicated than that.
We could combine it with " Domotica" (home automation). More and more, it is from let's say the functioning of the building, more than the construction. That's the way of thinking.

And the problems with Matura, the innovations were invisible and utilitarian. They had no style appeal.
I think it was started too much from technical thinking. It was brilliant, but …

The rest of the calculation still has to be found.
You have to sell the idea. People should believe in the idea.

(Frans de Vries) You're 100 percent right. Nowadays, here is as an example. Gyproc doesn't sell this – they sell solutions.
That is important, but let us be frank, it is only the beginning, it is not a real concept. The problem of Gypro*c* is they can sell in a traditional way.

(Frans de Vries) What the intention is, they sell it for an amount, they sell it not as a product, they sell it as a solution, and the price is per square meter separation wall. And nothing about what this cost, that cost, including electricity, including data…
But still it comes back to the gypsum boards, that's it.

(Frans de Vries) Have you other solutions or suggestions? You are welcome.
No, no, I want to go one step further.

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(Frans de Vries) No, Look at this. We put those in in a trade show China last year
I'm not criticizing, but for a breakthrough, we need more. That's important. … I have to think about it.

It's great to see you continue to dream.
I dream really for a house people enjoy every day. That they have an environment whee they can live and be happy and have everything they want. And in the future, it could be adaptable to their wishes, which are also developing.

And to the demands of society at large
And then they get older, and they have other problems, and they should be solved somehow within the system.

Thank you very much.

MATURA ORAL HISTORY INTERVIEWS
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RENE VAN RIGGELEN

Please share with us your memory of what led to the development of the Matura concept in the beginning? What was happening in the industry that provided what at the time was believed to be an opening? What made you think the time was ready for a comprehensive system like Matura.
I think it was a big dream. It was a vision, and it was an enthusiastic initiative – but I was not there when it was born. I was not involved in it then – but that's how I look at it. So an ambition, it must be the idea of Support and Infill. It must be possible. That was the feeling. I don't know which people were involved in the first idea.

In 1985, when they were beginning the ideas, were you already aware at that time of Habraken's ideas?
Yes, because I was studying in Delft. I studied with Age van Randen as my professor, so I was completely involved in the development of the modular grid, detail development and … changeable components.

You were part of OBOM?
Yes, I worked with OBOM, so I developed conduit solutions, the principles of conduit solutions. That was also my opportunity from that background to become involved in this development, because I was not only a designer who was interested in building components, but also in conduits and conduit systems and infrastructures. It was our thing.

The main points
Yes. In that period, we studied with Age, and others. That's my answer about what led to the development of Matura. It was a dream.

In the industry more broadly were there developments that pointed to the importance of an infill system? Were there other infill system initiatives happening at the same time of which Matura was one?
I think there was. Also this firm (Nijhuis) made infill developments in the years of the big housing, and we felt our own infill was good.

Partitions
Yes, partitions. These were of course not complete solutions for total infill integrated with standards and separation and completely distributed from one factory; that was not available.

No one else was thinking about this?
Only Bruynzeel Inbow infill systems was involved. I came from a development consortium known as Esprit House. Six years working on Esprit - Rens Metz and Harm van Triest. That was not so strong on the total solution for conduits. It was focused on solutions of parts - from separation walls (partitions) as consumer products, from quick-fit connections, connect conduit systems.

Plug and play systems
It was also too much inspired by industrial designers; they were total out of the box thinkers, but I think, maybe not driven in the right way.

You're speaking of Esprit?
Yes. The problem was the complete solution, the total concept idea was not found in Esprit House, not in the way that Matura did. That was the difference, and both developments were very interesting, and

I've learned a lot because we advised in that period all the big industries in consumer products and from Polynorm, Bruynzeel and Sphinx, their head designers, we made product development and feasibility studies and so on.

Okay, so Matura was the only initiative that was so comprehensive. The other ones were all partial bits and pieces but no one had put it all together. Why did the others not put it all together… why was Matura the only one that had the complete picture. For example, Jan van Vonderen was a contractor doing infill jobs, so he would pick from here and here and put it together and deliver it. The idea of a contractor, one contractor, doing the infill, that was not new.
The other infill initiatives were without installations – mainly the pipes. That was the crux. In our culture of building, it's a totally different knowledge with different contractors. And an installation man is not known with the building components. And the building man is not involved in the installations. The two things are quite apart. That was also my opportunity because I was studying installations at OBOM and at Esprit house, so I could go farther with the development of Matura because I have the feeling for conduit development and infrastructures. That was, by the way, I think also the big difficulty, because you had to have the complete knowledge of the complete infill system within a few people. That is amazingly complex.

You mean for the installation people?
No

Or the development
Yes, the development. So the traditional process has a big gap between the two disciplines.

Even in the design phase as well as the product development?
Yes, regular project development, also in this firm (Nijhuis). That's why we educate "integrated designers" in this firm who have the knowledge of the main components of the installations. That's going on here. That's our force to make with one designer a complete technical optimization, and that's why at this time BIM is not coming with the thing resolved because they had also put the different disciplines separated from each other. We can make them integrated. It's more the processing, and the people, and the knowledge, which were leading in this moment for the result.

So the big strength of Matura was the integration of the previously separated knowledge clusters or product responsibilities.
Yes

Could you speak about other strong points of Matura?
It's again the integrated solution. And the opportunity, I think, the very strong idea, the opportunity to make a customized product, a real customized product with support and infill, and you can select and change the infill with every separate client. That was a very interesting idea.

Also the idea of the production of one-by-one?
That was in line when you think about a unique customer, then you produce houses one by one, and that was the very interesting thing. The market was still in the after-days of big production, housing production - even 'til today, this sort of firm here at Nijhuis that is a specialist in housing. We are specialists in housing, are still leaning on the same housing project. Searching to do the same housing in

a project and even we have the designers to make them one by one … so, it takes a long time to change the culture. It took a generation or 15 years.

And still not changed, huh?
And still not completely changed.

Those are the strong points; what are the weak points of Matura?
I think a few very heavy weak points… I think first was the fact that the 60 by 60 matrix tile element needed a completely flat floor. It was a big problem in all of the projects we had to manage. It was very hard polystyrene.

How did you solve the problem?
There was no solution. We can bring the specification of the floor leveling to the highest standard, and we did it with instructions to the builder of the support, but they make a mess of it. I mean, sometimes it went reasonably well, and sometimes it was a mess.

They didn't understand. And in the renovation projects like Voorburg, it was very rough?
The problem was it had to be very well leveled, and that was a problem. I think maybe we could help to realize it when we were going to co-making firms - how we do it today with our Trento concept - if you can intensify the development with co-making firms to realize a very flat floor system.

So early in the development of Matura, was that problem recognized?
No, I think not enough. I think in the whole period, the dream was probably more important than the real consequence of implementation. That's a feeling I have.

What are some other technical difficulties, or other kind of problems?
The problem with the leveling gave problems with the construction of the infill floor, and it was directly found again in the two-10 mm Fermacell layers laid on top, because it was a very hard (rigid) element, could not bend, and it hds to be somewhat flexible which it wasn't, and also the seams overlap.

I helped to install the first Voorburg, so I remember.
You know the concept. That was indirectly the problem of the not-flat support floor. There was another problem that it cost a lot of work to put the two Fermacell layers on top of the matrix tiles. You need a lot of hours to cut them to the correct sizes and fasten them.

Cutting and …
Yes, cutting. I saw it in projects later on, that every development that was depending on solutions like this to make floors with an underlayment or panels - together or not - was every time a problem in the hours you need to install it. It was not only to make it in the right shapes, but also the conduits and pipes and ducts that came up though it…to measure and make holes consumed a lot of time. It was a difficult solution because you make a completely new floor, and you had to put it down, to walk on it. Again, to another solution, I saw a wet product to make the top layer… with a wet product, you pump it in, it spreads over the floor, and it's ready. You make a thousand meters a day. It makes a very interesting coupling. What happened to later developments on this point? I think the electric conducts and the placement through the system with the conduits remained a problem.

You mean in the base profile?
And wires under the door…that was a permanent problem. It was a big problem and became bigger at the point where all the cables came to the circuit breaker. Too many cables together would not fit in the base profile or in the under-door channel.

Also the pipes were a big problem at the central utility closet, right?
Not so big. That was possible, I have a point for it, but the electrical was a real problem.

Because always there is one circuit breaker panel from which …
All the cables must be spread out in the house, but where they came together … our design software program was not making a calculation of the space they needed together at the worst point. I think you, maybe you, for everything there's a solution, right, but on this point maybe we need such a solution that the design program alerts us with warning symbol: at that point, too many cables! You have a problem - you have to reroute them!

What about under the door, was it too full of wires sometimes?
That depends on the place in the house.

The closer the door to the main circuit breaker panel, the more problems
Yes…near the circuit breaker panel, the partition walls were shorter, and there were more corners, because the circuit breaker is close to the entrance of the house.

Smaller spaces
There were not problems in the living room. There was space enough. But where it concentrated …

Turning the corners …
Yes. There was another issue. Today we cannot install water pipes and the heating pipes next to each other because of Legionnaires disease. We have very strong regulation on that point. It's a real problem to make houses in these days based on this regulation. We have real problems with it.

Is it only the crossing of the cold and warm?
There are separation regulations: 30-40 centimeters between heating lines and domestic water pipes. They can't even cross. Even the distance between them is regulated. So you can't distribute all of the piping from one central distribution point any longer.

If there's good insulation between, pipes could be closer.
No. That is a problem. Those days, it was not an issue. Later on it became very important. And then the price, the money, I think we sold the complete infill for 30,000 guilders at that time. I remember one of our last projects with this firm that helped to build with her own people in our projects … people from this firm (Nijhuis) worked in Matura projects. We were in discussions in the selling process with Nijhuis for Matura, and at that time, he was also a real housing expert, and he told us that the traditional cost of an infill in new housing was about 20,000 guilders.

That's total cost, labor, material, time and management?
Yes

MATURA ORAL HISTORY INTERVIEWS
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There were lots of studies and calculations about it.
Oh, yes, it was never-ending. Karel Dekker made many studies, and we made them, and it was always the fight with the support builder to get money out of the support into the infill.

Yes, what is their advantage to do it?
They don't want to give away their advantage.

Exactly
We (Matura) were too small, too little power, to bump these big firms. They were on a traditional way to buy it for the lowest price. We were no party to force them. In the renovation projects like Voorburg, where we would do one dwelling unit at a time, we had to compare Matura with traditional one by one solutions, and then Matura is advanced because nobody does it. It was only possible with this kind of a system to successfully do a one by one process. There was the advantage. And in other projects, in Sleeuwijk we had a lot of discussions with Stam and we said if you have a support without installations, you can do it faster and cheaper, your planning will be different, etc. with Matura. It was a difficult discussion, always.

Why did potential investors decide not to invest? Were you aware of the discussions with Jansen and de Jong and TBI for example?
Not directly. It was not my first responsibility. I was at Matura for process and product development. I have maybe a few points about it. It's again the price, and I think the trust in the solution. Maybe. I don't know, we never asked them back what the problems directly were. I think the biggest problem was the price.

Was the price projected to decrease with greater production?
Of course, but we had no scale in Breda. No scale, no volume, no big factory. We had a very small factory and a very small crew.

In your estimation, if the production had increased, would the price come down?
Of course

So the price wasn't inherent in the technical solution …
Of course it will be okay for the components you buy from the supply industries, but the factory work on the place, no.

That doesn't go down?
No. It may be when we can deliver the panels, precut, and with holes, we came to a higher speed. We measured the time. It took ten days and three people. It was 720 hours to install.

What problems came with the development of the software? How did that work?
I think there were no big problems with the software development. That was not the biggest problem. It was a very high level of integrated information within the four dimension data base … I remember because that's still one of the most inspiring aspects from the total integration from the design product and the specifications, the elements, and the hierarchy of the groups of materials and groups and to put them in the design program.

That was fine?
That was. It was very advanced for that time. We now come in the possibility to create with the BIM solution the same as possibility, but that is 15 years later.

What were some of the key turning points along the path?
I will talk about the period during which I was connected. Which I think was from 1992 to 1998. I began with Matura Nederlands. I think we worked with it four years, I don't exactly remember. I remember the big problems with investors; the talk about contracts between Jansen and deJong and Matura Nederlands and Infill Systems. I remember it always as a big problem. Every time.

How did that affect your job?
Not very much, because I concentrated on the technical developments

It was in the background, but you focused on getting the product out the door?
Yes. In that period, this was the subject of a great deal of discussion. The next point was from Matura Nederlands to Matura Infill, the period that Jenssen and deJong ended their involvement and stopped their investment.

And Steinke came?
Yes

Matura Inbouw
Matura Inbow and we had also Ager Holding. He was also investing in the development. You don't know?

Which one was that?
Ager Holding

When was that? Do you remember? A Dutch investor?
Yes, a Dutch investor who was found by Steinke or Steinke and me together, I don't remember, but Steinke was not able to invest on his own, and so we needed more.

There were difficulties, technical problems, but no technical changes were made to the system?
Not fundamentally. No. We tried to do it every time better and learn from the last project, and make new specification to inform the builder of the support to make a better support, and we redesigned the products with Age involved, and so on. There were not, in my remembrance, any fundamental changes.

What about the problem of finding buyers; finding a demand for Matura? How did you go about advertising, marketing, creating a demand?
It was not in my responsibility.

Who had responsibility for that?
Toon Huijps. He was director of Matura Nederland. In the second part, I was responsible for the whole company, but, yes, it was with too few people and too much work …

You had you and Louise, right?
Yes. In the last days, we had about eight or ten people on the payroll, but it was, I think, one of the

overall problems. It was a too ambitious project for too few people and too little money. There were not really big investors from industrial backgrounds to support the development of the system. I think, at the end, the way was too long for those small investors. They could not support the development year after year. That's what happened.

So now in remembering, if more money had been available to invest, and you had a bigger staff, then success would be possible? Or do you think there's something so fundamentally wrong … the market did not want Matura?
When I see it nowadays, and when I look to renovation, I still think the most important clients came not farther than considering parts of the infill to make them in a new quality, and the rest of the house is what it is, and they do nothing with it. For these days, the main reason to renovate is to make a better support, to improve energy efficiency. That's the main reason for renovation today.

Not the infill?
Well, yes, also the infill… last week on a big project, we do 50 percent in renovation and 50 percent in new housing, all housing: Euro 100 million we do in both. There was a project where the complete infill is making too high a level, the bathroom, the toilet, the kitchen, and the heating. And so that would be a project to set it in, but when I see to the investment levels and when I try to take the thinking through from Matura to this day … it's not easy to make the right conclusion on this day.

It's still too comprehensive?
Yes, I don't see solutions in the Matura way of thinking to this day that are successful in this sort of market.

How about the new requirements for acoustical isolation between floors?
No issue. They don't talk about it. I mean in 80 percent of the big production. It's not an issue. The driving factor is the skill and the energy efficiency, also ventilation is changed from natural to mechanical. Those are the basic points for the process.

What about the installation entanglement and the problems of replacing installations in the current renovation jobs? Is that not a big issue?
Of course, that's a big issue. It's a real big problem, I think.

So the matrix tile is not quite the right solution, still, for those problems?
It's coming from the fact that you make a whole house empty and put in it one system, one solution, completely in the entire house, and that's the question. Is the step to make it completely empty really necessary? Because there are also problems with the removal and disposal of the old parts which came out of the house. That is also a very important aspect of renovation, right? How many materials can I bring again in the surroundings or is it better to let it stay in the house? There are many aspects in this sort of renovation project.

So cleaning out the whole space turns out to be a nice idea but not so easy to do?
I don't see it in these days in the market. And I don't see it in the projects, and we do 50 million euro in renovation from big flats to little houses; and I see especially the aspect of energy saving, but second the infill, but they do it always piece by piece, or they do it to get 70 percent majority from the people in the project because the law is in the Netherlands, you're told you need 70 percent majority of the occupants

for the support renovation. Therefore the corporations will set in a better bathroom or a better kitchen, and when they are okay, well, we install one kitchen, you have my rent, go.

In the project in Voorburg, they said that 70 percent agreement was needed to upgrade the support but infill orders are individual by each family, one by one.
It was a good solution but not everyone's doing it. You also see that the building corporations have big problems with their money streams in those days, so the level of investment in a house is lower. Big firms say 70 thousand euros, that's absolutely the maximum for a complete renovation per house, but yet we see it's actually less and less.

Do you have additional comments to make about your experience and your memories, evaluations, any other things?
I think I've said the most important things.

After Voorburg, there were other deliveries of Matura to other projects?
Sleeuwijk was the last project. Fourteen houses. That was in 1997. It was also for me a very fine learning period, a very interesting period. I always said to Nijhuis, I learned so much from the first period from Matura, thinking in concepts of how to develop a solution, to repeat solutions, and the inspiration of the 4D dimension database, the integrated design. I developed myself the integrated design starting point for the 4D dimension database … there was always design in front needed to design the conduits in the complete building. I designed the complete vertical installation and that was the starting point for the infill system because there were two design routes - to make the complete connection and the specifications on connecting points to design the infill, and I was specialized in the big lines of the infill and the right specification to put on the conduits and specifications to the support. That was my work, and then it came to Louise, and she made a database design for the complete infill within the space.

I would say this that it was a very inspiring time. Repeatable solutions, that was the main thing and integrated design was a very important thing I brought from that time to Nijhuis.

Also the multi-skilled installation team concept
Of course, because we educate people who are educated in conduit design, in building design, integrated thinking.

What about the containerized delivery from the distribution center to the building site?
No, because Nijhuis does not work with a distribution center. We have no infill solution. But it is not completely traditional. It's based on the VBI FlexCasco floor system. We build houses with the concrete floor… but we had the possibility to make installation channels on the upper layer of the Flexcasco floor. Our TRENTO production is made with this floor, and I think when you see the production facility, you can imagine what the power of that product is. The power in price and prestige is very high level. And a problem for the regular support contractor is that he had not his own capacity to design together the conduits and the way the conduits would go. We did.

And you use that in the entire floors of the houses you deliver?
Yes, for the housing on the ground level and the apartments. It's very economical.

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

How long have you been using it?
Ten years. We take the best of industrial products and put them together, and we can design them as a complete solution.

Very interesting.
There is a solution to reorganize the complete infill to fill the channels with sand.

Not liquid concrete?
No, with sand to allow access for the future; with a normal concrete floor on top.

Easy to take up
Not in the way of Matura. But it's maybe the best of two worlds.

I understand. It's better than the alternative.
We can sell it. We can sell it very well, and that's what's most important for the firm.

Rene, you are specialist in housing; are you also building office buildings?
No, not yet.

The reason I ask is that empty office buildings can change to housing.
Just 10 percent of the offices are in market for housing. 90 percent are not … I'm not a specialist about this. But when it's on our sights, and we can take it, because we know a lot from building housing and apartments and infill and installation, and we can make integrated design. When it's housing, it's our business. When it's an office, okay, maybe also?

Thank you very much.

MATURA ORAL HISTORY INTERVIEWS
Interviewers: Mieke Oostra and Frans de Vries in December 2014 (questions in red)

LOUISE CROYMANS AND AREND VAN RANDEN

Thank you for agreeing to do this interview. How did you get involved at Matura?
Louise: I wanted to work as a practical interior designer and was seeking an opportunity via a technical employment agency. Age van Randen was looking for an employee via that agency. So I started in 1991 at the Matura location in Delft. I continued working for them when the company moved to another office in Delft. I didn't know Matura before my first meeting with Age. I continued working at Matura until the end of the business. First I worked via the employment agency, later via Matura and even later as a freelancer.

We made the first 1:1 scale models with Age in his workshop. These were the first Matura models, including the tiles. We completed it with the water tubes, cables for electricity, drainage, floor covering and the carpeting. We also made models with details like inner walls, wall liners, connecting façade, base profiles and base boards.
Our office was situated at the Buitenwatersloot, where Wouter Habraken was also working. He was making a kind of basic version of, in his words, Matura Cads. In that time we have made practically all the details. I don't exactly remember when we moved from the Sadatweg in Delft to Breda. All the models were made and the preparations for the dwellings were done. We had been working on the system all the time. I was also involved with the tests regarding the horizontal sewerage at the TU Delft.

I also participated in fire tests and sandbag tests. We were convinced that our system worked, but at the fire test of the Faay partition walls (a flax wall, finished with plaster), the fire spread very fast. The wall passed the test, but I should not allow it.
I don't know a lot about the cooperation with Janssen and De Jong. I was working with the customers and the content.

Do you remember the early test houses?
Jan van Vonderen bought the first test house for n installation in Bergeijk. This dwelling was almost ready when we installed our first Matura kit. We ignored all the conduits, poured into the dwelling's concrete floors and walls. The second test dwelling was situated in Eindhoven. We also made a test dwelling in Voorburg. The girl that was going to live there showed her home to a lot of interested people, especially the technical solutions like the ones in the utility / meter closets. The interested people could not handle all the choices. I had to help them with, for example, arranging the kitchen layout. In the end they chose the traditional layout, except for the sink. In that time we were already designing with a computer, but we also had to do a lot of measuring on the site.
A grid of 10cm by 10cm had to be laid out first on the floor. The best starting point was at the place where the drains came together. On this drawing you see what happened to the dwelling layout. The toilet was at a fixed point directly at the soil pipe. The drain of the toilet could not be moved within the size of the tiles. For this reason the system was unfortunately not 100% flexible.

What about the computer program?
Louise: Wouter made a computer program. He went back to the United States at some point. Arend was his replacement. He was still studying Logistics. He did all the programming of MaturaCads again.

Arend: For example, pieces of sewer pipe had to be sawed in perfect pieces in the factory. But how did we manage this? We had a label for only that little pipe with the size in millimeters and a fitting

dimension. It was fun when you drew it just so that a label was produced automatically with stickers, for labeling the pipes in the factory.
Louise: For the other dwelling we did the same, except for a couple of things. For every dwelling everything was tailor-made. It was produced in the factory, which was very fast.

Arend: We sat down with the customers and drew everything via the computer program Cads System. The toilet here, this there, that here…. The program automatically said: "attention, a drain has to come here".

Louise: We didn't draw it. We drew a line and there was a drain with a pipe and a fitting. With Age we sorted out how far the pipes had to go into the fittings. This is important for MaturaCads (the stability of the sizes in the system).

Louise: For example, the doors of Berkvens - we had to know in every detail how far the hinges were situated in the door. How far the door opens. We had to know this because of the space of the baseboard. So we had to buy a door and measure it. We had to do the same with all the drain pieces, like Dyka. Measuring everything. Because of the change of the material, from PVC to polypropylene, we had to measure everything again.

Arend: At the end of every dwelling we reflected and learned why the cutting of parts in the dwelling was important. But cutting was forbidden in the dwelling. If it happened, something was wrong. If an error was detected, the computer program was modified. In that time we spent a lot of money on promotion videos. In one video a mechanic was using a hammer and saw. But that was not allowed at all.

Arend: We showed too much to the customers. Then you see the big gap in knowledge between Matura and the customers. Matura has tried to sell the system instead of the dwelling.

Louise: I tell the people what is in their floors. But you don't have to bother people with that. In Voorburg, the people were not interested in all the possibilities of the layout and finishing of their dwellings. They were only interested in some of the finishes, like the kitchen and the sanitary space and equipment. They said: 'this is good, let's do that.' They hadn't chosen anything, but also didn't want to choose. But one time, a customer gave us a sketch of his vision of the layout of his house. It showed a few sharp edges and in the bedroom, the bed almost didn't fit in. We advised him to get a layout where at least a bed could fit in the bedroom. He was the only customer that had his own opinion. Arend: In that time, and even now, you see that if the design of the builder is pretty good, the customer chooses that. People are easily enthusiastic. They don't want to think about possible variation in the layout. "We want the standard." The choice of nice tiles is important, but has to be limited. Otherwise it is too difficult. Nothing has changed even now.

Louise: We want to buy an apartment in Rotterdam now. The layout and finishing can be varied. We are really curious if the other buyers are going to make their own design or are buying the standard (what is offered by the developer).

Arend: If the design is bad, there will be a lot of changes by the customers. If the design is good, there will not be any changes.

How many different floor tiles can they choose from?
Arend/Louise: Three basic and one more expensive. The expensive one has never been used.

MATURA ORAL HISTORY INTERVIEWS
Interviewers: Mieke Oostra and Frans de Vries in December 2014 (questions in red)

Arend: Louise was just very good in making the designs for Matura.

Louise: The profession of advising customers with their interior design was an unknown profession. But that was my job. At the office I had a room equipped with all the choices. Later on, I was doing that even more. I started to work for my own. I wanted to receive bigger assignments, including furniture and more artistry.

Why was it not possible to create a market for Matura? Was too much focus on the traditional parties in the construction sector instead of the customers?
Arend: It was not clear to whom we had to sell our products. Still, it's not clear who we have to contact in the construction sector. The architect? No. The customers are also not interested. The construction company Wessels came with the promise: we are going to use separation of support and installation. We will build the house for the housing association; Matura will install the house. But they told the housing association that they were doing it all; building the house and the installation. Matura is too small for that. The separation of the building and the installation is not suitable for the contractor. The innovation is not noticeable. All this arguing, the residents don't notice. But one time, it went differently, in Voorburg. Matura sold the installation kits directly to a renter. He was going on vacation for four weeks. The installation was done when he came back, and he paid all the extra costs.

You have to oversee the building sector; who is in charge. It is a complex sector. Everyone has to get an advantage. At the project in The Hague, the main contractor backstabbed us, giving us the death-blow. There was enthusiasm that we called 'cooperation'. Everything had to be made for 7 million. The price for Matura was 2.5 million. We asked the main contractor the price for the complete support without any conduits. The price was 5 million. We asked how they got to 5 million. The answer was: we used a traditional calculation method and removed the installations. But that is a wrong approximation. For example, all the overhead costs still existed. They didn't dare to make an honest calculation. The main constructor offered the client to build the whole project, traditionally, for 7 million.

In that project, a base building without installation was possible for less than 4.5 million. But the main constructor wanted more work. Maybe we had to intervene in the building sector. Offer our services plus the building to a corporation. That is what we should have done.

Louise: I really thought, let us build that building.

Arend: It's always the same story. Constructors want their projects with installations, because that gives more sales volume. There is a lot of politics in the sector. We didn't know to whom we had to sell our solutions. Age wanted to buy a whole flat, but then you are acting like a developer. That is not what we are specialized in.

Who was first at Matura: Wouter or Arend?
Louise: Wouter was the first one at Matura. Arend was his successor. They didn't really cooperate. Arend started from scratch with the program, and did nothing with MaturaCards from Wouter. Maybe that was why they didn't cooperate. Arend started after the cooperation with Janssen and De Jong and he started with the last phase of his study.

Arend: I did a lot of programming work, but I didn't stay until the end. I stopped when I could start my own business and Matura was one of my clients.

MATURA ORAL HISTORY INTERVIEWS

Interviewers: Mieke Oostra and Frans de Vries in December 2014 (questions in red)

In the system of approaching clients a lot of improvements have been introduced. Could it be better?

Louise: Clients didn't fit; the freedom of choice was too big for them. It was not a good target. We also couldn't show the model, only the interior. For the average customer it was hard to understand. Doors, heat recovery, etc. What is it? And how, they didn't know.

Thank you very much

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

WOUTER HABRAKEN

The assumption here is that we can learn from the experience of Matura, its conception, its business model, financing, management, its place in the history of innovation, and so on. How can we build on and advance the principles and goals of future endeavors and avoid the difficulties faced in the Matura effort? What general lessons for open building implementation can be found in the Matura experience?

When did you come into the story?
I got involved because I was working for Jan von Vonderen's company. Von Vonderen had a company doing drywall systems. He would do very large projects, renovation projects, projects like large hospitals. He also had a group that cleaned rooms. One of the problems they had was how do you know you're quoting a project correctly, and how do you know that a project is on budget? As you know I was doing design specification work before that. I was developing software and I'd written some papers in that area—what I developed for them was a data-base system that allowed them to take graphical information - because basically when they are asked for a quote, they get architects' drawings and they turn that into numbers – so the data-base system would allow them to specify the materials in a way that throughout the process, you could track it, and people could understand what it was. I'd been doing that for quite a while for him, and the Matura concept was essentially very simple; the idea was to basically ship a container of materials to the site and then be able to install everything … so the idea was that the work I'd done for Jan would be applied to the Matura system. That we'd build a data-driven system to basically manage the specification process and the inventory process.

How long had you worked with Jan?
It's a long time ago … I think several years at the time.

When van Vonderen became part of the initial group, you were already at that time aware of the Matura initiative, and of course, knew what was being developed?
As I recall … his (van Vonderen's) daughter had already taken over management of their company – Connie - although Jan was still involved at that time. On a day-today basis, I was working with Connie and her team. I don't really recall how the process was going. It has a fair period of gestation before things got started.

Were you then part of the early discussion about how to get Matura moving?
Of course I dealt with John on these issues, because John and I shared the work on the Matura specifications. But again, this was very much an informal process until it became a serious venture.

Did you personally have a sense that where they were headed made sense at that time in the Dutch context?
Yes, I thought there was a real opportunity there, but I think that in the end, the way I conceived the opportunity was perhaps different. It was a business opportunity. One of the problems you have in building systems is you cannot sub-optimize individual systems, especially in an environment like the Netherlands which is quite advanced - where you know it's very difficult to change the system overall. So to introduce a complete infill system from that perspective makes a lot of sense because it eliminates a lot of the dependencies and allows you to capture the value across the whole system. That's what appealed to me about it.

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

Was that discussion … was your point of view mirrored in the discussions that were occurring among the partners and the investors?
Yeah, I think they would all talk about it in that way.

It was a business opportunity that couldn't be accomplished by picking the parts; you had to really do something comprehensive?
Yeah, the idea that the infill as a whole should be addressed

Did you know of other software developments at the time that were available to help make this kind of thing work?
I think maybe now is a good time to discuss the time that the concept, the Matura concept, changed dramatically from the beginning to the end. The beginning concept was you have these materials, you have a very simple and straightforward methodology, and you get them to the site, and you put them in place, and then you have people finishing them off. The concept is of course you don't know what the situation is in detail … let's say that you're in a renovation environment, but even in a newly built shell, you don't know what the actual dimensions are until you're on site. So the concept was you deal with the things that you can control in a systemic way and the initial concept was going back to the SAR ideas of having a grid, with fitting sizes, plus or minus to a 10 cm grid, if you left the system for the pipes, they have to be set back a certain amount, we know exactly what that amount is, so we have fitting sizes for these, so if you want to have the specification information, what you need is the number of parts and their dimensions. These dimensions and numbers flow directly from the gird. If you have a grid of 20cm by 20cm and you have a starting point and an ending point, you know what is required for these pipes. Anywhere those pipes meet …

"Out-of-system" parts
Out of system, was out of scope, and the idea was also … you have the right materials, but how you implement them on site is quite flexible. If you go from point A to point B on a grid, there's any number of ways you can get there. So that is how it started, and so the approach of a database-driven system made perfect sense there because the graphic interface … the architects and designers are in love with drawings, but it's hard to get quantitative information out of drawings. At a level of abstraction, it makes sense to people who actually use that information. Sure, you can go to the AutoCAD and draw something, and you can get the fact that you have so many square inches or feet or so many cubic centimeters … that information is useful as a high-level estimate, but for a production specification perspective, it's useless. So the original concept was one where you were basically assembling a list of materials and you could do that because you had the grid and the fitting sizes, you could do that in a graphical way. Where we ended up in the end was the idea that you had to eliminate any on-site activities. We were going to bring in a laser devise that was going to measure the exact dimensions of the building, and then you would just put it in the computer, and the computer would solve the problem. Now the interesting thing of course is that if that is possible, then you really don't need the infill system as it was conceived. Right?

Explain that a little bit more.
I'm maybe overstating the case, but the whole point of the infill system as conceived was that you had all these different zones and levels where the systems wouldn't interfere with each other, and therefore, you didn't care where the elements were, as long as they were on the right plane, right? That's the whole basic concept of Matura; you have these different zones, vertically or horizontal zones, so you don't really need to know where things go exactly. That was the original concept. Where we

ended up--and this is where the opinions differed and this is where I differed with Age is that with Age, as things went along, he got into more and more and more details and wanted to specify more details and everything needed to be controlled, everything needed to be defined ahead of time, and in the end that's not something the system was capable of doing since it wasn't conceived ahead of time that way, and in the end, what he wanted was we're just going to solve the problem with the computer. And of course there was no budget for that at all. So, in order to do something like that, you would have to actually have a team of computer software developers and you would need to do things that there was no budget for, and also it didn't make any sense from a … to me, it was repudiating the original concept, right? So when you think about the Matura system, and I think this is an important point, the logistical aspects of it were secondary, right? Basically you could send a bunch of containers without doing any of the logistic analysis, and just have people go in and grab the materials they need and go upstairs and cut them to size and put them down, and you would achieve a very large percentage of the value of the system that you would otherwise get, and you would be able to benefit from a lot of the positive building traditions. You can get very competent people. You can train them. So that's kind of where we ended up. The difference from the beginning to the end changed dramatically, and, therefore, my role at the company of course changed dramatically.

It's a point of view that has not surfaced in the discussions so far. The starting point and where the project ended … you characterize it as being quite a shift, and that …
It was a shift, right. It is a classic start-up mistake, you know. You have the old software development methodologies that are called waterfall methodologies. No one develops software that way anymore. Right now, if you're not doing incremental development, then no one really takes you seriously, which in certain areas of software is unfair. But that is also a reflection of a start-up methodology, business methodology, that has been extremely effective, and it was completely ignored by the Matura group to the extent they were even made aware of it.

A process of incremental adjustments…that was ignored?
Yes. Age was already 10 years down the road in terms of the kind of developments he was doing and the improvements he was doing to the system when the first phase had not been proven or tested out at all.

And that's a typical start-up …
Yeah its typical when you have engineering-driven, technology-driven founders. The whole bootstrap thing—if you look at what's going on—it's all about taking very technically literate people and teaching them some basic business methodologies so that they don't destroy their own company.

I think I'm not fully getting the picture.
There's another thing that was happening at the time. This whole idea of disruptive technologies, which is a business concept and popularized by some business gurus, and it was all happening at that same time, that you can take new technologies and address business issues. That is very much the perspective that I had on this thing; that you have a system of doing business in the building industry that is ripe for change, because it doesn't meet the larger goals and objectives, and so the business challenge then is to find a way that you can get into the business and take technologies and take the business value of those technologies. So let me give a specific. If you look at the infill system, what are the benefits, right? What are the benefits of that? Karel Dekker of course did a lot of the calculations on this. He did it very much from the perspective of the existing clients being housing corporations, large developers … and to his credit, even in that client system, it makes sense. The benefits are number one, you can meet requirements from the customer in a very short time frame, so if you want your custom house, it doesn't need to take two years, it can take as little as three months or two months or even six weeks.

That is a tremendous value to the end customer, except that the end customer has absolutely no say in the Dutch building process, so in order to realize that value, you have to have a different business approach. The second aspect that is related is the time value of money, and from a support or base building perspective, it is the fact that you can optimize the revenue from individual units, so if you have 50 units, then you don't have to choose the lowest common denominator. You have to choose the highest common denominator. The lowest common denominator is easy to sell, but you leave a lot of money on the table, and to be specific, what I mean with that is adding value in terms of upgrades, in terms of fancier features, and just addressing the requirements of the people who will live there. In Holland, basically even if you get a new house, you move in, you rip everything out, because the wallpaper is terrible, if there's some finishes on the floor, it's awful, the toilet, everything else, it's just really bad. So what you do is you literally rip it out and you find someone from Poland or you go to the local home project center… and you spend a lot of money. And of course a lot of the money could be captured in the building process. You could do that if you get the highest common denominator, you have a sales and marketing issue, which again in the Netherlands because they're strict with houses so that's a huge cost.

A huge cost?

It's a huge cost, yes. In the United States it's a huge cost. Finding the right buyer for your house that you're building as a developer, it's a very high cost. So that's the problem you're addressing, right? And so then the key is to build a company that is able to go after that in a way that understands what the goals are and understands the value. The opportunity is that value. From a business perspective, if you can capture the additional money the consumer is willing to pay for their house, if you can capture the financial advantages of not having to put an enormous amount of capital into a building over a period of two to three years until you sell it … that's risk capital. It's very expensive money. Then you have a business. On the other side of that of course is your cost structure which from a materials perspective Matura looked at in detail and often went for more expensive materials; and then there's the cost structure of not being able to benefit from the system as it exists which means you are selling a different product into a new market that doesn't quite exist yet.

Those were the real problems that needed to be solved. But if you look at how the Matura Company was set up and how it was structured, those problems were not actually recognized or dealt with in the beginning. The company was set up as Matura International. It was going to develop intellectual property and license it on a country-by- country basis, because the recognition was that building systems were different in different places. It was an intellectual orientation, an intellectual property orientation, an IP orientation except that the IP was patents and high-level abstraction. The kind of people that on a country by country basis who might be able to take advantage of that, there's a huge gap, right? And so Matura the Netherlands was really the start up. It was really the start up.

In Breda

In Breda where the real work was done. But it wasn't set up as a startup. There were the kind of things you need to have a successful startup—and there's any number of books you can buy at your local store that will have different views on them—but there was no entrepreneurial team. The team was led by technologists. Day to day decisions were taken -- and technologists who didn't have a commercial background but were professors at the university where you told students what to do, and they did them, and you didn't get talk-back. There was no marketing to speak of. They hired a sales guy. You don't hire a sales guy if you don't have a product. He could not sell anything. They put in charge some guy who had managed a division of electrical power tools, and he didn't know what to do because he didn't know what he was dealing with, and he saw his career go down the drain. It was just a classic, a

classic train wreck. In the meantime, all the focus and all the money was being spent on developing this system, and the infrastructure of the system, when it wasn't even defined yet who the customer for the system was going to be.

And how to attract the customer

Yeah, and then once you decide who the customer may be, you might want to try attracting them. So my perspective on that is where you need to start – it's in the high end of the market, because it's a customized system, the advantages for it are specifically in high-end renovation and new construction. In the Dutch system, you have these office buildings that are downtown, that are not effective as office buildings anymore. They make beautiful Supports, and people would love to live in these buildings. They're often quite grand, and they're in beautiful locations, but the kind of people who had money to spend there don't want cookie-cutter solutions, they want a custom environment. Perfect for our system. So where we ended up was doing mass housing renovation. And at every single level of the business, of the product, of the kind of people, the business model, these two are completely different things.

A real mismatch. That is much clearer now. I think we'll come back to that in a bit, but thinking about the technical bits and the technical systems, what do you think were its strong points?

I think the basic concept was a good one. Having a raised floor, putting the systems in there – that's good. Is the next question what were the bad aspects of it?

Yes, exactly. What were the weak technical points?

And the other aspect of it was using the industrially produced systems. So, exactly, so you could just plug them together. That is what you want. So you're not reinventing all the existing systems, you're organizing things in a better way. And that's all good. So to the weakness of the system….the material of the actual tile is you know polystyrene, so here's the difference again, if you're going to go into renovation where there's a lot of difference in heights and in the floors, sure you can use that and in the end, Age decided, we have to have a flat floor, so we're going to put in a

GypCrete? A liquid floor leveler …

Yeah, whatever it's called. You level the existing floor to get it perfectly level. I forget what they ended up with. But the material is critical, and the noise is a very big aspect of it. Also the sound. It sounds hollow when you walk on it. And hollowness has a bit of a cheap aspect to it. In the worst situations, you get squeaking which is very bad, so I think that the idea again of having a much more forgiving material in that having foam on the top or the bottom to deal with these issues … my point is, these were essential issues from an end-user experience, and again if your business focus is in dealing with big clients, Karel Dekker's business model says with a large user and saying, you're going to save a lot of money on interest, because if that's your business focus and you don't deal with this, then so, I think in the end that aspect of it was highly problematic. Again, in renovation where the ceiling height is already not that high, 10 cm adds up. Your windows end up having lower sills, which actually in most renovation is actually nicer. It looks a little more contemporary, but it's still an issue. In a high-end renovation, where I think the money was, this is problematic. A second aspect—and I understand where the partners have gone afterwards—the electrical system was a secondary problem. The idea that you needed to, this is where we really went off the reservation, the idea that you needed to prefabricate the electrical and have the—what you ended up with was these baseboards and in order for us to do that right, we were looking at an incredible amount of money just for one type of baseboard and then you only have one type of baseboard to offer. The ones we ended up with in Voorburg I thought were just ridiculous.

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

I was just there in March and saw the installations.
And from a business perspective, the electrical stuff is not such a big deal, okay? So we could have just started out by having the floor and having a couple of points where you feed the electrical into the wall and you know the basics—if you want to use studs—and the other point is, do you really just want to use studs or do you want to allow different kinds of walls like gypsum blocks. What's wrong with gypsum blocks? So I think that was a big mistake. If you really look at why does it take two years, or you know, it takes two years because stuff has to be poured into concrete, and the electrical isn't put in until later and if you want to have the position of your electric, or if you want to have a door somewhere else, that is not a big deal. So you don't capture a lot of extra value by doing it. And then the Wieland electrical systems, beautiful systems, very expensive, and really is it necessary to put them all together? If you're going to do something like that where you prefabricate it in the factory, why don't you just use regular cable? You're fabricating it anyway. Or if you don't want to prefabricate it, put them all together there. Here again, it is striving for perfection without actually addressing the issue you're trying to address, so I think all of that was a big mistake, and I think we should have said okay, our innovation is the floor, and sure you need to feed the electrical systems, but that's not a big deal. Let's decouple those things, and then in a later phase, in a later phase, in certain market areas, it might be viable to do what …

What they tried in the end. So is that part of what you were referring to earlier about the iterative development process?
If we had had an iterative process, we would have run into that much earlier, right? You didn't have to talk about it intellectually. It has more to do with an understanding of what the real value of the system is and how you realize that value. You're going to say we're going to do great things for the end customer because they're going to love our system, and then you put an electrical system in that's dumb. Those two things don't relate.

I think this goes back to your earlier point about the lack of attention to the market and if there had been a greater understanding of how to develop a market, that early tests would have given feedback that could have incrementally been worked on. I think what you're saying is there was an attempt to create a complete system and deliver it to the market, and then hope somebody would want it.
That is also a reflection of—you said hubris—there's the hubris, but there was also contempt of the existing system. When you talk to Age, it was almost contempt and disgust for the way the system was organized. Personally, I think the Dutch system is pretty impressive. I think that if you start with this perspective, then you are going to miss learning opportunities. It is an attitude you can afford when you are in a university, and when you're in a university where you're not actually expected to do serious research that has benefit or interacts with the real world. That's a weakness of the Dutch system as well, right, but it was fatal.

I'm interested about that because Jan van Vonderen was in business with normal business supply chains and logistics. Did he have a role in tempering the overly academic approach that was found among some of the other partners … and also Frans de Vries who was in the business of building buildings … didn't they say 'wait a minute, guys, we better try some things out first and see what the market is'?
As we can see from what actually happened, this did not occur. Jan van Vonderen had some very serious personal health issues at the time, but I think he was not the right guy in any case because he bought into this from a conceptual perspective.

And so did Frans

Yes, and Frans as well. Frans is first and foremost a lawyer, I guess. He has a lot of business experience and a more formulaic approach. If you looked a venture investor in the eye and said is this an entrepreneurial team, a complete team, there was no marketing guy there. The other … is often taken … which you can disagree with … is you take someone who's respected in the industry, and you hire him as a CEO. You find somebody who has done the traditional path like the former president of Yale, you hire him for an online school venture, right? So this could have been a model, but I don't think that model was ever discussed.

They did, to their credit, bring in two business guys who were running large companies with the assumption that they would bring that perspective to bear, but it seems that they were …

You say that but there was never any discussion. The function of those people was to put up the money and buy the license. Remember, the business model was that Matura International was supposed to sell licenses, and then when they said 'what am I actually buying?' they said 'sure we'll help you set this up and we'll help you get going, but you know, you're going to hire…' Rene van Riggelen was going to run the product stuff of Matura Netherlands because Age's job was being the conceptual CTO at the Matura International level. That's not how it turned out.

What turned out to be the reasons potential investors didn't step up … they had Jansson de Jong, and then they had problems internally and had to withdraw their funding. They had tried to get Steinke and that fell through …

It was all too late by that time. The reason's very simple: If you need to sell, if you need to franchise, which is what the original Matura International was going to do, essentially, or you're going to license technologies, and you're going to expect someone to invest 10 to 20 million dollars to set up a business, you're going to have to have a whole story. There's any number of guys that hire, that develop patents, and patents, you can't sell a patent as such, except in a very particular, if it's strategically developed, but that is definitely not the IP business Matura International was in. They weren't 'we know from market analysis that in 10 years, 30 percent of the market will be infill systems; therefore, we're going to develop some strategic patents that everyone will have to make use of, and we'll have the licensing income.' No, that is not what they were doing. And that is one of the critical elements. In the end, Matura purported to be selling an infill system. There is no market for infill systems. Does not exist. Did not exist then. Does not exist now. Arguably, in the office buildings and others, there are markets where things that could be conceived as infill systems exist, but if you go to anybody in the business today and you say what's an infill system, they'll look at you blankly and say "I don't know." So this market does not exist. This is another classic start up. You are developing a product for a market that does not exist, and that's possible if you have a very effective marketing strategy. Groupon developed a product for a market that did not exist. They developed a whole new market category, but that's because their product was effectively self-marketing. Paypal, the same. It was again a brilliant marketing concept for itself. Classic mistake. There was no market for this product. You need to develop a product for a market that exists, or you need to take the bull by the horns and say we're going to take 10 or 15 years and go into a niche and develop a product for that market that's essentially an infill system, and yet when you read the brochures, that's what it was. It was touting an infill system and touting the benefits and features of an infill system. If you picked that up, you know it takes three seconds for someone to look at a brochure and they don't know what you're talking about. Classic, classic mistake.

That's why the first question that I've asked everybody was what was happening in the industry that was at the time believed to be an opening for an infill system, and everybody had their own, well, the word BELIEF emerges out of many of these interviews.

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

I didn't see the business plan … I saw the business addressing gross inefficiencies in the Dutch system, and worldwide you could argue it's the same. There are inefficiencies, if you look at the overall system, there are inefficiencies that allow you to capture an enormous amount of value, if you change the system as a whole.

The building delivery system
And if you consider the business as being building homes for people, what's the word home in Dutch? Doesn't really exist. House. The Americans have homebuilders. That's what they do, they build homes, not houses, because they are addressing the needs and requirements of people who are going to be living in these places. If that is the business you're in, and if you look at the amount of money those people are spending, if that is what you're going after, you're not in the infill system business. So your question you know the infill systems business was just a mechanism. It may very well have been if you were successful at doing that, the result might have been an infill system market. If you do your job right.

I think the perspective you're sharing on this was missing up 'til now, and my own perspective is that it's the most important set of issues and I agree with your analysis. It's shockingly missing from the early discussions, and that's what I'm interested in exploring because so many of the other major brilliant ideas to change the building industry failed to take hold historically.
If you look at the American building industry, the companies that have actually been very successful are typically very large, vertically integrated companies. They capture value from the entire value chain. They won't address the quality of their products, but they address the right issues. They market and sell to the consumer. Everything else in the … I'm not talking about quality, but if you realize that in real estate the issue, like this year in Texas, if you can get hold of the real estate and build the infrastructure, then everything else is gravy, then you have to address that problem. And that's what they do.

The issue is from my perspective, the lack of building a good management team and a good business. It was actively resisted, especially by Age.

Because?
Well, he would kick the can down the road and say 'that's not really our responsibility; that's the responsibility of Janssen, whatever, we don't deal with those issues' but in fact, of course, that was the reason he could just keep doing what he wanted to do, by not addressing these issues, by holing himself up in Breda. You look at this as a company with four founders, but all the money and all the work was being done in Matura Nederland and the founders had no responsibility there; there was no accountability amongst the founding partners.

Because Janssen put most of the money in
It was a separate company owned by a separate entity. Of course, that again is a bad structure for the company. If the future of Matura International is dependent on what's happening in Matura Nederlands then Matura International should have a licensed contract, an agreement in place, then all these things are successfully addressed.

And they had none of that?
Well, maybe on paper, it existed, but in reality, it did not exist. Those discussions, 'let's not be confrontational,' everyone's trying to do their best; never 'the company's going to go down in flames because we're not addressing some basic issues.' No, no, no discussion. For me, and this is an anecdote about Age, because in the end, Age's one of the founders. Age went out and bought all these hand tools,

and I have no idea what the approval process for spending an enormous amount of money on hand tools was but he said 'I know these are very expensive tools and there's cheaper ones; in the long run (whatever the Dutch expression is) in the long run you get benefit from that.' In other words, the return on capital that someone investing in a company like that has to be 100 percent or more for them to justify the risk. So, to me, this is when it became clear to me that these guys just don't understand this basic principle. You are not actually spending, say it was a thousand guilders on expensive tools, you are spending tens of thousands and even hundreds of thousands on these tools because of the future cost that is implied; that is an extremely expensive dollar that you're spending today.

Good. Okay.
And that should be behind every business decision you make at that phase of the company, right? So around that time I realized that this was just not going to happen.

This was when you were deeply involved in the software development?
I was working in Breda for Matura Nederland ostensibly.

And you were working for Rene basically?
Yes, I was working for Rene. That's the other aspect of course that was completely unclear, what the reporting lines were. Essentially, basically, we had a professor and some substitute student-like people doing projects, and you know, that's how things got done. It's not unusual in a startup of course for reporting lines to be blurry and for responsibilities to be blurry. What you need to substitute for that is a very strong communication between individuals and being held accountable for people's time and money and their initiatives. Rene probably didn't think they'd understand what I was doing. I don't know what the reason was, but his personality was a bit prickly as well.

Was Age essentially running Matura Netherlands?
Yes. By proxy, or he was seen by the Janssen folks as the guy who knew it all, and Janssen because of his own personal issues, or he was too busy to put someone in charge next to him or above him, but in the end, Age was running the shop. You know, look at the budgets. I'd be very interested to go back to the financials because what I know is the personal interactions with people and what they tell me. I never saw the financials, but in the end of course where the money is spent, that's really …

That tells a story.
That tells a story. Yeah. Exactly. That tells a story.

Can you speak more about the evolution of the software that ended up in Matura CADs?
The concept was based on the idea that you were going to have a database with names of parts; you were going to have named elements, so a pipe, if you have a piping system, it would have 8 or 10 or 20 elements to it, and ideally each of those elements would have a fixed size but if not, it would have a variable size based on the grid plus a fixed size, right? So if you have 10 grid units, then it would be 10 grid units plus fitting size. You know, it's a long time ago, and I don't know exactly what the time frame was, but at some point that just became impossible because the system wasn't being developed in that way, and the database environment that I was using at the time had its limitations as well so the idea of building a graphic interface to it … essentially a graphic interface is extremely simple because it was basically a reference to an element or a group of elements, right?

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Well, I don't know much about the Matura CADs. I saw some of the output, the drawings that went with the packages and the parts were named and holes to be cut were identified, and it was very nice from what I could see, but wasn't it the case that this was a very, very early venture in territory that hadn't been visited before. There was really new stuff going on.
Yeah, that's true, but also it was a little unclear what the exact objectives were with the Matura CAD system. Of course we had a nice workable system we built for Jan van Vonderen. In many ways that system was more complex, but in many ways it was also simpler because there was no requirement to prefabricate everything, so you just needed to have enough material on site and not too much. So if that had been the goal for Matura in the first phases, then Matura CAD's technical problem would have been minimal, but as you say, when the decision was made to move more and more production, not of elements but of systems, right, if it's an element that sits in inventory, even if it's "just-in-time" in inventory, that's one thing, but if it becomes a complex subsystem with elements that have to be put and holes that have to be cut and screws that have to be put in particular places, that's a completely different problem. You don't solve that problem by putting a computer on it. You solve the problem and then you may write a computer program to automate the solution. So, yeah, in the end, again, if I'd been in charge at that time, I'd have said "Forget the whole computer program. It's irrelevant, it's becoming a barrier." But instead, it was 'oh we'll just put that in the computer.' 'How do we solve this problem? Oh, we'll just put it in the computer.'

And that was your job to do it?
I was the sucker.

But you tried and you made significant strides to streamline the data input and its translation into documents that would guide the shop floor guys and that would guide the installers on site, right?
I guess so. One of my personal goals was that it would be very easy to train somebody to use the system, and so I wrote at some point a very simple instruction manual. I don't know if you've seen that.

No. And that's what Louise was using?
I assume. Actually I think I wrote that specifically when we were doing the Japanese project - the Haseko/Shimizu effort.

Have you ever written up the story of the Matura CAD's development and put it in a larger context of things at that time with software development and …
There's nothing innovative about Matura CADs. The only innovative thing is that it's a reflection of the system. If you define a system with visual elements in such a way that the interfaces between elements are known and defined, then you can make a graphic representation of that without having to have a computer-aided design system in the traditional sense. They become icons. They become icons that represent individual elements. The graphic information is symbolic in that 'oh, it represents this type of element' and it simplifies the process of organizing the information. So that was the innovation of Matura CADs that I had been working on separately; this had nothing to do with the system for Jan van Vonderen's business. I had done some papers on it, so innovation, how you can represent certain data like the length of something, etc., in a simple way by abstracting out this information, right? So for instance a line, if you say a line is a wall, then that means you have a variable length, a variable height, but the width of that wall is determined by whatever system specification you apply to. Or if the wall is in a system then the height is irrelevant because the height is determined by the floors and the system that then determines the floors. So that's an innovate part of Matura CADs, and if I had been running the company at that point, I would have said chuck that part of it, it's irrelevant.

Hm. Interesting.
Because if the system works, right, again, again if the system works the way it should work and was conceived, then you just need a general amount of information about the number of tiles and the lengths of pipes. This may mean that on site you're going to do some cutting. Truly, you may have to cut a pipe on site using something, yes, like a saw or something like that.

That was done anyway.
Well, it had to be done anyway.

So are you saying that the …
What I am saying is that throughout the process the goal became to automate all of this, to eliminate any kind of variability and flexibility on site, and then everything had to be prefabricated in the controlled conditions of the factory, preferably by people that aren't very cheap and therefore presumably they'll know what they are doing. I reject those elements of the Matura system. The moment that you do those things, you have two orders of magnitude of additional complexity, and you are not in control of those complexities, and it just defeats the purpose of the system in the first place. Why make a flexible system, right, that is able to be very variable, easily variable if you're not going to make use of that quality of the system?

If you try to automate too much …
Yeah, for example, why should that tile be a meter by a meter if you're going to prefabricate it? Why not make it 10 meters by 10 meters? Or make it big enough to get in a window or something? Why should it be one meter by one meter?

The questions you're raising are really interesting and I don't know quite how to pursue them.
Well maybe that's not the objective of this discussion.

No, I think it is
It does have to do with what the goals of an infill system should be, from my perspective, and from a business perspective. If you control the entire system, then we're just basically talking about prefabrication. There are people that prefabricate complete houses, as you're well aware, and they don't need this methodology.

No, but there's nobody who prefabricates just the infill.
Right, so if you're going to prefabricate just the infill in an environment where there are actual end users, consumers who presumably drive that, because that's a very important part of what the Matura concept was, if that's the case then you want a system that can deal with variability. If you know within about 10 cm what the dimensions of things are, then the system will adapt within that 10 cm.

So you're saying that things that ought not to have been standardized were standardized unnecessarily and even though the guts of the Matura system turn out to be invisible, they're not visible things. They're underneath the floor. They're inside the walls. The effort to systematize and standardize those invisible things was a flawed concept from the start.
Well, there are certain things you do want to systematize, but the ones you … so here's the iteration that comes in. To give an example, the piping, the hot water piping for the heating and for the water supply, the curve of that pipe needs to be much bigger than you can put in the grid, right, so you're going to have to cut into the grid, and in fact, those nice little slots that you have there, why do you

really have them, right? Well you have them because if you put out the tiles, it's an easy way to orient yourself when there are no actual walls. You can say, okay, this is where I need to be, so that's a good function for that, but that's really the primary function, but you're going to have to cut out an arc. For some reason that was so aesthetically unattractive, that was a huge issue.

A huge issue?

Yeah, but the practicality of this, that pipe when it heats up, it will expand and move, and if you have a long length, it will move a lot, and it will move exactly where the bend is, so you should spend a lot of time and effort architecting that, not to make it cheap to do, but so it doesn't make noise and it doesn't—here's a classic one—that you actually know where it's going to be so that when you put a screw in the floor that you don't put it through the pipe, right? Which is one of the things that happened in Voorburg. It's like "The pipe shouldn't be there!" Well, someone put a screw in it! And it's a hot water pipe, so you don't notice that it leaks until it starts expanding, right? The great thing about that material is you can actually put a screw in, and it won't leak except when it gets hot and except when the stress increases … so those are the things that you need to focus on in the field. And maybe the conclusion was it's the wrong way of doing it and maybe what we should have done is said we're going to have to accept that we should have couplings under the floor—this is purely theoretical, by the way, I don't know if that's true or not – but why not, why not put couplings under the floor? Again, this is just the kind of discussions you would have if you're actually using these things in real life and trying them out.

So maybe the big lesson is that attempts to perfect a complex thing like this before putting it into use is a wrong way to go, that you need to try things out in the marketplace incrementally and fail and correct things and …

You know, let me you give you another example. There was a lot of brainstorming, but one of the ways you can raise a floor is to basically have little feet that stand on a grid right, put all the piping in, then fill it full of some material like sand.

Like they do in Israel.

I didn't know that. So, from my perspective, that would have been a perfectly acceptable solution and had some real benefits, a sound perspective, etc. but it does not meet, yet, you know because the point was you want to have a system again that's flexible, that because it can therefore in a short period of time meet the requirements of the end user that will can come in, design their house, and six weeks later they have it.

Also that you can patent it

No, why?

No, I mean that the matrix style is a product that can be patented.

Well, I understand that that's the case, but from my perspective, they're making some interesting intellectual aspects to it, and maybe you can patent some basic things. If you're creative in your patenting, you can get a patent on just the fact that you have a raised floor, and in that raised floor you have, there are elements and aspects to that, and does that make you money?

No, that's what I heard you saying. I understand that.

So if that had been the focus, instead the focus became the mass production of it, the making it into a product, and that's exactly what I don't like about the Dutch system, is that all these houses are just consumer products made by big corporations, cookie cutter, the same for everybody. So why do we take

certain aspects of that system, the industrialization part of it, and make it into the goal of the infill system?

Well, that image was there from the beginning. What you don't like was there from the beginning.
That's interesting. I didn't see that because at the beginning there were wild discussions about how to do it, as I said. This tile thing didn't come about for a period of time, and we didn't know it was going to work. We had to make these prototypes out of expanded polystyrene. The first types were like the kind of boxes you would make a television in. I don't know if you've seen any prototypes. Later it became firmer, firm, nice strong building material. From my perspective; this was not the start, this was the end.

So things started more open and then they began to converge on particular product solutions …
There was a design methodology, of course. And there were requirements, and there John must have talked to Frans van der Werf and this is why the SAR methodologies came up again, so that was the basis for the system, you know, if you can constrain that from the design perspective so that the variability of the design perspective, you take a 10 cm grid, you do this, you do that, so you can then think through the implementation details and you have elements that you work with. That was the concept for Matura as far as I'm concerned. And don't forget SAR did an enormous amount of work in practical terms on the industrialization of the infill systems, right? I remember going to SAR as a young kid, and there was a whole model house there with refrigerator and kitchen elements and all the sinks. That didn't get very far. Or maybe it got, you know, maybe it was actually quite successful in specific systems but not into operability systems. So again I don't accept that statement that it was part of the concept originally, and if it was part of the concept originally, then you would expect there to be a large budget for the industrialization part of it because presumably you're going to manufacture things, and manufacturing things is expensive. I don't recall that because basically what we did was look for third-party systems, we looked for other people's systems to integrate into this.

Do you remember any publicity or commentary about Matura within the Dutch building community during that critical period from 1990 until things closed?
I really don't.

What caused the company to close finally in the end?
All the mistakes that had been made caught up to them, essentially. I think it's more than that; however, it's the fact that Age and Frans decided that it made for them no financial sense to try to rescue Matura, so they essentially took the intellectual property out, and the rest died. It was from that perspective, a business decision and somewhat unfair to the other founders, though I was not a founder, I was a shareholder, a significant shareholder, in Matura International.

They couldn't find any other investors to come in with the capital needed to continue, right?
You know there was this, this startup concept of swiveling or spinning or reacting to the reality in the marketplace, and if you set up your company to be able to do that, if your business model is conducive to that, then you can. If the focus is on the intellectual property, the intellectual property, the intellectual property, the focus is on the idea somehow that the patents are valuable and that you can monetize them, then the business decision you make is to kill the company to save the intellectual property. I think that was a bad decision.

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That was a bad decision up front, but a smart …
A bad decision at the end, of course it was a result of the decision up front. It was a 'why don't you scale things back?' There are construction companies that make money by building ten houses a year. Why can't Matura build ten houses a year?

Because they had bigger plans, bigger visions
They didn't want to be in the construction business because it's tainted, it's dirty. They projected that onto the decisions. There are good rational decisions not to want to be in it. But in order to bootstrap a company, money is needed. If the same amount of money that went into that company was used to generate revenue, right, if they had just gone out and bought themselves an office building and built some high-end apartments and sold them, there would have been a valid, viable business there.

The story is not yet fully told.
Ok. I had promised already, you know this whole thing inspired me to get my MBA, so like I said, I wrote the business plan for Matura, so I will send that to you as well, and you can put that in the records.

I think your role in the software development is something we didn't explore much there, but the little I know of the Matura CADs tells me that it's a very important story, that it did things that hadn't been done before and that it was a key element of the vision of Matura.
Well, it might be worth saying a couple things about that. To me, AutoCAD is the evil empire. It is a reflection of the weakness of the building system. The idea that if you put all that information into a big AutoCAD file, and you therefore have solved the problem, you know, and just because you can automate, you can automatically create bad information now. It starts and ends with the building systems themselves and how people conceive them, and the reason that AutoCAD can work is because—and I'm telling you things you know—at the operational level things happen that the designers don't even begin to know about. They have no idea how a window actually gets in the wall and why it's waterproof. That in itself isn't bad, but if you look at the design, it suggests they do know because the information that's in there is a reflection of that window and how it fits into the masonry, but it is not a reflection of how it works and how it ends up in place. If that is the case, from my perspective, instead of putting in this detailed window design there, you should just put a blob there and say 'this is a window, and I would like it to be about 24 inches give or take 2 or 3 inches.'

And watertight
Well, but again, sure as a high-level requirement, but the people that build the windows are the ones that probably determine 'oh this is an outside window, it has to be watertight.' 'Oh this is inside an atrium, it doesn't have to be watertight.'

This, as I was saying, the role of smart software in the design, prefabrication and installation and long-term management of such things like infill systems seems to be a really important story, and I don't think it's been told. I don't think the Matura CAD story has ever been told in any way, and I think it's important that it would somehow be told sometime. Since you're the key, you and John, I guess, were the key initiators and developers, it would be just very interesting to have a fuller explication of what happened, why it happened, what was wrong with what happened, how it did or didn't solve certain problems, etc.
I think the CAD concept that existed before Matura computer design specification is that you focus your design efforts on what's specified, and that is a very distinct discussion. I think it muddies the waters with respect to Matura.

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It's a side story.
Yeah, it's a side story, and I will frankly admit that for a period of time at the beginning, I saw Matura as an opportunity to exercise my ideas about how you can, how you do design specification in a way that's meaningful to the designer. I think that as such, I was part of the problem. I was a part of the problem, and when I decided that I didn't want to be part of the problem anymore, because I started asking question about why this or that is necessary, I mean I understand it as a business case for a certain part of it. You want to have specifications at a certain level, but at that point, I think that you know as I said, if I'd run the company at that time, I'd have said "hey, let's forget that part. Forget the computer-aided designs part of it. Let's forget about the industrial design part of it. Let's forget about building a manufacturing facility and getting ISO certified. Let's forget that. Let's focus on the business and how to build the business to be successful."

And then eventually tackle these problems when they became evidently problematic.
Yeah, so that was the end of my participation in the company. I probably should have just left at that point instead of hanging on.

I hear you. This is very clear. I'm very grateful that you were willing to discuss this and dredge up all these memories.
And if you have more specific questions, I'm happy to answer them.

Thank you very much.

MATURA ORAL HISTORY INTERVIEWS
Interviews by Stephen Kendall in March 2014 (questions in red)

TOON HUIJPS

Would you please try to remember what was happening in those times in the Dutch industry that made everyone think it was a good time to bring Matura into the market? What were you doing at the time, and were you familiar with Matura as it was developing?
Before I entered, Janssen had gotten the license for Matura; they bought it from Age van Randen and Habraken, and I was appointed managing director of the new company called Matura Nederlands. It was a part of Matura International. I didn't know anything about Matura before I entered the company. That's one. Second, I think that at that time, Janssen and also John Habraken and van Randen saw possibilities with the system because of specially I think the wish and the demands of the consumers, not so much the industry, because the consumers were more and more individualist with individual wishes, and there was no possibility in the way the houses that were built at that time that they could fill in all of those wishes, meaning that if they had a few square meters for instance, and they said we want to have three bedrooms instead of two, that wasn't possible, because they only got what was built. That is I think the background of it. With this system, it was possible to fill in the different wishes of all those different houses. If you wanted a very big living room and a small kitchen, it was possible. I think that was the excitement of the Matura system. I think that's why Janssen, who had the license, saw possibilities to make it profitable.

How did they try to reach the consumer?
What they did is build a showroom in Breda. We tried to invite all of the builders, project developers, the government, everyone who was interested. But at that time, we did not invite the consumers because we wanted to convince all those people who were deciding on building of the value of the system. And of course there was a brochure, and that's about it.

When did you enter the company?
I think I worked there from 1990 to 1994 because in '94 I started working somewhere else.

Could you tell me the job description that you were filling?
In fact I was at that time managing director. You interviewed Rene van Riggelen already, I believe. Rene was my technical right hand man, you can say, he was the technical man. And then we had Louise, an assistant of Rene … she was especially very good in the software.

Louisa van Randen
Yes. She was there. The three of us in fact were the company. We were Matura at that time. And what I did was mostly in effect discussing everything with Rene and Louisa - the economic and the commercial possibilities and technical things for the system and software. It was a lot of work and I corresponded with so many agencies about the tests and so on to get the system approved by the Dutch government, because it was an absolute a disaster at that time. It took us years, and even when I left it was still not accomplished.

Could you explain that?
Yes. In Holland if you want to build and you have a new system, you must have approval by some institute like KEMA and all those other regulatory institutes. You have to do fireproofing studies, and we did a lot of fireproof studies because of the new system, always there was some small problem or a bigger problem you had to solve that again and it cost a lot of money and a lot of time. That's what we were really facing at that time.

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So when you came in around 1990, the early experiments with the matrix tile and the base profile had already been done. Mockups had been done and trial installations made, right?
There was a mockup and we were in the process of getting it approved by all those institutes and when I left, we were still in that process. The matrix tile was there and the wall, and the connection of the wall and the matrix tile were already there.

So the early installations in Eindhoven, the system had not been approved at that time?
No. And also when we used it in Voorburg, it was not approved.

Given this, how were you able use it?
What I remember is there was an institute called SEV. I don't know what it stands for. As I managed it, it was a renovation in Voorburg, and so we could experiment. We were allowed to do it. Without having an official approval of all those institutes. It was organized by SEV.

Okay. So the approvals for the zero slope drainage line, that came later?
That is probably after my time. The biggest problem we had was all those fireproofing issues. They cost a huge amount of money and a huge amount of time for us. We constantly had to build new examples, new situations, and try it again.

I'm very interested in those issues. Could you remember what the fire issues were that caused such a lot of money and time?
Yes, it had to stand … when there was a fire, it should be able to stand, I don't know, I think that Rene maybe knows all the details, but it should stand there for instance, for one hour or for 30 minutes, and it must hold, the wall and the connection, so the matrix tile, the base profile, and the wall should hold for, I don't know, 30 minutes, 45 minutes. It was a very heavy test you had to do there, and we never managed to get it accomplished, never, in the time I was working there.

So the complete assembly was tested in some kind of laboratory?
Yes.

Run by some testing agency?
Yes, I think Rene knows the name. I don't know which testing agency.

So during the four years of your being managing director, those tests continued, and even by the time you left, they had not been approved.
No, they were not approved. Then of course, Janssen invested a hell of a lot of money in it, and Janssen as a whole company wasn't doing very well. He said we cannot do this any longer it goes on and it goes on and it goes on; it costs money and we cannot go out into the market because it's still not approved, so we have to stop. Then they stopped it, and it was sold to a German company, but then I already had left.

So your day, every day, was spent trying to get the test approvals?
Together with Rene of course, there for the technical details, can we change the drawings again? Build again new setups for the laboratories? Discussing of course with Janssen, can we get more money? How can we sell it? Then we got some builders, members of several government agencies, project developers

in the showroom, and I led him around the showroom and explained the system. That was my job. Of course, I was also discussing the developments with Age and with Habraken.

And von Vonderen?
And Von Vonderan. Yes, but that was in the beginning. In the later stage it was in fact only Age and Habraken. Mostly Age. Frans de Vries was also sometimes present, but not all the time.

This is very interesting. This is the first time I've heard this part of the story.
Rene must have told you, because he was always working with that problem.

Can you remember any of the specific modifications to the system that you tried to make it meet the fire regulations?
No. I've been reading through your questions, and I couldn't remember any change in the drawings because I'm not a technical man to remember exactly the changes. I hope Rene still remembers.

Do you remember anything about the software development?
No. I think Habraken's son Wouter was in charge of that, together with Louisa.

What was your role in trying to develop the market, the demand, for Matura?
The role was limited because of the lack of money. We had contacts with a lot of builders, and with a lot of project developers and government officials and we tried to follow up with them at the showroom in Breda. Of course we hoped to make the next step, meaning market to consumers, and we said we will do that, but to do that we must have all the approvals otherwise we cannot very well go into the market. There were a lot of efforts and nice brochures and television time, there were big plans for that but it was all limited to the builders even in the situation that the approvals were not there.

When the builders came to the showroom, did you tell them about the technical problems?
No.

You were silent about that?
Meaning at that stage we could go on because of SEV; we could always find a way out because we were still in the phase that it was experimental, it was not large in the market; it was experimental. We always tried to get some smaller projects sold like in Voorburg. I think in the Voorburg project it was five or six dwellings, or apartments. Then we didn't really need all the official approvals. We could find a way out. It was still on a small scale.

So during the four years of your management, you were operating under the SEV experimental projects umbrella.
We talked with them. They also saw the market possibilities and also the filling in of the demands of the consumer. That's why they supported it.

Do you know if there were competitors of Matura at that time?
No, there were none.

I wonder if that was part of the problem? Whenever a new innovation comes in, it's always good to have competition, but there was none.
There were some trials. There were some other companies who tried to make the building of houses more flexible. But it was in a completely different way than Matura as far as I remember.

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Was fireproofing the matrix tiles one of the big problems? Because the matrix tile was made from polystyrene, which is very bad when it burns.
For me it was more of the place where the matrix table and the base come together, and the connection. There was a kind of leak. I don't remember exactly. Maybe you should ask Rene again because maybe he knows the problem. And of course, all the money Janssen invested in the process. When I started the expectation was that within six months or one year at most we would have all the approvals. And then we could start. After four years it was still not a fact.

How many people were working in the factory at that point?
Three: Rene, Louisa, and myself. And in the end, there was someone working in the storage. In the time we were making Voorburg, we got a lot of supplies of course, and we had one young boy working in the storage. So there were four, that was all.

Who was fabricating the base profiles?
Rene did that in part but we also had help from a painter in the neighborhood and an electrician. We just hired them in for the project.

And you hired some company to make the matrix tiles?
Yes, there was a company that produced the matrix tiles. I forgot the name.

At any point during those four years did Age or John show any indications of changing directions in a big way to overcome the problems? Like really rethink something?
No. What I remember is that most of the discussions and meetings we had were about money. At that time, business was not very good for Janssen. I think Jacques Janssen was also fired. He was one of the owners, and someone else came. So there were big problems, and they were not very interested much longer in Matura because it only cost money and it didn't bring anything and it was taking too long, so the discussions we had were mostly of the developments, there was nothing new, nothing was coming, and it all cost too much money. No, they were not very nice meetings with John and Aga on one side of course, and on the other side of the table, Janssen, myself and Gruijters. He was my boss at the time.

This was your boss from Janssen and deJong?
Yes. He was part of the Janssen group. So that was the kind of discussions we had at the time. It was not always very nice.

Do you remember any of the publicity in the building industry journals or magazines commenting on Matura?
Not much. Sometimes of course when we were making Voorburg, there were some articles in the magazines explaining what it was and of course the advantages and maybe the disadvantages, but mostly more descriptive, not giving an opinion or saying it was very good or anything. In the magazines it was said that this was the maximum you can reach on flexibility for building houses. That was of course the big asset, the flexibility.

What had you been doing prior to joining the company?
I worked before for a company called Skil, maybe you know it; they make electrical power tools. I worked for the international department. But then I moved to a company Brink Molijn, part of Akzo Nobel (a paint company) before moving to Matura.

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You came into Matura for four years and then you moved on.
It was only for four years, but of course, I'd hoped it was for longer. At the moment Janssen said "we have to stop" and I was fired in effect and there was some discussions, and I think Rene stayed and Louise stayed, and there was a German company who took it over, and it went on. I think still there was Rene who stayed on. I lost sight of it.

It came to an end very shortly, maybe a few years later.
Oh, okay

This is very revealing. Even Rene didn't talk about all these tests that had to be done and that they were not successful even after trying again and again.
Maybe you should interview him again. I don't know where he is. I miss him.

He's working for Nijhuis
Maybe you should re-interview him because that is what my recollection is. That the big problem was the time, the money, caused by the problems we had with all those tests.

This is great. Do you have any other memories of the whole experience that you'd like to share?
No. No, I think this was it. I looked into your questions and I came up to what in my opinion were the big problems and again then also the situation with Age and Habraken, Frans de Fries and Janssen and de Jong was not very good after one year or something like it. There came all kinds of irritations because of the developments. It was a nasty situation from that time.

Even among the partners?
Yes, I don't think there was any discussion between de Vries and Age and John, I don't think so. There was the one party, and we had many discussions with them, but when there was an official meeting, then it was no. It was always about money. It was not very nice; not very positive.

I think that's probably all we need to talk about then.
I think so.

You couldn't even develop marketing strategies because all your time was consumed with the tests.
Yes, of course I made a very big book. I had already made plans for after two years when all the approvals were there and then after 10 years and so on; marketing plans and publicity and all, but we never came to that place.

You developed all those long-term plans?
Financial models, with investments with everything. I remember that I made it. I think it was an internal copy that I made and only for the Janssen and deJong guys, not for Age or John or anyone else. I'm not sure. You can ask.

Did you discuss those things with John and Age?
Normally, we did. But we never came to that place. That was the problem, we never came to the place where we could seriously project were we would be in four or five years. We were always kept in the same place, because there were no approvals. We couldn't go on.

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The evidence of planning for a successful rollout and marketing and commercialization and so on has always been a discussion in my interviews - that the company was not successful in developing a demand for its product; there was no demand, and there was no understanding of how to develop a demand. But it sounds like you were doing some work to try to do so.
Yes. There was a plan. There was also a time-line.

I think that's all if you don't have any other points. Thank you very much.

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NICO VONK

Before the Voorburg project, had you been familiar with support / infill ideas?
No, only building in the traditional way. You just complete the renovation of the inside of the building and rebuild with metal studs, like that. Not with this system, not in the Matura system.

In projects before this one, had you found the cost of renovation to be effective and people could find value in not demolishing the whole building, but repairing it.
There was a lot of money from the government to renovate; the costs of renovation were too expensive. So the subsidy was great.

What was your first experience with this way of thinking, one-at-a-time renovation and the Matura system?
Voorburg was the first project and Matura was also one of the participants, but the others were still developing. We once had been in Breda where the mockup could be seen… so in following the development of Matura, I was very interested because in a renovation, it was something new, especially the shorter time, and in buildings that are occupied, and so I spoke a lot with Rene von Riggelen about what is needed for the system. I was a little bit afraid about the system, of course in my vision, it was too much developed…it was already too far. You had also the people, who had too much choice. They could choose anything.

What do you mean by "too much developed"?
The system with the floor plates; a lot of thinking had been put in it, and that was the system, there was no other possibility because that was the system. From my experience, there are a lot more possibilities. But that is what we had to use. The good things about the infill system of Matura was the speed of the time and the system was all, complete with wallpaper and so on, that was new; the man who rented the house was a month out of the house and when he returned the house was ready. He didn't have to paint or make wallpaper and so on. Just leaving the house and furniture in storage and come back and put the furniture in, and the house is ready to live in. I had some concerns about the system in the floor that I mentioned: the temperature of the cold water and warm water, and heating and drains in such a position. There was in that time, there was the system from VBE (Flexcasco) but it was more-well known, and normally you learn to make the pipes with a little bit of slope. For me there were a lot of questions: How does it perform after years and years?

You always look for a situation in the building where there is the vertical pipe shaft where you can put the toilet and the bathroom and the kitchen next to the stack. The Matura system wanted to place the toilet here, the bathroom there, that was the first thought, and that was impossible about the dimensions of the pipe. Now we have the macerator and the pump.

You mentioned that your first understanding of the Matura system was it was too developed. I still do not understand your meaning.
It was a good system, but in my thinking, I felt you can choose where you want things, but you have the electricity, you have the floor, it was already finished.

It was a complete solution. On the one hand, the complete solution was attractive and beneficial – it was fast, efficient.

Yes, but in that time, it was expensive, more expensive than traditional. And not a small percentage, it was about 20 – 25% more expensive.

Yes, but not more expensive compared to when you do a one unit at a time renovation using traditional renovation methods?
Correct

But as a principle, Matura wanted to be able to provide a renovation service only when the people are moving. And if you do that way, then the Matura system was advanced and much cheaper than traditional one by one.
Yes, but our view of making complete building renovation was cheaper.

You offered the same options for the renters?
No, they had not so much options.

So ERA never did provide INFILL in the Voorburg project?
We never made an infill. There were two contracts with the occupants. There was a contract with ERA for preparing the support, and from the buyer with Matura there was another contract and that was for dwellings – the infill.

So ERA was not involved in the infill at all?
No, we were delivering the empty units.

So in Voorburg, your job was to prepare the building, to strip it, and prepare it, and then your job was finished, and Matura was hired by the association to fill in that house.
Yes.

Did your company do the new elevators?
Yes.

New windows, installation cores as well as the empty houses on the ground floor?
Yes.

And the new ones at the corners
Yes. Empty.

And you had a subcontract with Matura to fill in these?
For ten there was a subcontract between ERA and Matura, and for four units Matura had contracts with the buyers. Matura got the order from ERA, I think, for the ten-infill packages on the ground floor of the housing block. Those 10 dwellings and 10 Matura packages, they were built in the same schedule as the whole support renovation. They were delivered together with the total renovation. Those ten Matura packages were integrated in the whole contract, and the four new – owned - dwellings were for the people who bought the houses. The one-by-one renovation was dependent on people moving, and when the society got a new renter they could ask 'how do you want to live?' 'How do you want to have your layout?' And it was entirely and directly contacted with Matura for that.

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The entire infill system … was a separate contract?
Yes, one contract for one house.

So, you had no responsibility for the success of the infill work?
No.

So when you first saw Matura, you were interested … oh, a complete system … oh, it's too developed … you didn't have those responses because you would be responsible, no…you had no responsibility for the infill delivery.
No

So when you prepared the building for Matura, did you have difficulties or problems with the necessary preparation? Because you knew that Matura would come in, not another company, not traditional, did you change your methods of working; was your pricing or your scheduling different because Matura was coming in?
No.

So, Matura was there first, and they said 'Okay, Mr. Contractor, you have to prepare the building for us, for Matura, in exactly this way…here is the list of requirements.'
I will explain. Matura provided specifications – 15 to 20 pages of Support specifications.

Written by Matura.
Yes. I'll show you what it says. It is not only important for Matura, but also for other systems or to do it the traditional way. Also because of the raised floor inside - and formerly it is not a raised floor - we have to change the windows in the house, so these kinds of changes were related to a hundred millimeter thicker floor … required by Matura. The pilot dwelling in Voorburg with the Matura package came first. After that the study about the way to strip a dwelling without disturbing the tenants was made by KD/Consultants. In that study (ERA, Matura and other companies were involved) the conditions for preparing the support for a Matura package was embedded. After that the cost planning by ERA was made and negotiated. So the support was prepared for just a Matura fit-out system.

The step at the front door
The changes were all done in the specifications for ERA, and they had prices. Yes, they had to change the front door because of the matrix tile….

(Frans) But I believe even in that time, it was necessary to make insulation between the dwellings in the floor. You can do it above the ceilings - so you need a certain space to provide sound isolation for any infill.

My only point is to find out to what extent did the Matura specifications affect or change your ways of working, or your cost? Because they came first to the job; you followed.
We had no real change in methods of working. But it was important that the entrance for all the people who lived there; they could really live there during construction, during the work.

Looking at the experience with Matura. Do you see a place in the future for separate companies delivering complete infill into a building? Not the standard sequence of sub-contractors managed by a

general contractor. Now in the Netherlands, there are companies doing that for offices, or shops. So the idea of one responsible company delivering everything inside of a shell. It's happening, right?
It's happening, but I think it's a problem. We use it because the new houses we build without a kitchen … no installations … the pipes … not more. They choose a kitchen, anybody that likes it … we install them … But installation was traditional.

The other idea of Matura was the workers were multi-skilled. They worked as a team, right? Not subcontracting with different people coming and going, waiting …that is perhaps the most difficult concept. I want to hear more from you about that innovation. Why is it so difficult to introduce not a new technical solution but a new way of working?
That is only possible, I think, it is only possible in an infill system like Matura. We use traditional systems and there, the carpenter is not allowed to do electrical work, etc.

Not allowed by whom?
By law. But mostly it came from a carpenter. Always installing wallpaper and painting the stairs and so on. They are still not allowed because you have to, at the end of a building, you have to sign a paper that you are responsible for it. So that's why we never used multi skilled teams.

Who has to sign? The worker?
The company. Like in Germany, it's very strict. You have to understand, in that time--nowadays it's changed--when today you go to a DIY shop, you can buy all the materials for central heating, electricity, etc., there are no demands, requirements, if you are skilled or not. But this is generally for renovating, not new building.

(Frans) How we handled that in that time, in Matura Nederlands, there was one person, and he was doing the inspections. He was before an employee of the local authorities, but he was so interested in our systems, he studied the regulations regarding central heating and electricity, and in no time, he had all the papers (certifications) to do central heating and electricity. He was very, very important because he was an employee of Matura Nederlands and Matura Inbow, he was an employee and because of that, Matura was allowed to do everything including installations …

The separate workers were not licensed, just the man in the head office. So today, the same regulations exist, right? The workers on the site are not required to have the license?
Only one. Only one license, and the driver of the crane must have a separate license. We always had a subcontractor of electricity. Always had a subcontractor of heating.

So do you see advantages to the multi-skilled team?
Yes. Sure.

But you never do it?
No. During that time, we optimized our schedule from eight weeks, six weeks, to three, four weeks with subcontractors.

How did you manage that?
LEAN thinking. Now in renovation … new kitchen, new bathroom, new toilet, changing the windows, all out, make better insulation on the ceiling and so on in three, four weeks. They stay in one or two rooms;

do everything to one or two rooms. Outside of the building, we have a shower compartment, toilets and so on.

It's always the same story. We are all multi-skilled – most of the people have a renovation of their own house go to the DIY store, and they can renovate everything, and there are leaflets, instructions. Plus there is the internet. The problem is not the people, the problem is not the society. The problem is the building industry itself. That is the problem. Right?
I agree.

But before we leave, do you have any other lessons to teach us? Frans said the problem is the building industry. From your point of view, the building industry is just fine or what?
There are a lot of problems but there are many more rules … how can you make it in an old building? Our biggest problem is the oversight of the government. The government who says it has to be like this. It has to be like that. Measure this. Insulation is like that. There are a lot of problems, and every year new rules come. The rules get bigger, bigger, bigger, and you don't have any room to live.

I am impressed that you improved from an eight-week to a four-week delivery. You can go to three …
Yes. But to go further may not be possible. There are technical problems with the ceiling or the tiles. It has to be dried, and so on.

I don't believe it because 10 years ago you would say it's impossible to go from 8 to 4.
Yes.

Well, you did.
Perhaps with new products it is possible. Why is the first thing a flat floor? Why not the old floor with steps? Or it can be just two centimeters. With the floor system you have, it needs a flat floor. The man who made it in Voorburg said I make it at least 3 cm to give you guarantee. I said I don't need guarantee. I need a flat floor. A flat floor can be just one centimeter because it is a structural slab of 8 cm… the quality is not necessary. Just a flat floor. But then the man says …Then they came and they need a kind of quantity each day. At one house, 70 plus square meters, 3 centimeters, it is too expensive. He says I will do it for you but it will cost you 1500 and it is wet, so it has to dry.

The other theory is that technical solutions will always be found, so the problems aren't in new products. The problems are in the demand expectation from society. So ten years ago, you could deliver an eight-week solution, now the demand is 'do it faster' for money or convenience. So, now we're at four weeks. You have new products; new management skills, so the pressure from the demand side has to come first, then you will deliver. An example. An innovation initiative in the Netherlands asked the building industry to offer ceiling installation in one week, and there was no answer. Then they went to Philips ceiling technology, and they do it now together with an exhibition builder. They do it in one week. I think technology is following the demand pressure.
We can say how we will build because we need about 12 weeks from start to finish, two houses a week. That's the planning. And now we look for what we have to do. Can we place the concrete one day, not the whole day, no, just in the morning from 8 to 10 with two or three men, we make the noise, then they go away, and they come every day. They come from 8 to 10. When one is sick, it's the problem of the contractor … it's not our problem. The job is finished at 10.

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It means to me that the contractors and the subcontractors and the product manufacturers will find solutions, and the last 30 years is evidence of that. We have LEAN; society puts on more regulations. But how does demand know they can demand?
I don't know.

How do you know you can get it if you want it faster? I think the demand/supply question is very interesting and important and very dynamic.
But they change your bathroom in one week. In my spare time now, I look for the apartment building of, say, 170 houses. I do the technical jobs, looking for everything around. People want to change the bathroom. And when they have a problem, they come to me. The problems are always the time; the noise, and the dust - it's terrible. And then I come and I fight with them, and they talk about three to four weeks until the bathroom is ready - you need to do this, you need to do that. And I like to see what you are doing in the corner. Because when there is a problem, the apartment below has a problem, so I want to look. Also when you have a multi-disciplined people they have to know everything.

So you need certification?
It's more the mindset than the paper. What am I doing that is different now or will it make a future problem? And the workers have to feel responsible for it themselves. I always say you have to do it like it's your own home.

Thank you very much.

MATURA ORAL HISTORY INTERVIEWS
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KAREL DEKKER

What led to the development of the Matura concept at the beginning? What was happening in the industry at large - at that time - that provided what was believed to be an opening for Matura?
I think the circumstances were there that … there were a lot of studies by SAR, the Bouwcentrum in Rotterdam, and ARO at that time. ARO was my office. Studies about modular coordination, the impact of the distinction of support and infill, and discussions with the industry how to implement modular coordination in the industrialized systems. And the discussions and the programs were leading in 1984 to a program where they said 'is it possible to combine the efforts of the industry because of some industrial companies at that time, Nevanco, the same company's now called Heembeton, and make their spokesmen and there was a contradiction between the group of van Randen and the SAR, and the industry. They were competing and quarreling about the rules of modular coordination, and at that time the Ministry of Economic Affairs decided that this must be ended, this quarreling. It's not good for the industry, not good for development in the building industry. They required that we get consensus between industry and academics.

Why was modular coordination the focus of that conflict?
Now that was because the idea at that time was that modular coordination was needed for very efficient production in the building industry, so that all building partners could develop their products independent from each other, and modular coordination guaranteed that the products fit to each other.

And everybody believed that was really important?
The concrete and windows industry believed that it was very important, and about 10, 20 percent of the architects and also the academic world in Eindhoven (Bax and Fassbinder) and the academic group in Delft (OBOM), were also thinking that it was needed for a better building process. It was needed to have system rules and if there are rules for the industry, then companies can work independently and have project-independent developments that still work together on the building site.

This was happening in the early '80s?
Yes. It was happening in the early '80s. But all these studies cost a lot of money, and the Ministry of Economic Affairs believed that if there was no consensus between the academic world and the architects, and the industry, that there was a waste of time. But we decided together, and that was the time the Ministry of Economic Affairs asked me to coordinate the consensus, and they said 'can you organize it?' and then we had a meeting on the boat of Age van Randen and we tried to find a method to get consensus between industry and SAR and the academic world, and we were successful, and then there was a new philosophy coming, and that was that we agreed about a new way of modular coordination, very similar to the old one, but more clicking at the 1 M module. The industry didn't like the symmetrical measures as ½ of 3M and ¼ of 3 M. They want to have modules and the smallest module 100 mm. In this "Agreement of Eernewoude", the basic rules were depicted and all parties signed the document. After it the new code NEN 6000 was set up. The building industry ("Progresbouw") organized to write about implementation of the new rules for MC. And that was the time we thought there was a change; now industry was ready to work together. And then they said 'Can we give it a new name?' Not support and infill, but can we give it a new name? Then we were adding something to the total idea. We say okay, support and infill was very important for everyone; modular coordination was also, but the industry said the performance approach was also very important. Performance requirements and drawings from the designers, and power from the industry to make the

technical design, and to offer total solutions, and the three together, those three ideas together, they were calling that 'open building' method.

Who was calling it open building method?
The total group: SAR, OBOM, ARO, the industry (Progresbouw) were calling that the open building method. For this open building method, they want to use principles and made a handbook. That was the time I was heavily involved in these developments because on behalf of the ministry, they asked me to coordinate the R&D programs. So in the same time, a governmental policy idea was in discussion to make an innovation development program, IOP BOUW. For the building industry work plans were needed for further developments. Four work plans: Open Building, Materials and Products, Environmental Impacts and Information Technology. The first three work plans were written and coordinated by ARO. The work plans were supported with a lot of money. The studies in these programs had to be carried out by the academic world - by the universities - together with the industries. In Delft, there was special focus on building technology under the leadership of Professor Age van Randen, where he had established the working group, OBOM. OBOM made a proposal for the work plan materials and products, and they got the funding. They did the study about the materials and products, about how materials and products are related to each other, knowledge about the building node and relationships. What were the relationships and interfaces between products? But also they made rules for them, for the interfaces. So one of the ideas that OBOM invented was to make rules for the positions of MEP (mechanical, electrical, plumbing), the installations, to define zones in the floor for several positions of installations. In their time came the idea also that there must be the possibility to develop an infill system.

Can you put a date on this period that included the national funding program?
Started in '84 and running to '86, '87, and in that time there was the idea that this system of rules could be good enough for the industry to start an infill industry.

It was discussed even at that time.
Yes, it was discussed at that time that it could be a good idea.

An infill industry - that idea was coming up even then?
That was also coming up. That was a theoretical approach. It was coming up, and it was also in all kind of lectures, papers, and it was in that time an idea for product development in the industry. There were already some examples such as the Bruynzeel infill system. Bruynzeel was an important supplier for kitchens. And Bruynzeel took the initiative to develop an infill system based at the idea of Support and Infill and Modular Coordination. Bruynzeel became in this way a competitor for the contractors. They were at the same time a major supplier of building products, so they were warned, but it was not official, that if they go on doing it, they could lose the suppliers position of the big contractors.

This was before 1980, right?
Yes, about 1974-1976

But he first Bruynzeel infill package was used in Adelaide Road in England in 1968.
Yes, you are right, that was the first. And in the Netherlands, there was an attempt to use it in a project in Dordrecht.

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Fokke de Jong's project, right?
Fokke deJong (JOB) was architect of a housing project in Sterrenburg III, Dordrecht a support – infill project with Bruynzeel infill systems. In that time there were heavy negotiations with the contractor about the cost of the infill system and the other part – the support. In that time, it was about 1975, '76, '78, that was the time that I was coordinating architect for the projects Sterrenburg III. Negotiations about the cost of the industrial infill system compared with traditional construction were difficult but successful. The publication "Supports can cost less money" (from MIT, 1981) was based on the Bruynzeel studies about costs.

And you used Bruynzeel infill?
We were discussing about the infill industry, like Bruynzeel infill - from the '70s. The vision was at that time an idea that was not new, although it was beginning, it was not accepted by the big contractors. They said okay - it was about '85 - they said 'Okay, let's come together, we want to support an idea—one of the biggest contractors was Wilma—we want to support the idea of open building and we want to support the idea that we will do it." The contractors were afraid to lose one third of their production, and they wanted to do it themselves, and they had big layouts on a big exposition, and everyone was thinking that now, it is changing, and in the Netherlands there was the Foundation of Open Building, and in the Foundation of Open Building, it was industry, research, and university together in one foundation. In that time we were thinking about a new approach, and that was '84. And in '82 was the start of the innovation program. In that time, I was a member of the board of SAR, so I had very good connections with the other members of the board and SAR and Age van Randen was a good friend and board member. We were already in a kind of an "in-crowd", the SAR in-crowd.
So the contractors agreed to the principles of modular coordination, performance requirements, and support/infill. Even before that Bruynzeel had developed an infill package, and they'd used it in Lunetten, Dordrecht and Schiedam and before that in England.
There was also a study about whether the consumers liked it, and there were several kinds of infill possibilities. There was also an infill system used by Frans van der Werf and his project in Keyenburg.

Was that Nijhuis?
Yes, and that was also an infill system, and there was one model dwelling built by Wilma, and they asked hundreds of people to come and to fill in forms what they like, if they like it.

Did Wilma's project have their own infill system?
They were not developing their own; they were using standard products from the market. They thought they could arrange it themselves, and not by one party but using separate subcontractors for electricity, etc, etc, It's not one team; that was later. In that time, there was discussion enough and there were also successful conferences, and there were many reports. They were a philosophy of believing in it. In that time, in the same time of the innovation programs, OBOM, Age, and the group and all the people who were around were believing it was happening now. There was a market for it.

The time was ready
The time was ready.

The Netherlands is a small market. It's a small country. Do you know if there were similar conversations happening in the larger European arena about modular coordination, performance, and support / infill or is this really just a Dutch conversation?

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Mainly Dutch conversation, but we were invited in 1988 for instance by the university in *Weimar (DDR).* We were giving, with a delegation of the SAR, seminars for the students. We got an enthusiastic response. From that time we started to spread the ideas of Open Building within the CIB and we thought 'perhaps CIB could also could be a forum for the ideas'. We visited a Support and Infill project in London. Bruynzeel was carrying out an infill project with the "Bruynzeel infill system". In that time the power of the labor unions was very strong. Multifunctional professionals were not allowed. For instance a carpenter was not allowed to do painting.

Labor jurisdiction boundaries
Yes there are many. For instance, the Bruynzeel infill installation was used in London. It was not allowed to use multi-skilled craftsmen. So there were 14 people coming to do one part of the infill system. The idea of one multi-disciplinary team making the infill including installations failed. In France there are special requirements for craftsmen for installations, so multi-skill work is difficult.

So, back to the Netherlands… you're saying there was a strong consensus that modular coordination was the key to the development of better infill and performance requirements was a key, and that contractors were interested; but then the contractors decided to do it all themselves; so was there a wind against the development of a separate infill industry? Some people were saying yes, an infill industry is important, and other people were saying, wait a minute, this is taking jobs away from contractors, and no we don't want to do that.
It was a hidden resistance. I never got a verification of it, but they said Bruynzeel was warned that if they continue with a self-developed and contracted infill system they should lose their other contracts. An independent infill industry is competing with the main contractors, and that was not allowed.

And this came after years of Bruynzeel's development of their infill, but at a certain point they were starting to get market share, and they were slapped - don't do this anymore.
An evaluation report on behalf of the Ministry of Housing discussed about the reasons why infill systems and others were failing and an independent infill industry was failing. The **first reason** is a conservative construction industry, not willing to lose any part of their turnover. The **second reason** that was in the report was that the requirements by the infill system for the support were so high in flatness of the floor slab and all kinds of requirements so that the infill system could fit in, in a good way, that they didn't accept these requirements. That was mentioned as one of the problems. The **third one** was that the tenants have no power at all. In 1980 a report from ARO showed the real economical consequences of separation of support and infill. I think that was just after the period that Bruynzeel and Nijhuis were doing the infill systems in Dordrecht and Keyenburg. Later the projects in Lunetten and in Schiedam could profit from this knowledge.

Were other companies developing either total systems or partial infill systems at that same time?
No, there were partial developments for other systems for instance - here is a report in about 1996 about an evaluation of the use of infill systems and flexible building etc., etc. They discussed for instance the Esprit House, Actibo, Interlevel, Matura. Only Matura was a fully integral system. These were the four developments in the Netherlands.

And those were in the 1990s, right?
Yes, at the same time.

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In the years before 1990, the only two players were Bruynzeel and Nijhuis
Yes. The first dwelling of Matura was in about '89 in Eindhoven. That was the first one.

But of course the actual development of Matura started in '85, '86 with the partners working together, the early mockups in Jan van Vonderen's company, and the actual design of the technology was beginning already in '85 with Matura.
It was not named Matura in '85 because the first ideas came in the systematic OBOM study where Habraken and van Randen were working together on a new way of distinctions of layers in the added floor layer, and how to do this. That was before the initiative to do it themselves, and to develop their own company.

Do you have other things you'd like to tell about things that were happening in the Dutch industry environment, discussions on regulations and the legal and economic issues that you believe were important to giving confidence to the Matura partners that it was a good time to develop a comprehensive system? Not individual products, but a comprehensive system despite all the failures of such comprehensive systems in the past. I'm very interested to know why the partners felt confident that this was the time.
I think that we had in that time two developments. One was the industry found the right people who want to work together on a real Open Building System. In the same time, however, we have an association of housing corporations, and that association of housing corporations was worried about big contractors and their power. They were thinking that the big contractors were working without competition and the big contractors got too much power in this development. That was the thing the housing associations didn't want; there was a resistance in that area.

This was before the national government started to withdraw from controlling the housing supply. This is when the government was very active …
That was about 1990. Later, much later, and there was the first study of the consequences of withdrawing the government from a direct influence on social housing. The first report I know was in 1993, that was about the consequences of this policy for social housing and the consequences for the people. In 1994, that was when I think the government was withdrawing from social housing.

So, the reason for the question is that in the 80s when the groundwork was being laid for infill systems … the centers of power were clearly the national government, housing associations, and contractors.
There was a power from the government related to building technology - Ministry of Economic Affairs.

Government had the power to stimulate
Stimulating innovations with the program and ideas, and they thought 'okay.' There was an innovation program for the Ministry of Housing. However, later, we recognized that it was related to some specific individuals with a clear vision. They had power in these ministries, for instance, in the Ministry of Housing was that Wim Bakens - he was coordinator of all the new studies about modular coordination and innovative developments on behalf of the ministry, etc., also the establishment of the foundation of open building strongly supported, etc.

This is important contextual information… the market operating the way we know it today wasn't operating much in those times. Government was a very, very strong player, in pulling the strings, and making things happen, directing resources, so the number of players was actually quite small.

Yes. And in the same time, the government was steering very heavy on social housing but also on subsidizing owned houses.

Subsidizing market rate housing
Yes. There were market regulations. And in the '80s - I think it was '84, '85 - in the same time, there was a real estate crash in the Netherlands. And that means there was a big problem with selling houses. But in that time things were completely different from the crisis now (2008-14). The government was able to help the building industry. They offered the building industry that all the unsold houses could change to subsidized rented houses. So they tried to prevent a serious problem in the building industry. However the total real estate market was going down, also jobs of architects were going down and for contractors, too. In that time, '84, '85, '86 there was a recession in the building industry and real estate. In the beginning of the '80s, craftsmen were scarce so there was a tendency to more industrialization. Later in the mid '80s there was no problem to get enough people on the building site so it seemed cheaper to build at a traditional way.

Well-trained and skilled
It was for economic reasons that it was not needed anymore to industrialize. We can do it the "old fashioned way." And that was the time that - for instance - the companies that invested a lot in industrialized housing - had a problem. They invested so much money, but they couldn't change the policy so fast. Then you saw there was a moment when innovations were halted, and they fell back on traditional methods.

Was the market at that time growing for the renovation of existing buildings?
Not yet - totally not yet.

New construction was still dominant?
All new construction, yes, 'till the second half of the '90s

We remember that one of the guiding principles for Matura was that it was useful both for new construction and renovation; that it was a smart thing to focus not on just new construction.
Yes, but it was typical perhaps with construction firms like ERA which was one of the first construction companies working in the existing stock which were confronted with the idea of renovating a whole block, and also doing one-by-one infill. Also, learning fast track renovations so that they would not hamper the people. They were doing this in 1990, 1991, 1992, and they were one of the first companies in the Netherlands who were so experienced in the existing buildings that they were advanced in the second half of the '90s they were being recognized in the literature for getting lot of projects for renovating existing buildings. This was later. It was a good idea, Matura was saying, the whole package must go through the front door - that was very important.

The story you're telling in the '70s and '80s up to '94, the political power of the central government in steering investments and steering money to technology innovation, the social housing market, the management of rents and production, it was so strong, that was the climate in which the partners decided to launch the Matura development, and to make the support/infill concept viable. I'm speculating, but do you think the ideas were heavily influenced by the reality of the political power structure running the housing market at that time? Now you're in a very different situation with the government having withdrawn from pulling the strings. So that kind of political and economic reality …

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how did it have an impact on the thinking, the technology development, the business structure, the way of marketing and so on that we saw in Matura Netherlands?
I don't believe that I can draw a causal relationship between the policy of the government at that moment and the changing in the industry at that time and in the idea that it was a good time to set up a consumer-oriented infill industry. They believed that the consumer should become much, much more powerful in that period.

But they weren't. Consumers were not powerful.
They thought that because of the crisis in 1980, there were not a lot of houses sold. In that time the consumer was much, much more critical about what they could buy. In that time there was no crisis. They could sell on one Saturday afternoon, 200, 300 houses. … But when later there was a crisis, they thought that the advantage of the crisis was that the consumer could get more power.

But it didn't happen.
It did not really happen, no, but it was one of the backgrounds, and the policy of the government was also to try to improve the power of consumers, and also the government was not able to do it. And the government said 'okay we will withdraw from (in the 90s) the social housing and make the social housing companies more self-supporting.' Also the idea when they are self-supporting, they have no central rules anymore; then they can focus on the consumers; a very kind, friendly relationship with the consumers and give them power. In that same period – that was about 1991 - one housing corporation in Voorburg got interested in the philosophy 'the consumer is the boss behind the front door' - they were the first in the Netherlands. For a long time, they were the only one. In the housing corporations, the consumer was not as powerful as we hoped, and that was also - if it should happen, it should be a much better for a consumer oriented infill industry.

Your experience with Matura was most direct in the Voorburg renovation project?
Yes.

What did you then, or do you now think were the strong points of the Matura system's technical design? You wanted to do the one-unit-at-a time renovation. You developed the economic model for it. You convinced the housing association it would be a profitable approach, and then you went looking for companies who could deliver the infill.
Yes.

Well, what other companies or methods did you identify who could meet your performance requirements? Was Matura one of several, or the only one who could deliver for you? And if there were several competing providers, I'm interested in knowing what you were looking for and how Matura's solution was the strongest one of the choices you had.
When I was installed into the board of the housing corporation in Voorburg, I was confronted with the Beatrixlaan project and there was already an architect making plans for renovation. The architect made a plan not related to the distinction of the support and infill. He was a good architect, but he was not aware of it, and he was also not willing to listen to my ideas. He was making a design for the refurbishment, and we had a meeting with the tenants, and this was just a few weeks after I became a member of the board. I was involved in that meeting with the tenants, and the tenants were angry about the ideas and the plans, and they were not satisfied, and then I was asking the tenants 'how should you like it if you will decide yourself everything behind the *front door, a*bout your quality, the kitchen, the bathroom, everything, and you decide together about the total/overall renovation?' Then I

found that the people were reacting very positively in that meeting, so I promised to come back with another proposal. After discussions with the architect we concluded to separate our ways. We were looking to another architect who was able to work with our ideas. And I proposed Henk Reijenga, out of the school of SAR. He became the new architect for the renovation project there. You ask me why I thought Matura was fitting: I was intending to split the decision making about the environment at the tissue level - the urban fabric, with the trees, the parking, public spaces and everything around the building blocks, discussing it with the whole neighborhood. And I wanted to discuss everything that was renovated in the building block with only the people who were affected by it, the tenants of that block; and for the tenants I wanted this one-by-one renovation process, to discuss this with each family "one-by-one." I was studying how can you organize it, and it was in that time that there was a government innovation development program (IOP). In that time also the OBOM working group was involved in this innovation development program. "Materials and Products." They were looking for a demonstration pilot project. The Beatrixlaan project could be one of the demonstration projects for the OBOM study about restructuring the existing stock. There was a conference about the study results, and I asked my board members to participate in this conference. They were enthusiastic about the ideas of a consumer-oriented infill package to be used in our project. I asked my board to provide an empty dwelling for this experiment with one house, one dwelling, with a new infill system developed by Matura. You ask "why Matura and not the other ones?" Matura was the only one who could fulfill exactly in a short time what we needed. Our objective was to strip the existing infill in one week, and to complete a new fit out system in maximum two weeks, then with one week to finish everything, only one month with no rent for the association. This is the unit you helped install, as I remember.

Where I'm going with that is the extent to which the formulation of your economic model and convincing the residents to work with the separation of the shared part and the individual part, whether that was all predicated on your knowing that Matura was there to be used; or whether you were developing the decision and economic model and so on and then looking for alternative solutions for it, and then you said, 'the only one out there is Matura."
After this study about alternative solutions, the OBOM study about economics was that it could be feasible. For the Voorburg project I developed a tailor made economical model to achieve the total cost for the tenants, total cost for the housing company, and the Net Present Value for 30 years of exploitation.

You already knew about OBOM's studies, the principle of the separation of support and infill, right, so that was very influential in your development of this economic model, right? You were part of SAR, you were part of the open building foundation and of course … you were part of that network of people. Were you aware at the beginning of the Voorburg effort that the Matura partners were working hard to develop an infill system?
Yes, they already proposed to have an infill system for new dwellings. They had already made one in Eindhoven.

You thought, we could use that over here'?
We could use that in Voorburg, yes.

And there were no competitive alternatives to Matura?
No, they don't come to my mind. I think it was not studied, because I studied the cost of the separated innovations on the *traditional way;* what should it cost to do a one-by-one renovation when it was run the traditional way, and it was unbelievable how expensive that was. So I was deciding to make a

distinction between the social rent for the support and the market rent for the infill. I calculated the social rent for the support and the investments for renovation over 30 years. After showing the evidence that a healthy exploitation of the support over 30 years was possible the strategy to rent out the infill for the market rent with a shorter depreciation will give a balanced economical situation. It was a completely new approach about calculating the future costs and benefits. To construct one-by-one in a traditional way was too expensive and cost too much time. This flexible Matura concept gave the tenants complete freedom in their choice of how to arrange their dwelling. Matura could fulfill both the tenants' wishes and construct the fit-out system in 10 working days.

What turned out to be the weak points – technical, performance, etc. of Matura in the Voorburg project – the weak points of their comprehensive approach?
The requirements for the old building after stripping out the old infill. The requirements for the floor and for other measurements were very high - that that was … a big problem.

Could you be more specific about that?
The floor. The requirement for flatness of the old surface of the floor was a big problem. We had no solution for it at that time.

How did you solve it? Leveling the floor.
Yes, leveling the floor was one thing.

So how did they solve it? Do you remember?
I think with some liquid equalizer

Liquid gypsum or something like that
Yes, special for solving differences in the floor surface. A special problem was the quality of the existing core for installations. A new installation shaft was provided in all staircases at the same time that we installed the elevators. The new shaft was situated so that it could contain the new piping for the individual infill systems and also the individual heating systems. The existing building had a collective heating system and after the individual renovation, we wanted an individual heating system integrated in the Matura packet. Everything was prepared, so the only thing to do to install the individual heating system in each unit, delivered by Matura, but also to connect all the piping to the new central shaft. The old shaft had to be still in use because it was in use by the dwellings on the other floors. There were not so many technical problems in the project. It was really positive.

Were the costs okay in the end for the total cost of the project? Did it stay in line with your projections and your model?
I had not negotiated the price with Matura. They made a detailed offer, and I got a total explanation with an open book, with the price of about 30 thousand guilders per house for different types, A, B, and C. That was a good negotiation with no big problems. I accepted the costs at one point, and the benefits were how could I organize my total model in this special market for this infill system. Typically, the people complained about the increase of the rent of the whole - I explained in my article, it was 75 guilders at that time, or about 35 dollars. And that was for upgrading the whole – the support. They got new balconies. They got new elevators. They got new staircases. They got insulation, and a new insulated roof, new glass, less energy costs. They were complaining about 75 guilders per month extra!

And individually, they decided themselves how to do it in their own apartments. And it was 200 guilders per individual a month. It was no problem! That was one of the findings of spending that was fairly important. When people decide for themselves, they also decide about their own budget and that is not a problem. If it is a collective cost, they just discuss it. And that was an interesting idea, and therefore it was also one of the ideas in the market studies that Matura was thinking about. Individual people wanted to pay more, and it was already proven by the kitchen industry. I can't remember that there were many negative points. There was a point of some people complaining that the power plugs were only close to the floor. They wanted them moved one meter higher. What do I say? That was small.

Did Matura do a good job of interaction between their company and the individual tenants in the Voorburg project? How did that actually work? When an apartment became available, it was cleaned out, Matura was there, and the new tenant went to Breda and sat down with them, right?
It was working so that when there was an existing tenant leaving, we knew it one month before leaving, that was the general rule, one month before he leaves, he has to write a letter to cancel the rent contract.

Give notice.
We gave the order also at that time to empty the unit four weeks later. In the same four weeks, we have examples from the architect about how you could make your layout. In that period, there was a new renter coming from the list, and then the renter was asked 'you can get also new infill, but that costs extra money, and you can review the choices and you can discuss exactly what you want,' then during that period of four weeks, also Matura got in contact with the new tenant, discussing the possibilities.

It is very important not to force people to leave during the construction. Then you have to pay 4000, 5000 guilders for people when they move out and come back. I saved 5000 per house only because we said 'you can stay there during the renovation time.' And that was a financial advantage. A big change was that this part was rented out with a long lifetime and a low depreciation and low interest rate, and the infill was expensive for the people. They paid a lot more. They paid 7 percent for the interest rate cost. We had two systems economically, the short-time, expensive, market oriented, and critical was also the housing, the more social thinking people thinking about the housing, then here you get someone living in this house, and it is 100 guilders more expensive than the neighbor. We don't like that, that it is so different. That was a BIG discussion in that time. They didn't accept different rents between neighbors. That is now not a problem anymore, I think, but in that time, it was very heavy discussion. Everyone should be equal in the social housing. Now it is come back into discussion, because it is not allowed to rent out for people earning more than 33,000 Euros a year. If they don't earn that, they can't afford the luxury infill. They can't pay it. You have to find new ways to do it, and then you have to rent out empty and to do it in a complete separate contract not renting.

So the tenant got on the train, went to Breda, went to the showroom?
The only way to show the kitchen etc. was to visit the showroom in Breda.

And Louise sat down with them in front of a computer and showed them the alternatives, and they had a discussion. They talked about cost.
With the renters only the extra facilities and their costs were discussed. With the owned dwellings also the costs of the whole infill package were negotiated. And I said, okay, I agreed with the process and this is my budget for the rented dwellings. You don't get more than this budget. Only when you agree with the tenant that he will pay more himself for extra's. That was also possible. One of the tenants said they wanted a luxury kitchen and would postpone buying a new car.

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You told the tenant that they had a budget, or you told Matura that they had a budget?
Both. You told the tenant what kind of an infill he could have, and they could show it in the showroom. It's not complicated. As I said before there was a difference between rented out and sold dwellings.

Not complicated at all? Okay. Did Matura perform well in respect to the discussions with the tenants?
There was an evaluation of the whole idea. Evaluation with the tenants was in 1990, 1994.

You made the evaluation?
No, no. The evaluation report was independent. There was a working conference organized by the housing cooperation, and in the working conference, there was an evaluation. And that was just after the video film was finished. We had the conference, and the evaluation of the people, how did they like the renovation, how did they like the ideas, and how did they like the other things, and one conference was a workshop about 'behind the *front door'* led by myself and Rob Geraedts, and there was another workshop about the urban *tissue*.

When you say a conference?
It was more a workshop with the tenants and board and staff members of the housing cooperation.

It wasn't a public discussion.
Not a public discussion. We had discussions with the people of the project but also the project leader of social housing. Staff from the municipality of Voorburg, also the director of wellness, and some people from the local council of elderly people, … the manager of the housing association, the umbrella group, and there was also, … we have a national housing association of renters, and the chairlady of that association was also there. So in the workshop, it was a mix of the people …

The tenants?
Yes, the tenants, and experts, from all areas.

1994
Yes, in 1994, we evaluated the whole process, not only the infill system. Just after that, one year later, the project was awarded in1995 in a national competition, the most innovative project for the existing stock. We got the first prize. We had two evaluations of the project. And people were very satisfied. There was only one problem. In the beginning and in the economic models and also in thinking of Matura, before we started the renovation process, we expected at least 12, 14, 15 people to move every year. After we renovated the project – the support - we had calculated that every year 10 people could move, and 10 infill systems could be delivered per year. That means 50 in five years. After the support renovations people were so happy there they didn't move: only 2 per year. The whole concept of delivering infill systems at a regular basis failed because the people were so satisfied that they didn't want to move anymore.

They were satisfied with the upgrade of the tissue level and the base building …
Yes. People require a house, but they also require an environment. They require elevators so they don't have to walk up the stairs. People were so satisfied with their beautiful balconies and all of it. And, inside, people were the boss. They could do what they want. They could do it themselves. They could make a palace of it by DIY.

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But they didn't.
Some made a beautiful house by themselves, DIY.

But not with any special method
No, no, no, improving the kitchen, the bathroom etc., improving finishes. They were satisfied about two things: the overall environment was improved, and the block – the support - was improved. They had nice balconies. They had new elevators. They were satisfied and not moving. Not 10, 12 per year – the premise of the project - but only 2, and only when they had a new job forcing a move.

But even now, 20 years later, the people living there are still the king behind the front door.
No not any more. In 2000 there was a fusion between seven housing corporations in the region. So there was a much bigger Social Housing Company. After that, they had a new policy to not do new things. Don't experiment. Do everything at the traditional way.

So they took the power of the renter away.
Yes, but a little bit softly. And the people said okay as you do everything again. When we need a new kitchen, you do it; you pay it; why should we complain. They promised them new kitchens, new bathrooms, etc. In my opinion, I didn't promise new kitchens, new bathrooms. The tenants had to do it themselves or buy it. That's the difference.

After the 1995 award, or even at the same time, do you remember publicity and commentary in the Dutch journals about Matura?
There was a series of conferences with the name The "Apartment of the Future." In that series of conferences were all kind of actual developments in the Netherlands, and I was one of the speakers about the Voorburg project and the application of Matura. And I remember in the conferences, most participants were enthusiastic about the idea, on the other hand, they were afraid to do it; afraid for new plug and play systems as Matura and afraid for the costs to do renovation one-by-one, afraid of the distinction between the support renovation and the infill renovation. They were afraid of taking on the consequences. I never knew why they were so afraid … there'd have to be someone in an organization who strongly wanted it and has the power to do it. If that's not there … This kind of concept needs strong people with power and a strong will to do it. You had the power to choose the architect, and you were also an economic expert, you could calculate all the consequences for your own company. The board trusted you, all the conditions were positive, and then things happened. And otherwise fundamental change doesn't happen. There must be someone who wants it. One of the problems is when is that happening? We need people like Frank Bijdendijk, as he wants it, with enough power, so new ideas could be realized. It will be studied how to prevent that changing and real innovation of the building process is only depending of some people. And later, after questions about continuity of this approach, I reflected that a combination of factors and the right people at just the right places was the only main reason that it could happen, and that it is not happening in other cases. At the conference, people were enthusiastic about it, however, some people who are more socialistic side, they were complaining that our philosophy was elitist, gives too much difference in rent. … and to pay for renting a complete new fit out was only possible for the people with better incomes.

It was elitist?
That is not my opinion but a more socialistic view that all the rents have to be equal and as low as possible for everyone in the complex. In this case the tenants in this complex have different incomes and it was perfect to make the distinction between one house with a bit less and one house with a bit

more. Fitting to their own needs. They have also different cars. In many social housing companies it is not allowed to increase the rent one by one, but there was a minority in the housing policy world - and also international - that a consumer-oriented policy is needed in the coming time. My lecture about this project in 1995 in Helsinki was given in CIB W70. And they were really enthusiastic about it.

Do you think now that this is all past … it ended 15 years ago - are certain processes so different now, so different that a comprehensive infill system like Matura has a chance of finding its place in the market?
Two reasons that there are better conditions. One is after so many years the consumer gets power, it's coming more and more clear in all kind of sectors, the consumer gets more power. The technology is developing so fast that the industry delivers "mass customization" and fulfills the requirements of the consumer without extreme cost and because of the crisis, everyone is looking for new ideas how to get consumers to their project, because the number of social housing is decreasing, and sold houses are increasing. The existing housing stock has to be renewed. 30-40 years ago we were building 140, 150 thousand dwellings per year. In that period, there were a huge number of houses built, and they're now 30, 40 years old. There is a problem with noise insolation between dwellings. In the first years of Matura you must accept 100 percent of the whole system. Now you can choose only the floor system or the flexible wiring system.

Pick and choose.
Yes, you can pick and choose things depending on your requirements. I think conditions are better now.

Well, the model of a complete system from one company responsible for everything still is, I think, a controversial business model, so we'll see what happens. Do you have any other concluding observations or reflections on the Matura experience?
In my opinion and in my memories, Matura was the only concept, the only total concept completely integrated - and that was also the problem - there was no competition. There were no real competitors for Matura. Nowadays, it's just a little bit changed. There are competitors for flexible walls and flexible floor systems etc. etc. I think you need competitors in the market, and at that time, we didn't have it. Also a reflection I think that in the '90s, and in the end of the '90s, we had a lot of international contacts about these Open Building ideas and we had the idea that we got a lot of support, first in the Dessau conference about the existing building stock in Europe.

In 1993 the European Commission was giving more attention for research in the building industry after lobbying work of the big contractors. They were forming a research group together (ENCORD) and I was hired by the European Commission to provide a view for the next 25 years of construction research. In this report, open building, and consumer oriented building had an important position. The report was accepted by every one - sent out by the Commission in thousands of examples all over Europe. Read by the Finnish authorities, they said "Wow, that's good for us." And later Finland adopted in general the Open Building as main strategy for innovation. In that time I thought that the support for a new way of thinking was internationally supported.

Later on from 2000-2005 we carried out the SUREURO research project based on "Boss behind the front door", supported by the European Commission. In 7 countries 7 urban districts were refurbished at the same time based on common knowledge in all these countries about sustainable refurbishment of existing housing areas.

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In 2006 there was a European conference of the ministers of housing. How do we act with 25 million people living in our early-built mass housing blocks, how can we give them a future? The Dutch minister was presiding at the meeting and she was well informed about the results of the SUREURO project. They accepted the main ideas of the SUREURO project. But there came in new ministers after the elections. I never heard about it anymore.

The ideas disappeared.
Yes. Not all the questions I can answer because I was not involved in financing Matura.

I know, that's fine.
Something else…this conference was also, there were so many speakers. Oh, so many!

1988. Tell that story again.
In the time that the foundation of open building was active, we knew that the building regulations were one of the problems for us to get free possibility for people to design their own infill. In that time the members of the board of open building were addressing the people in parliament to change the law on that point. In the same time, the new building regulations were made and now from that time, they were performance based. The Netherlands was the first country with performance-based regulations. And the lobby was helping, and now from that moment, we had a change in the building act and it was from that time possible to design an empty floor and you got a building permission for a building with empty floors, and you could fill it in as you want. You need a permission to use the building but including the realized infill it has to fulfill the safety regulations.

When was this law passed? You said late '80s?
Writing the concepts in the late 80's. The Building Act is from 1992.

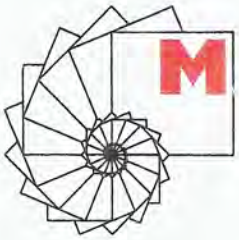
So, a building permit could be obtained without showing any floor plan at all, but the occupancy permit to occupy the space …
In the later phase, they are permitted to do the layouts, but it is also there that when you are finished with your building, you have to give a message to the local government that you finished the building and you want to use it.

And they'll inspect it at that time?
And they'll say 'okay you can use it.' There's a little bit of tension between these two permits, but it is working, but there are not so many architects using this opportunity.

Do the contractors recognize this?
Everyone recognizes it, but there is also a way of 'we cannot make a calculation without a layout,' so we do it the traditional way by making a layout. You see many plans of architects, they make the infill completely, but it is possible to give empty area to use. It is in our law to use for housing activities. It is not to use for hotel or to use for school or to use for other things, then you need another permit, and that is on a higher level. The local government is also depicting which kind of use is permitted. And in the SOLIDS in Amsterdam, many kinds of use, such as hotels, offices, living etc. are possible.

Thank you very much.

THE
MATURA
INFILL SYSTEM



THE MATURA® INFILL SYSTEM

Given an empty shell for a dwelling unit, MATURA® offers a fully prefabricated and adaptable infill system for residential construction. It includes spatial partitioning as well as all technical installations and kitchen and sanitary equipment, providing a fully equipped and habitable dwelling unit.

The MATURA® Infill System:

***Is a so called 'Open System'**, utilizing subsystems and parts that are readily available on the market like wall systems, doors and door frames, various wall finishings, as well as equipment for kitchens and bathrooms. It also can accommodate new developments of such 'off the shelve' products. All these subsystems are integrated into an adaptable whole by means of two newly developed elements: the **'Matrix Tile'** and the **'Base Profile'**. These new elements provide flexibility in design, fast installation on the site, and changeability in the future.

***Is based on a radically new distribution of technical conduits** made possible by the Matrix Tile and the Base Profile. Interface among conduits (for sewage, water, heating, electricity etc.) and between conduits and walls is minimized. Each conduits' deployment in space follows specific rules of positioning in the matrix grid, by means of which it can run freely without interference with other systems. Moreover, all conduit deployments are independent of the support structure of the building. All this assures extremely rapid installation of the technical systems serving the dwelling unit.

***Fits in any given physical context.** Installation does not pose special demands on the support structure and the facades. Thanks to the free distribution of conduits the position of vertical shafts does not determine floorplans any longer. This makes the MATURA® Infill System particularly attractive for renovation projects.

***Responds to user needs.** The systematic deployment of all parts makes future adaptation to user needs easier. Outlets for electricity, telephone, and television can be arranged by the users at any time.

***Is installed unit by unit** by a well trained team of two or three workers. A single team installs the complete infill package for one dwelling unit in a short time. This means that large scale projects with uniform floorplans are no longer a prerequisite for efficient residential construction. By employing several teams at the same time in one project, each doing a different floor plan, more units can be filled in simultaneously.

***Utilizes proprietary software.** This software allows the quick translation of a floorplan into a technical design of all subsystems needed for its realization. The technical design, in turn, automatically feeds a database which steers the selection and dimensioning of all parts needed for one unit and determines their packaging in the container from where the infill unit is installed on the site. Included in the software is proprietary know-how concerning the **dimensional coordination** of all parts allowing these parts to be cut to size before they reach the site.

***Offers advantages for all parties involved:**

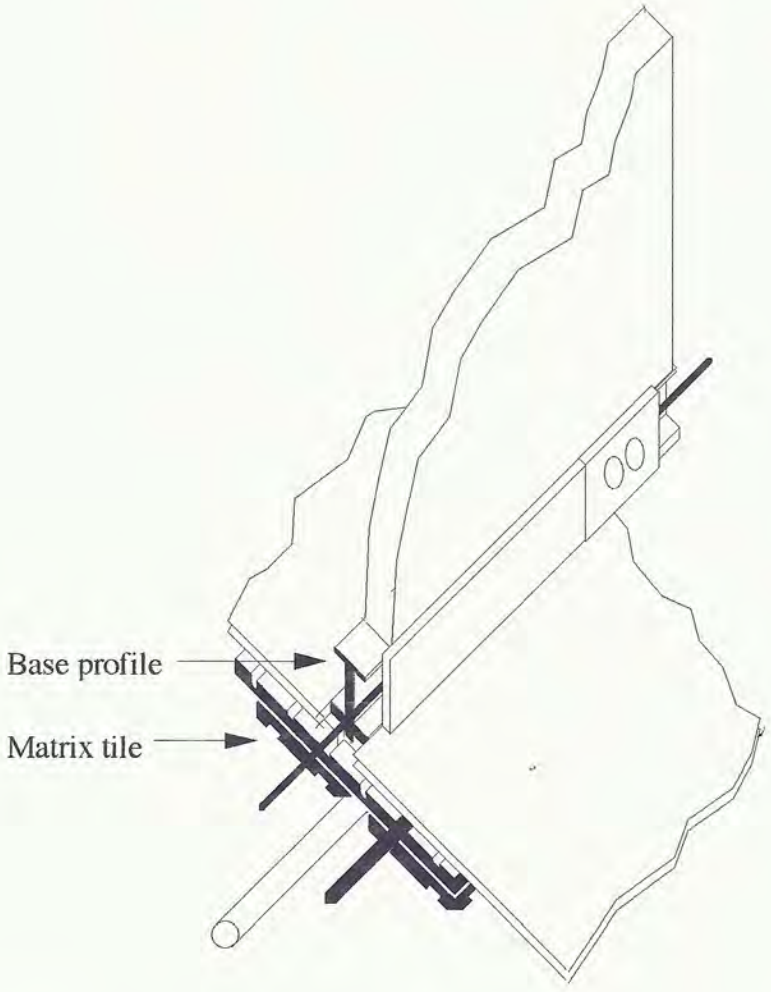
- **For the builder:** Faster installation on the site. Shorter time needed for interior finishing, less overhead, less logistics problems.
- **For the client:** Free choice of floorplans per unit. Determination of floorplans only a few weeks before installation. Choice of different wall systems, doors and door frames, wall finishings, and kitchen and sanitary equipment.
- **For the user:** Possibility to determine their own floorplan. Future adaptation of the floor plan and technical systems to changing needs. Easy adaptation and augmentation of outlets for electricity, telephone, and television to correspond to the chosen arrangement of furniture in the rooms.
- **For manufacturers:** Any technical subsystem in the MATURA® Infill System (including kitchen and bathroom equipment) can be replaced by a newer or preferred version without interference with other subsystems. Therefore improved or alternative subsystems can be offered swiftly and economically as part of the total infill system.

**

THE MATURA INFILL SYSTEM

The MATURA ® Infill System is made available for licensing by **Infill Systems BV,** which has worldwide rights.
These rights particularly relate to the deployment of technical conduits for drainage, gas, ventilation, heating, water, electricity, electronics etc., by means of the Matrix Tile and the Base Profile.
Infill Systems BV also has rights to the software used for technical design and related data.
Matura ® is a registered trade name.

Infill Systems BV
Postbox 105, 2600AC, Delft, The Netherlands.
Fax: 31-15-256.9242



The MATURA infill system offers a new way to distribute ducts and cables in a dwelling unit.

This re-organization of the technical systems reduces significantly the interference of conduits with one another leading to faster installation and increased flexibility. The new deployment of conduits in the dwelling unit is achieved by the introduction of two new parts: the 'Matrix tile' and the 'Base profile'. These are closely integrated and together make an infrastructure within which all cables and ducts have their own place.

Apart from these two new components the Matura infill system uses only parts that already are available on the market. This makes Matura a truly 'Open system' that can always utilize the newest products avaliable.

This new way of organizing the hardware goes hand in hand with advanced logistics supported by custom made software. This powerful combination allows each dwelling to be installed individually in a short time. There is no longer a need for a sequential on site organization \requiring a number of identical units. Each unit can have its own floorplan.

In the Matura system a distinction is made between the Lower System and the Upper System.

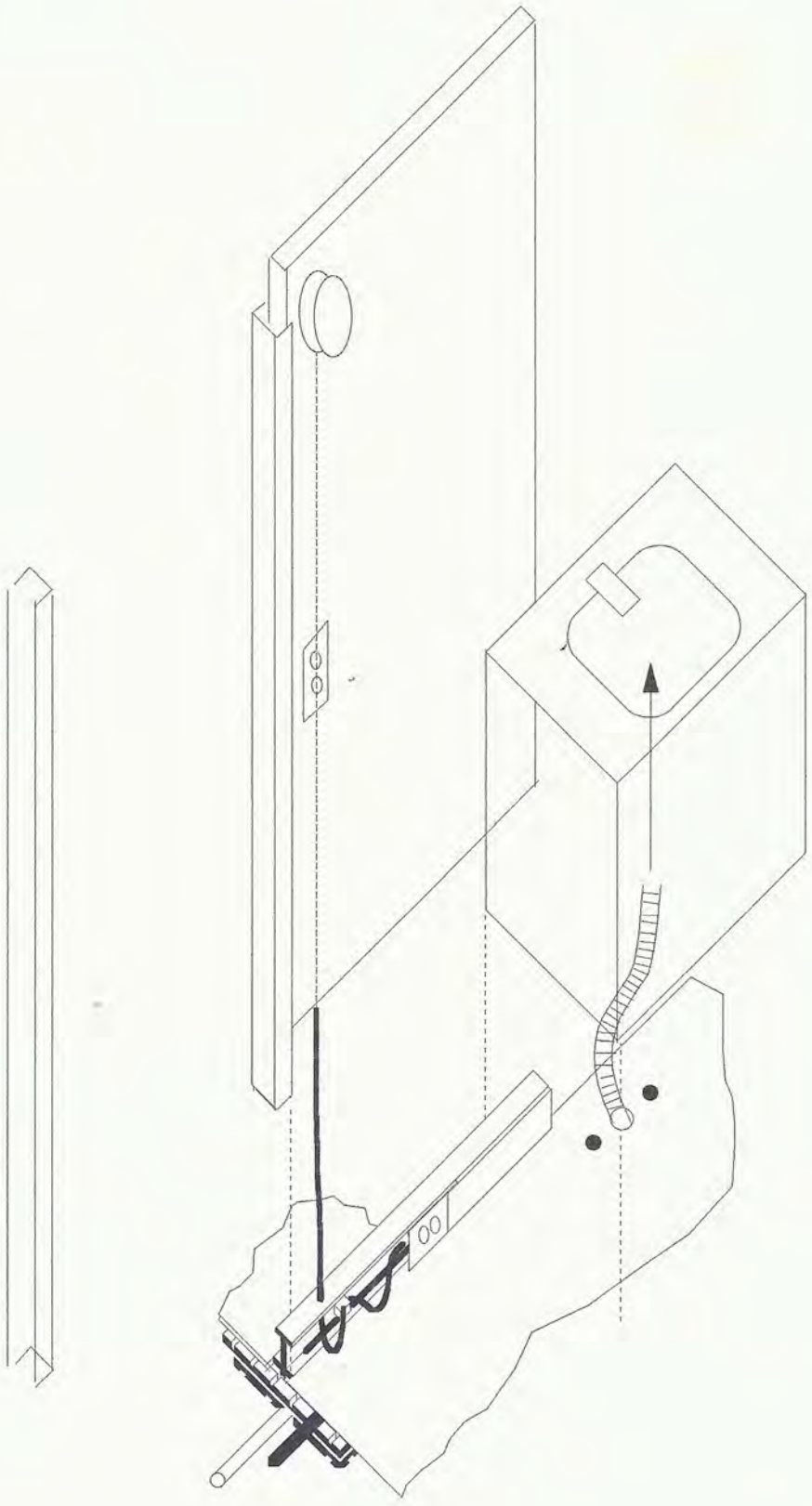
The lower system contains the Matrix tiles and the Base profiles and the tehnical systems accommodated by them.

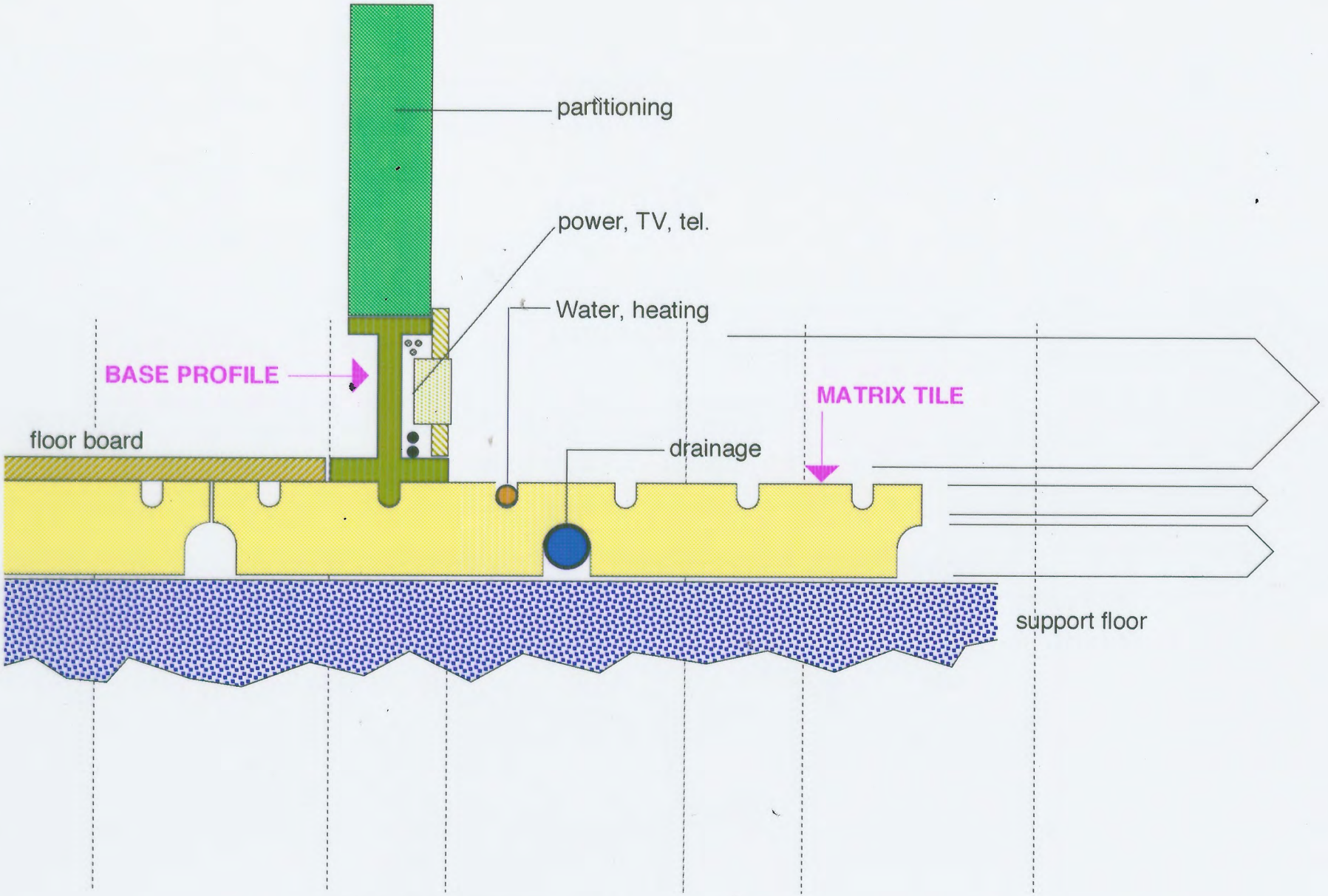
Next, partitioning walls, doorframes, doors, and equipment for bathrooms and kitchens are installed: these togehter make the upper system.

The components of the upper system are integrated with the lower system by means of plug-in sockets and flexible connections.

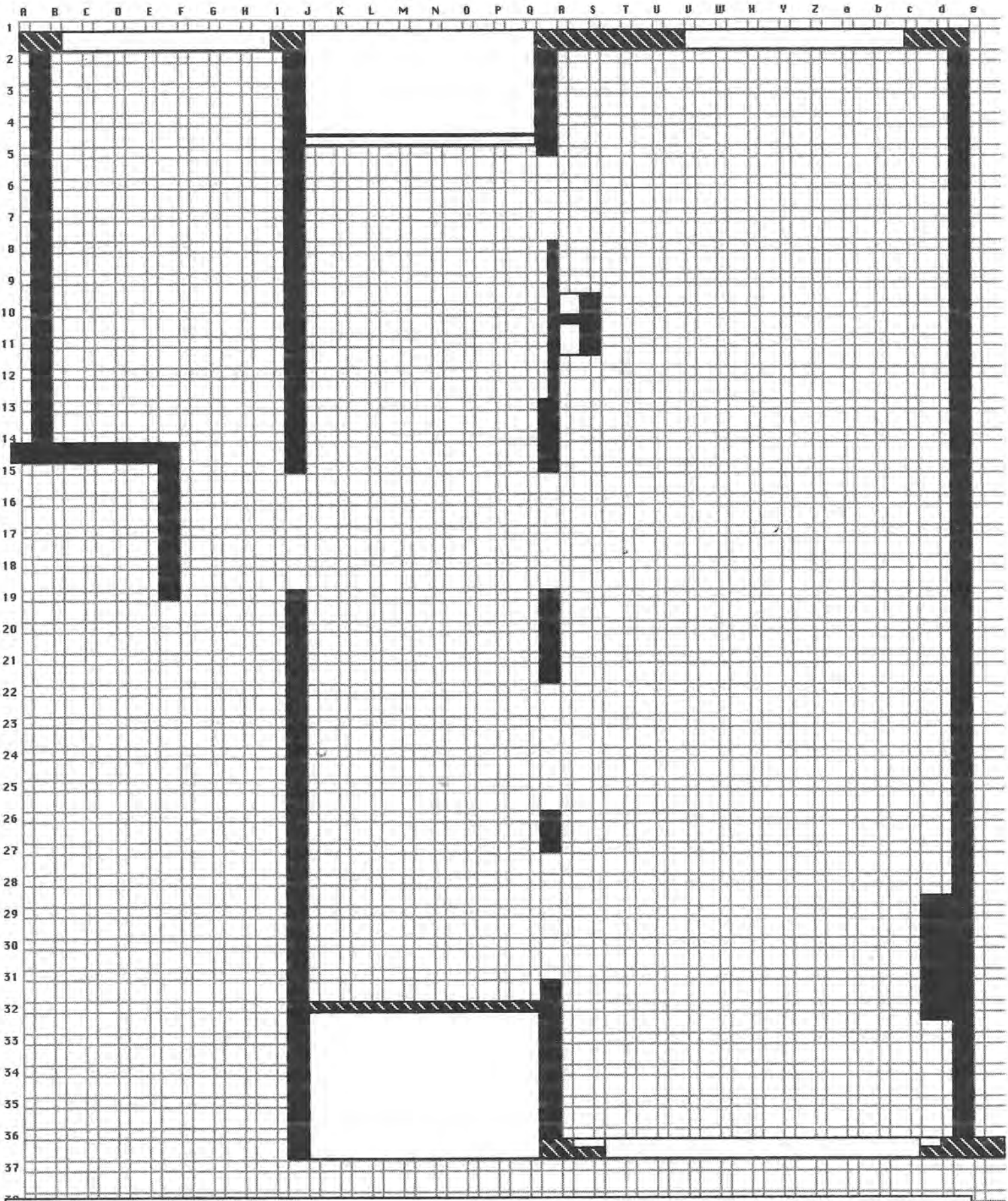
All parts of the upper system are readily available on the market and can be chosen by the client. They are subject to fashion and taste and variably priced.

The parts of the lower system are primarily selected for technical performance. Fashion is not an issue but the newest innovations can be incorporated.
The lower system , therefore, makes for a relatively stable base on which different upper systems, geared to user preferences, can function.





Matura Infill System
Section through lower system.



Tekening: **A1 drager**

Schaal 1:50

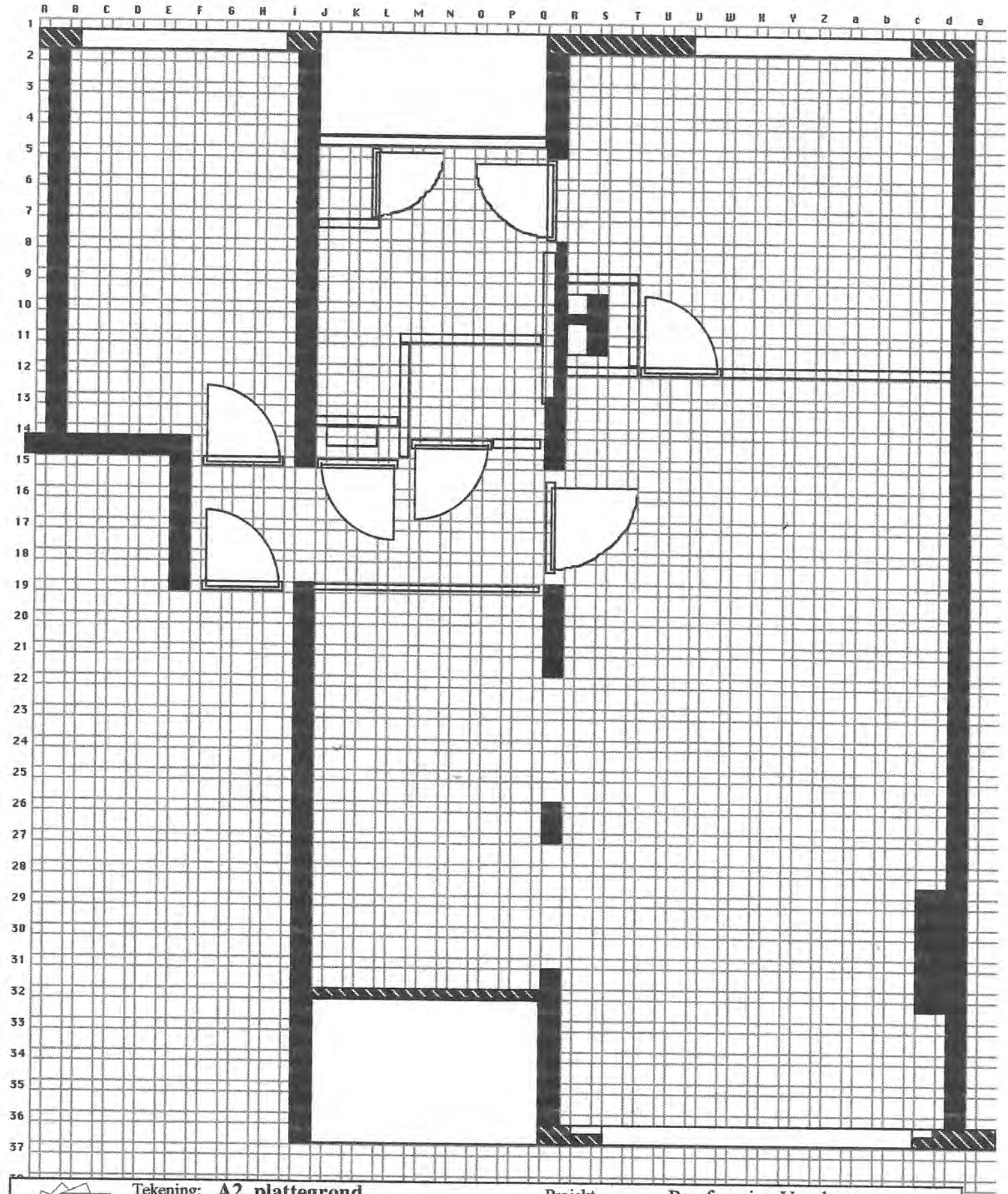
Datum 2/17/91

Projekt Proefwoning Voorburg

Opdrachtgever WBV Patrimonium

Architect Reijenga Postma Hagg

Matura Nederland



Tekening: **A2 plattegrond**

Schaal 1:50

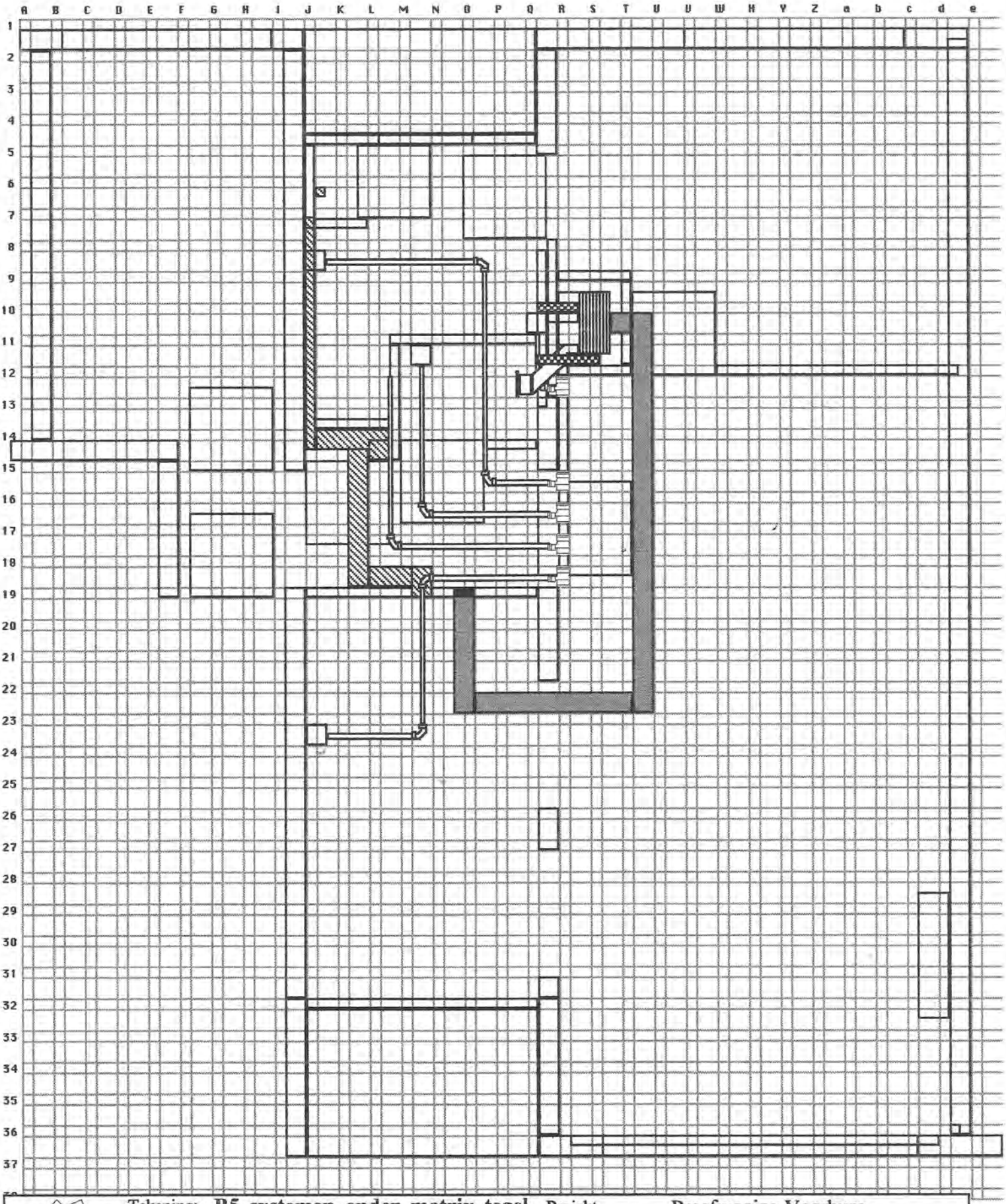
Datum 2/17/91

Projekt Proefwoning Voorburg

Opdrachtgever WBV Patrimonium

Architect Reijenga Postma Hagg

Matura Nederland

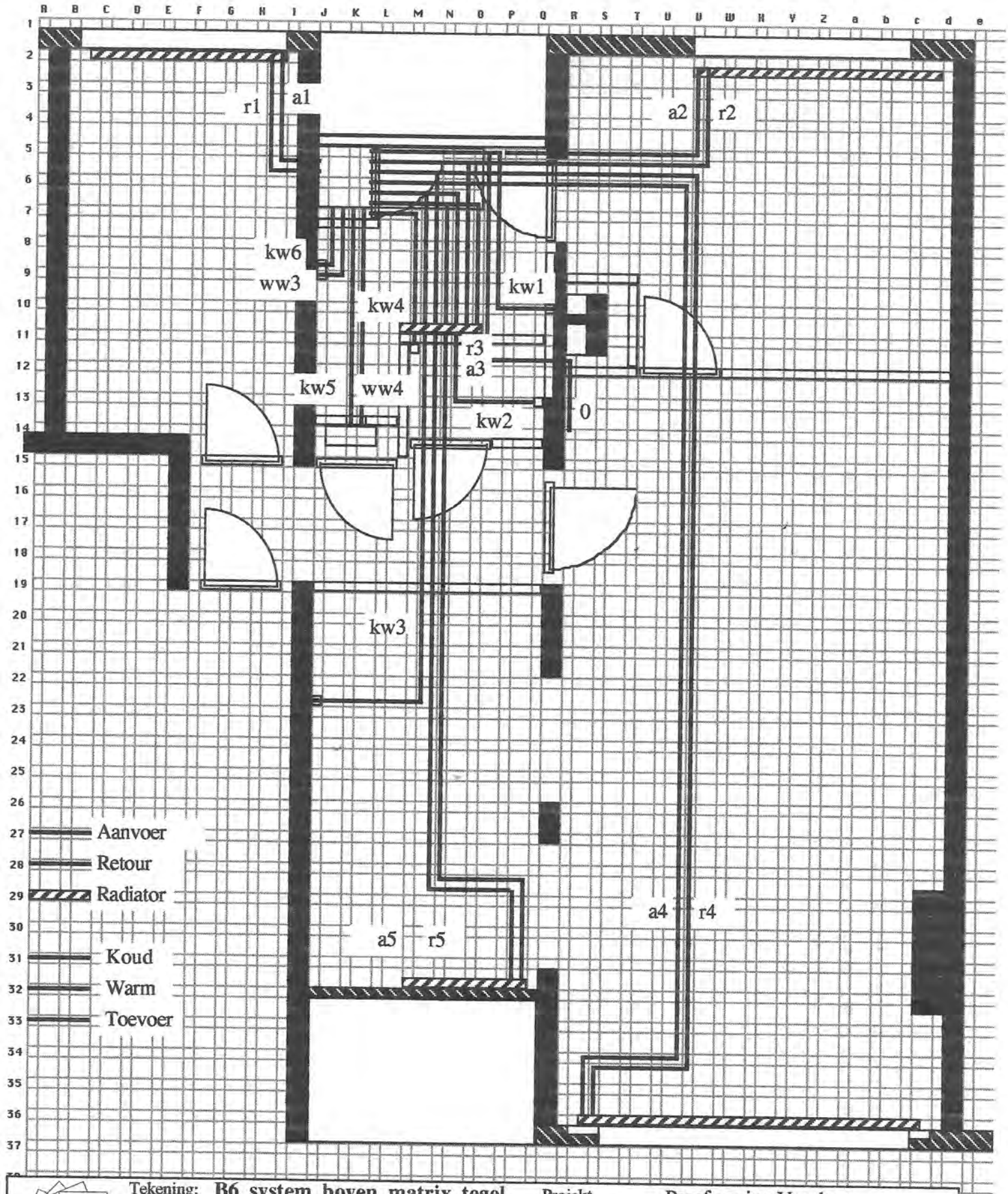


Tekening: **B5 systemen onder matrix tegel**

Schaal 1:50 Datum 2/17/91

Projekt Proefwoning Voorburg
Opdrachtgever WBV Patrimonium
Architect Reijenga Postma Hagg

Matura Nederland



Tekening: **B6 system boven matrix tegel**

Schaal 1:50

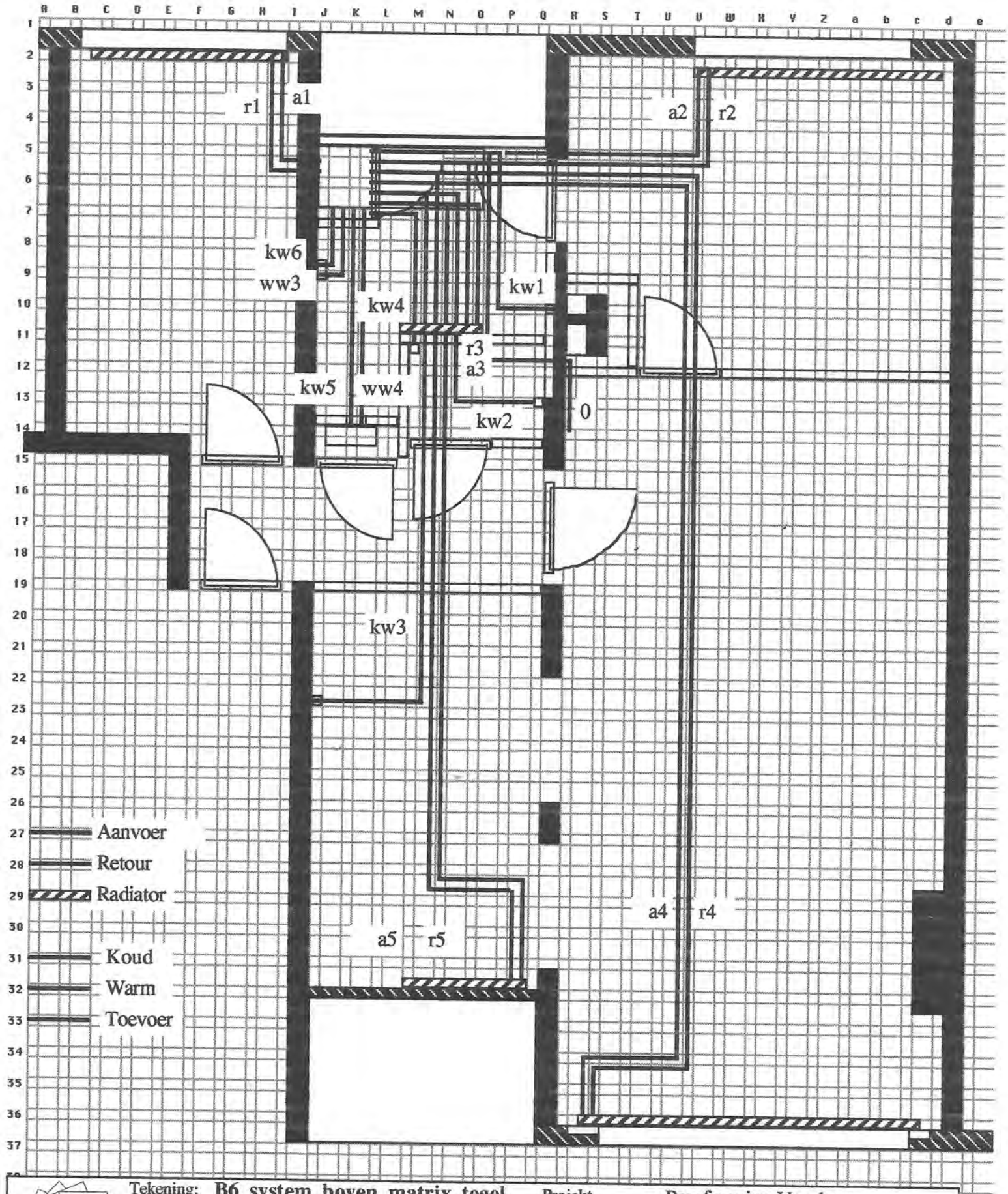
Datum 2/17/91

Projekt Proefwoning Voorburg

Opdrachtgever WBV Patrimonium

Architect Reijenga Postma Hagg

Matura Nederland



Tekening: **B6 system boven matrix tegel**

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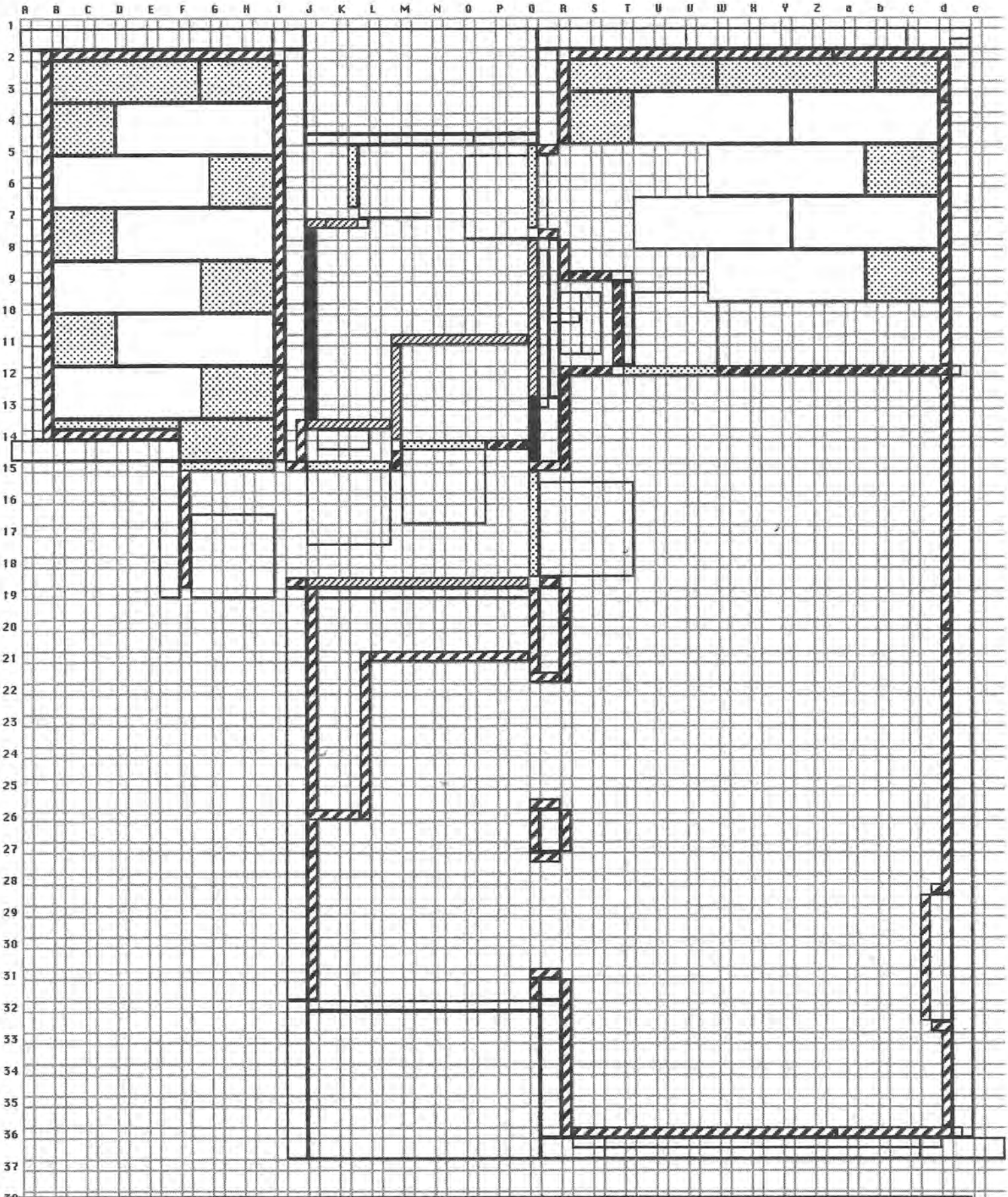
Datum 2/17/91

Projekt: Proefwoning Voorburg

Opdrachtgever: WBV Patrimonium

Architect: Reijenga Postma Hagg

Matura Nederland



Tekening: **B7 plintbalk en opdekvloer**

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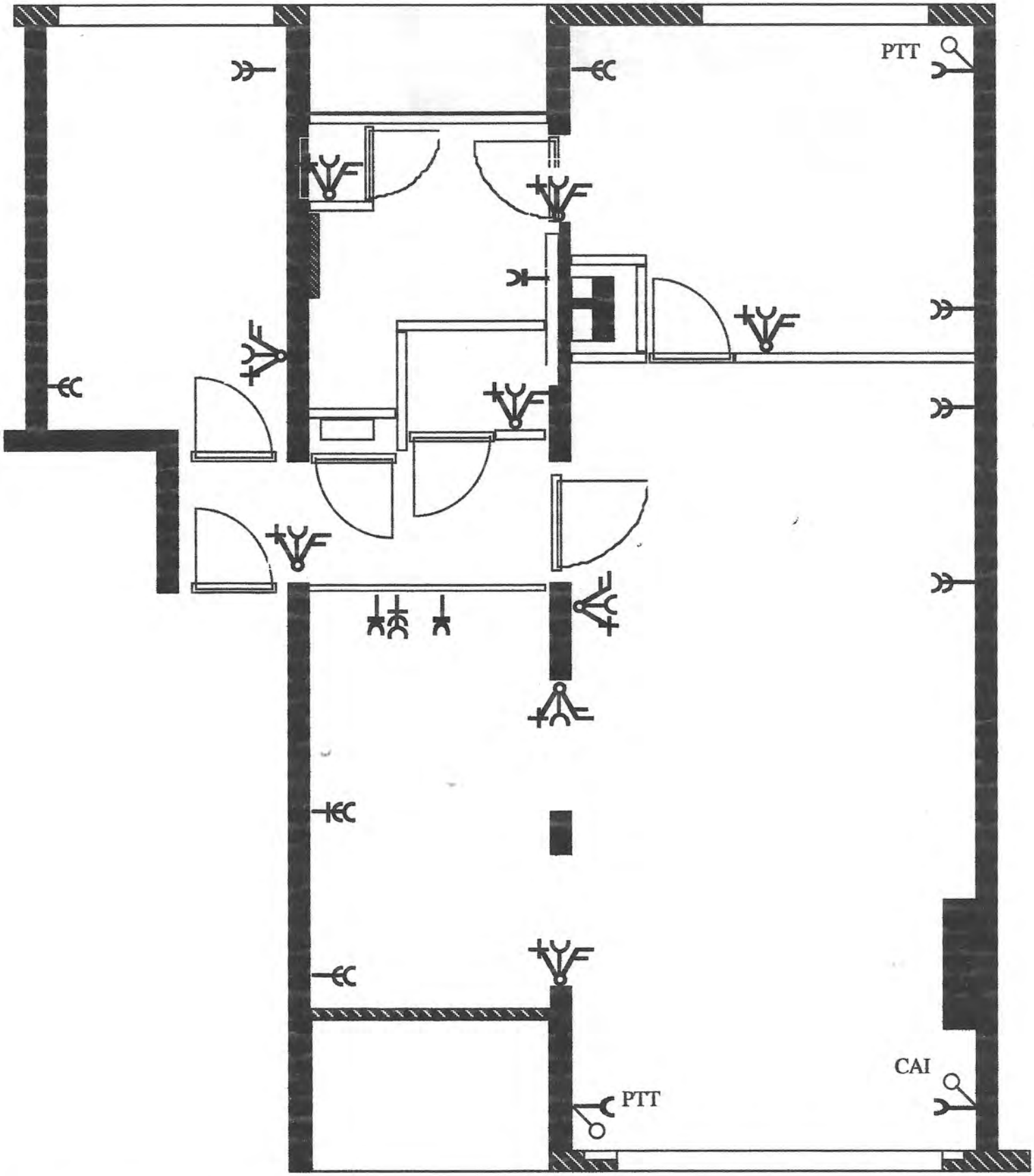
Projekt Proefwoning Voorburg
Opdrachtgever WBV Patrimonium
Architect Reijenga Postma Hagg

Matura Nederland



Tekening: **B11 electra**

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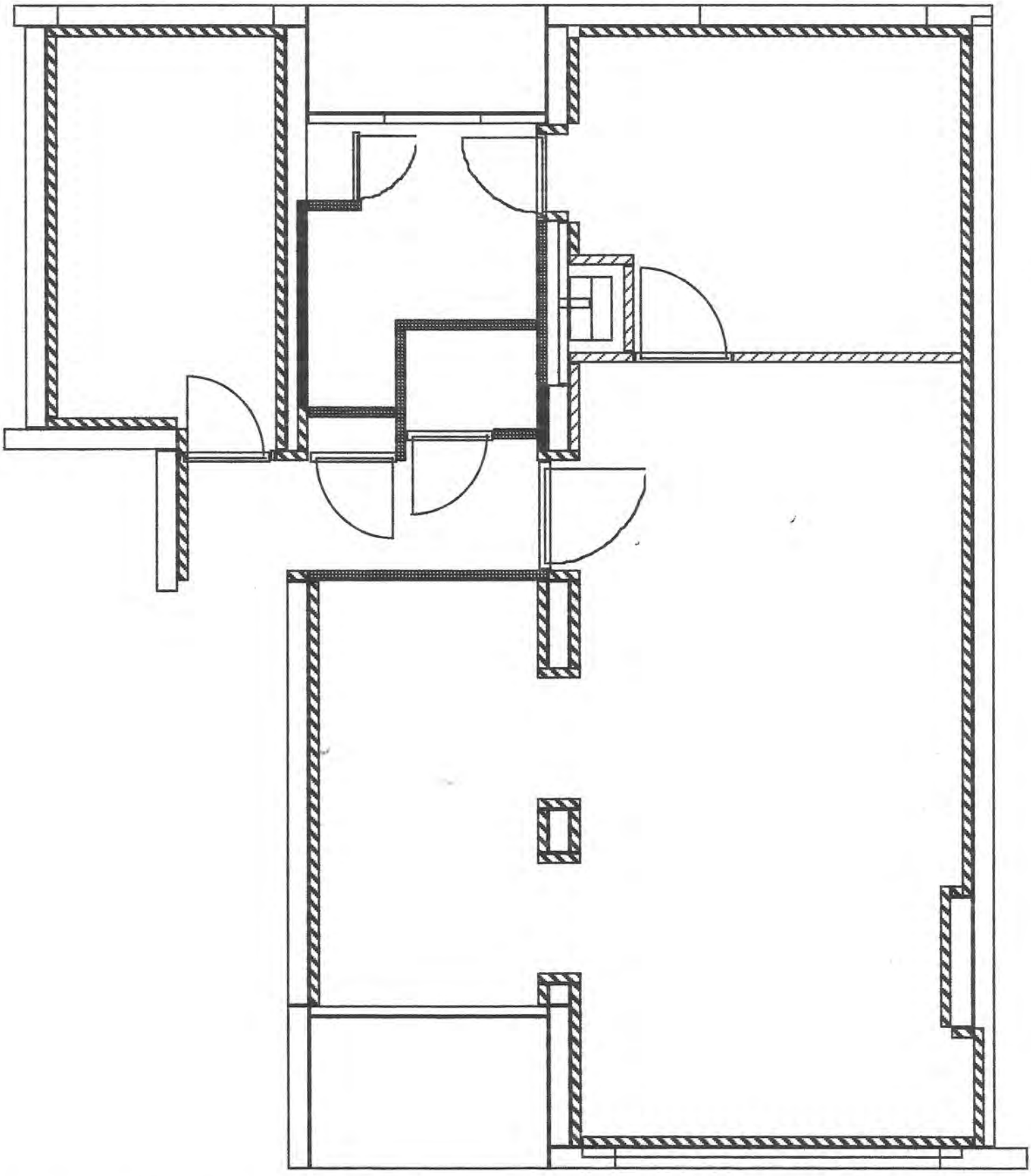
Projekt Proefwoning Voorburg
Opdrachtgever WBV Patrimonium
Architect Reijenga Postma Hagg

Matura Nederland



Tekening: **B13 wanden en deuren**

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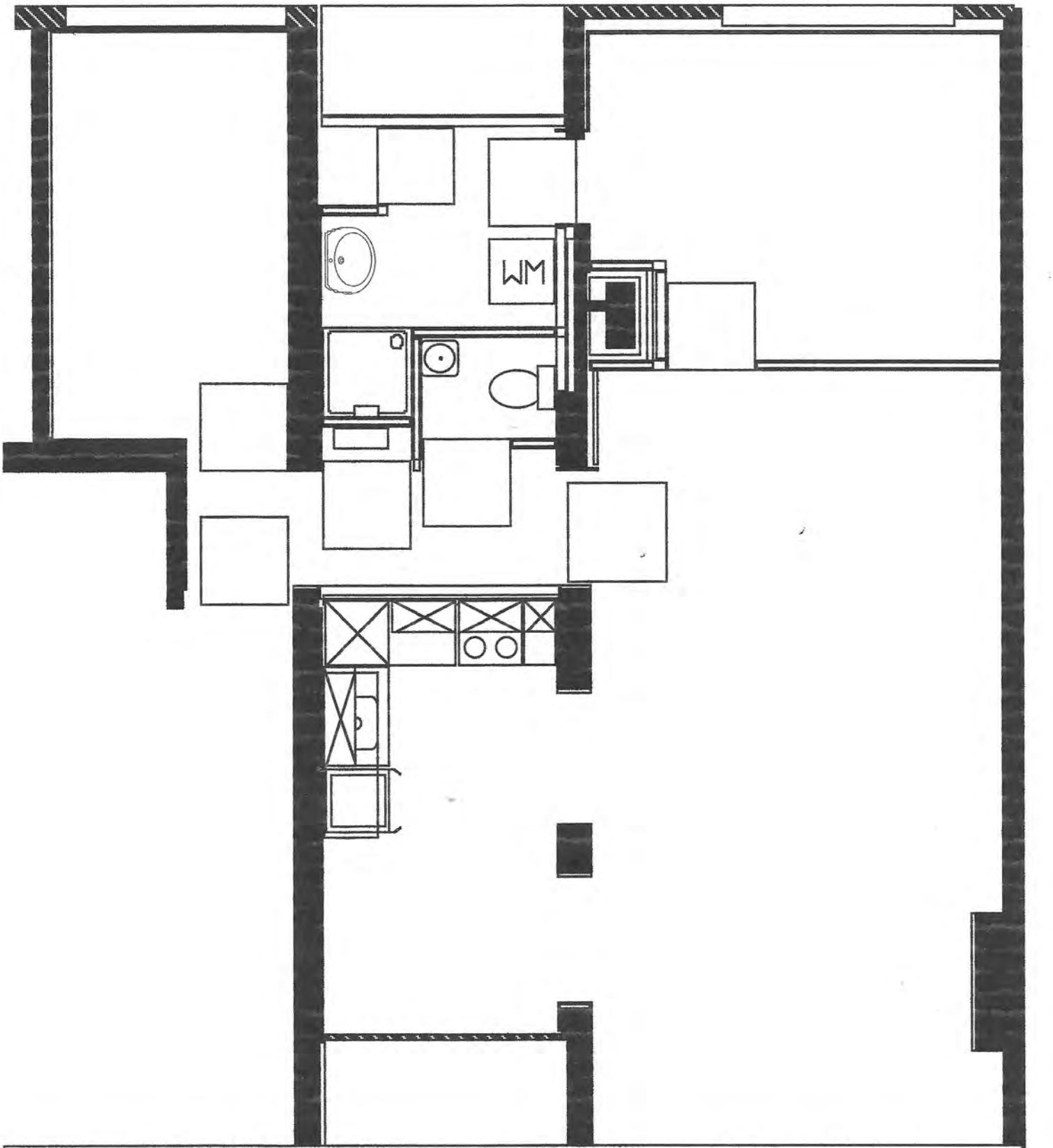
Projekt Proefwoning Voorburg
Opdrachtgever WBV Patrimonium
Architect Reijenga Postma Hagg

Matura Nederland



Tekening: **B14 aparatuur**

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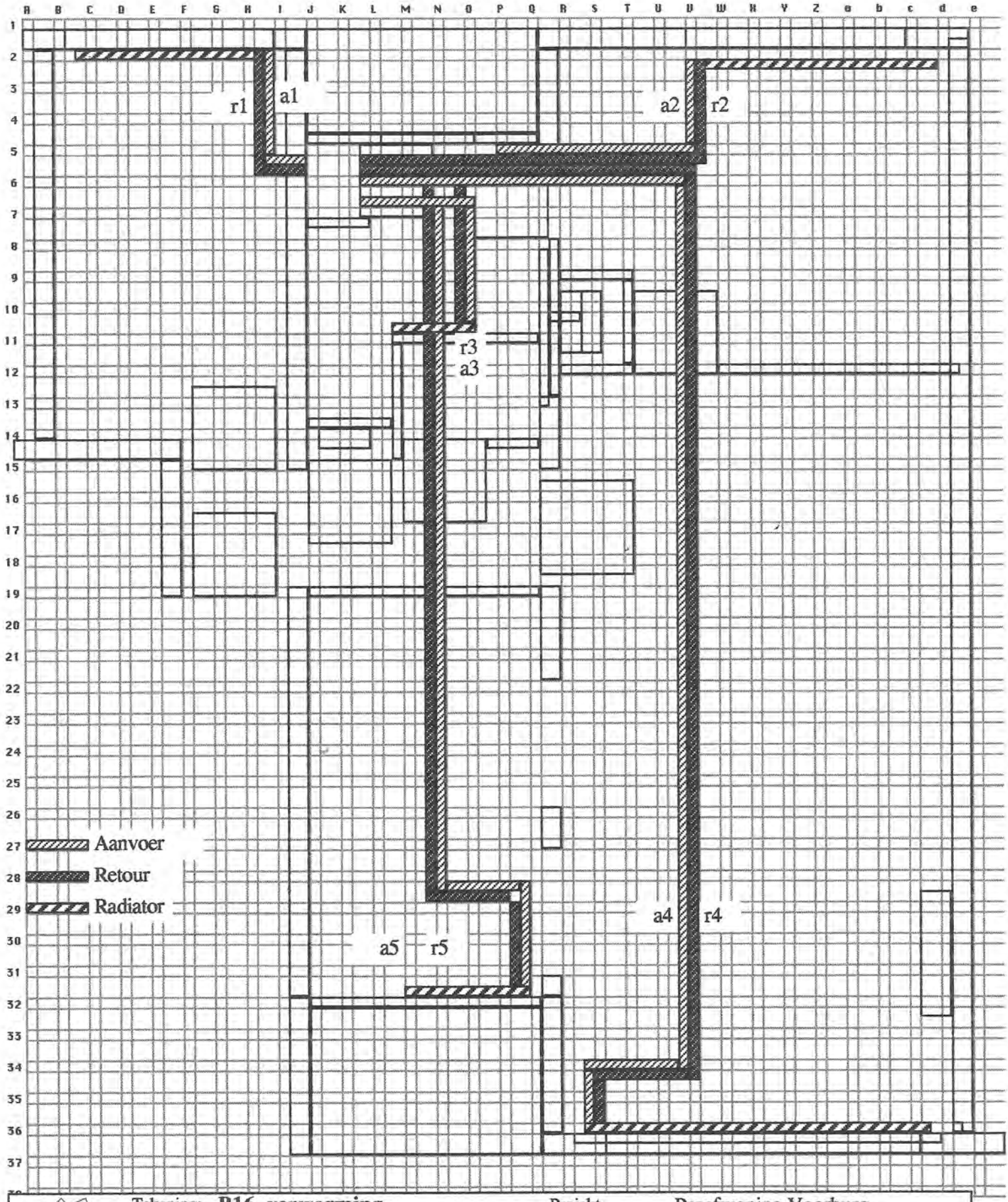
Datum 2/17/91

Projekt Proefwoning Voorburg
Opdrachtgever WBV Patrimonium
Architect Reijenga Postma Hagg

Matura Nederland



Tekening: **B16 verwarming**

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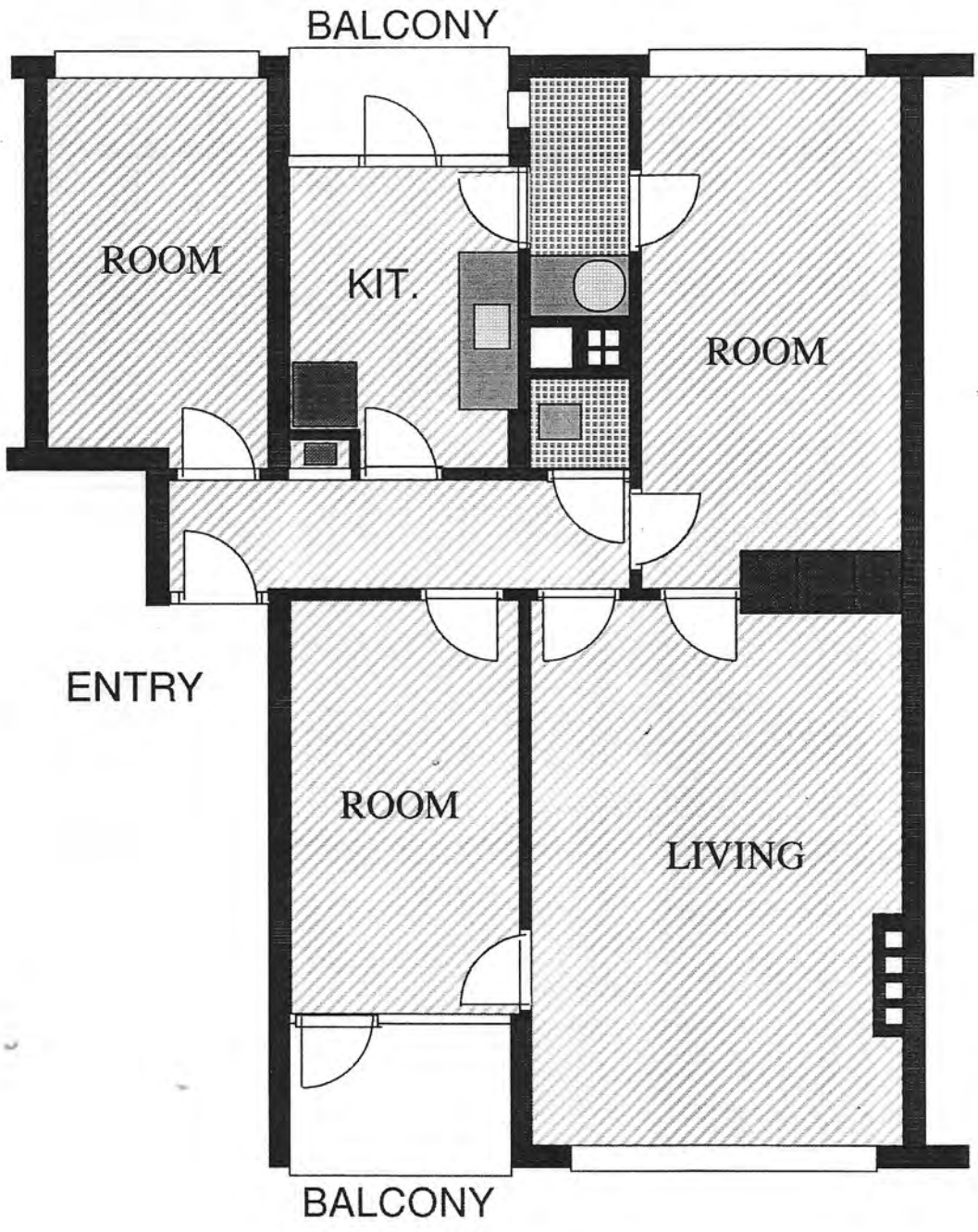
Datum 2/17/91

Projekt Proefwoning Voorburg

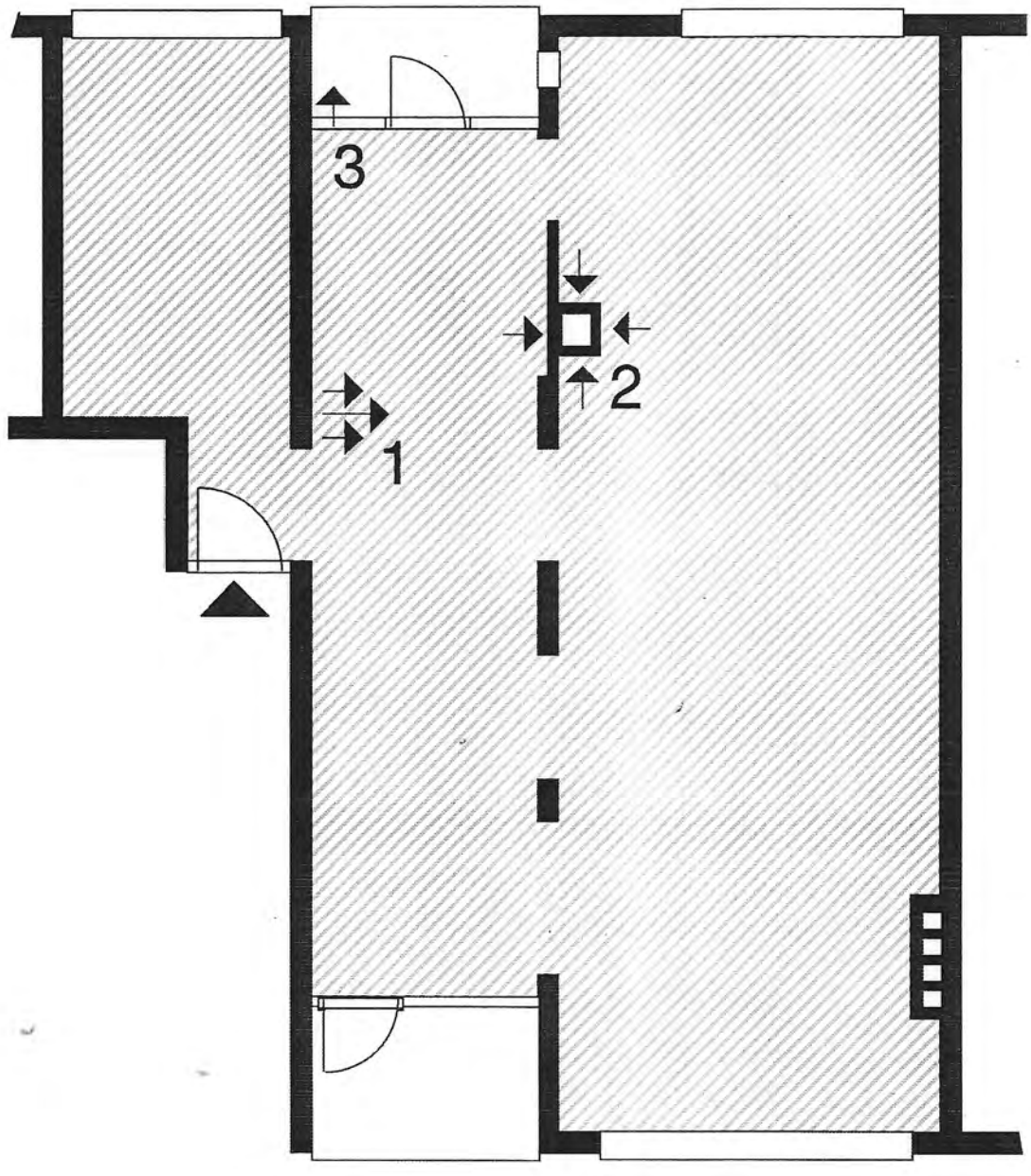
Opdrachtgever WBV Patrimonium

Architect Reijenga Postma Hagg

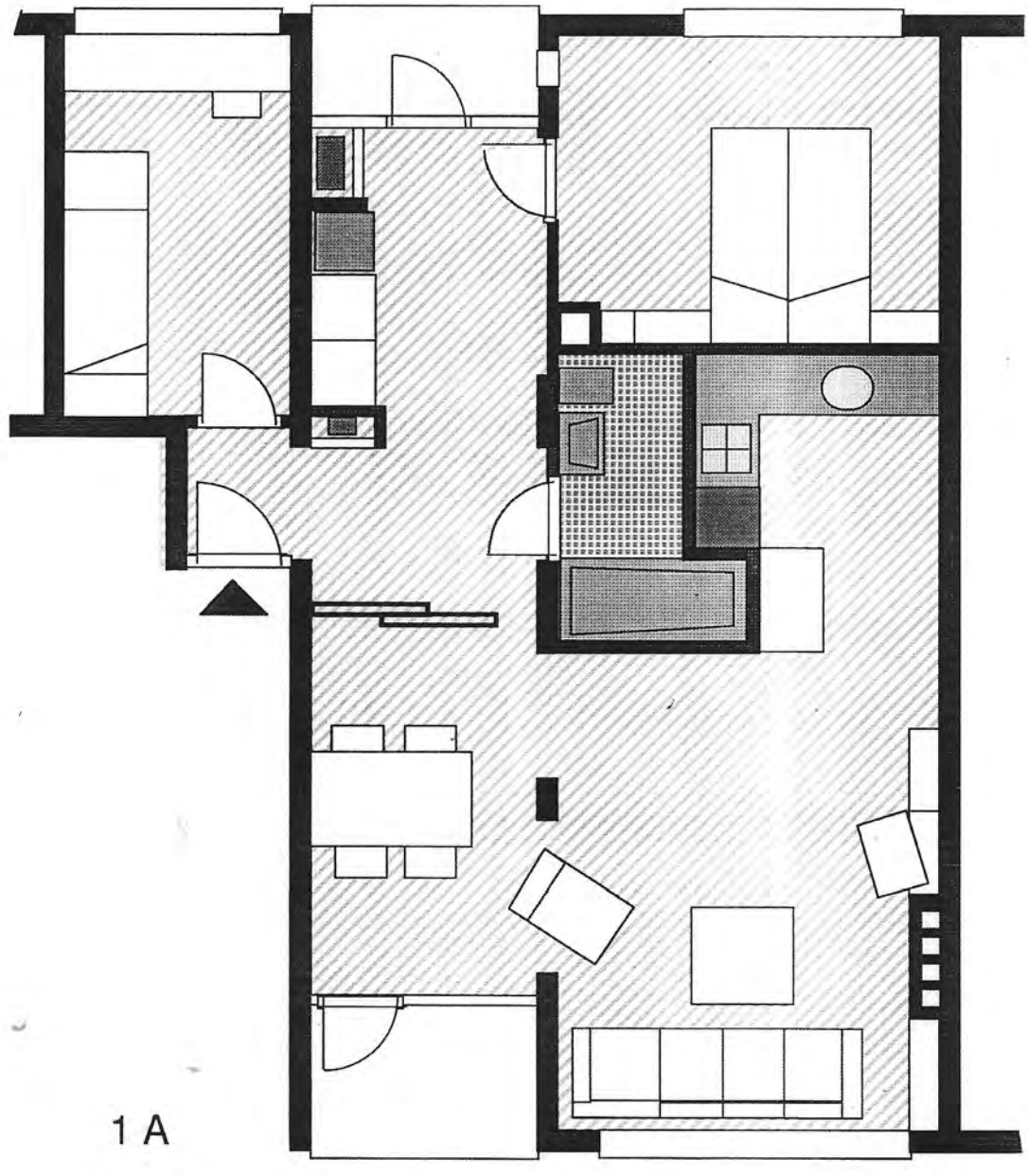
Matura Nederland



Existing unit

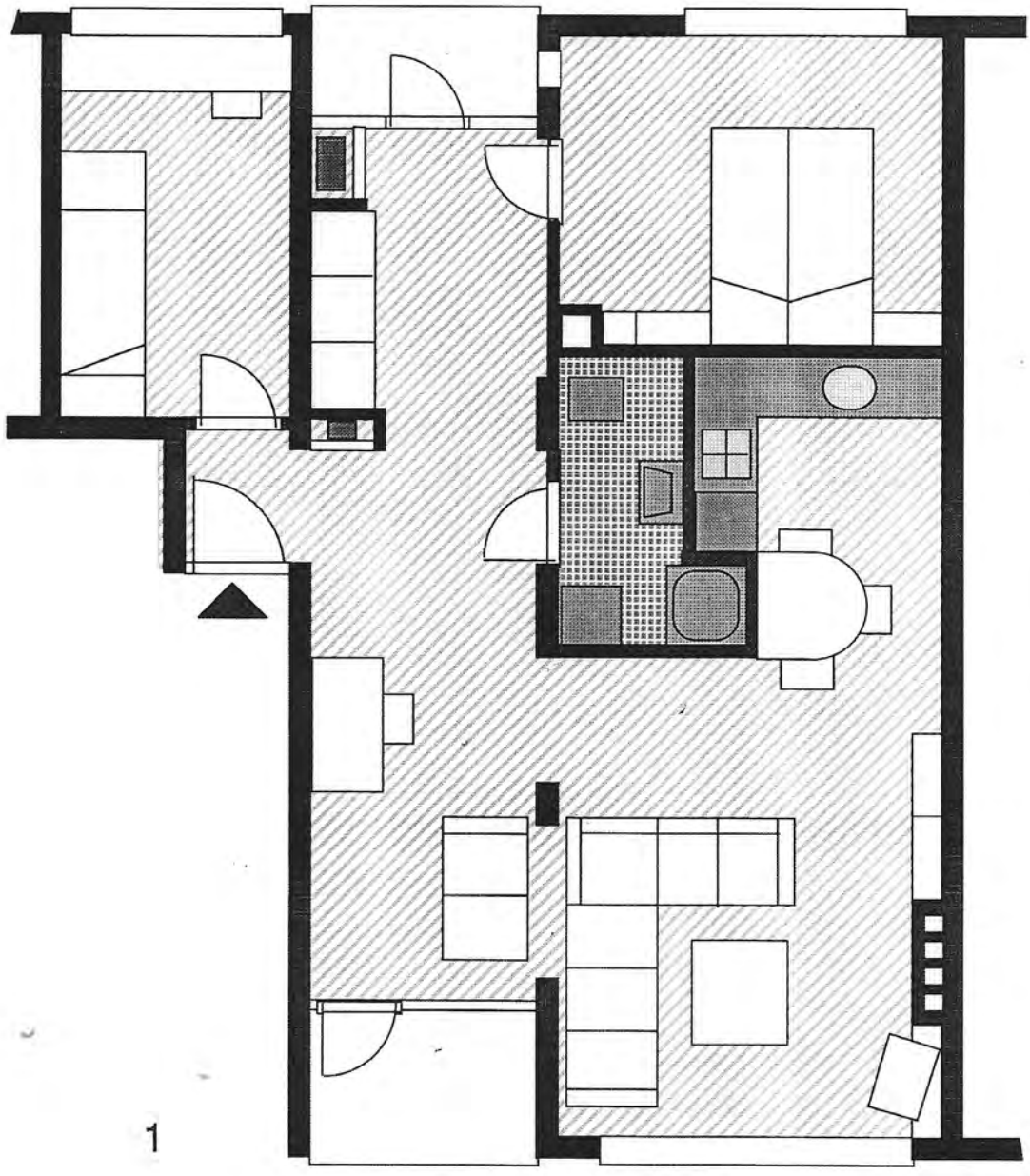


cleaned-out unit space 1



1 A

Grundriss



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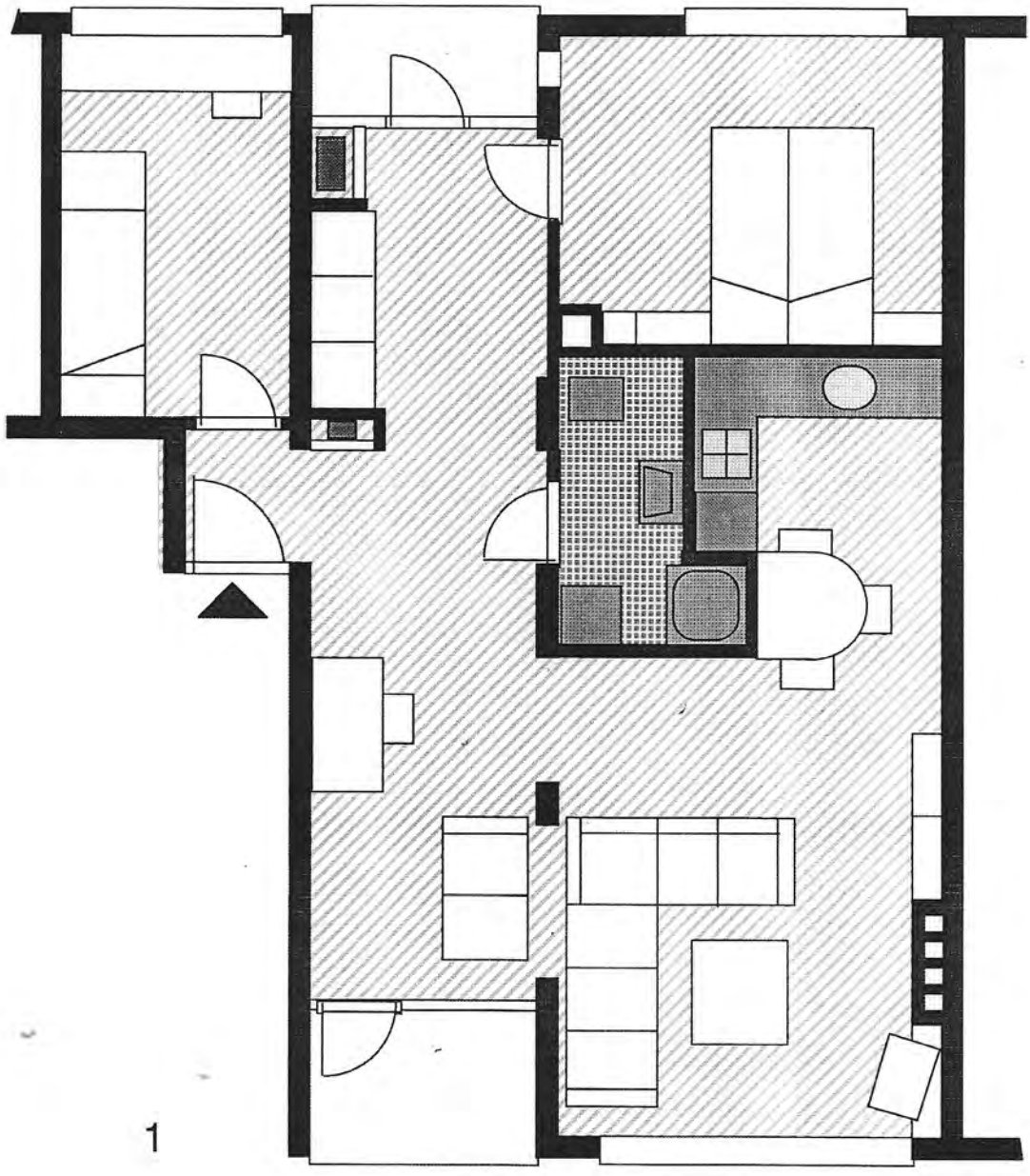
Unit plan option C



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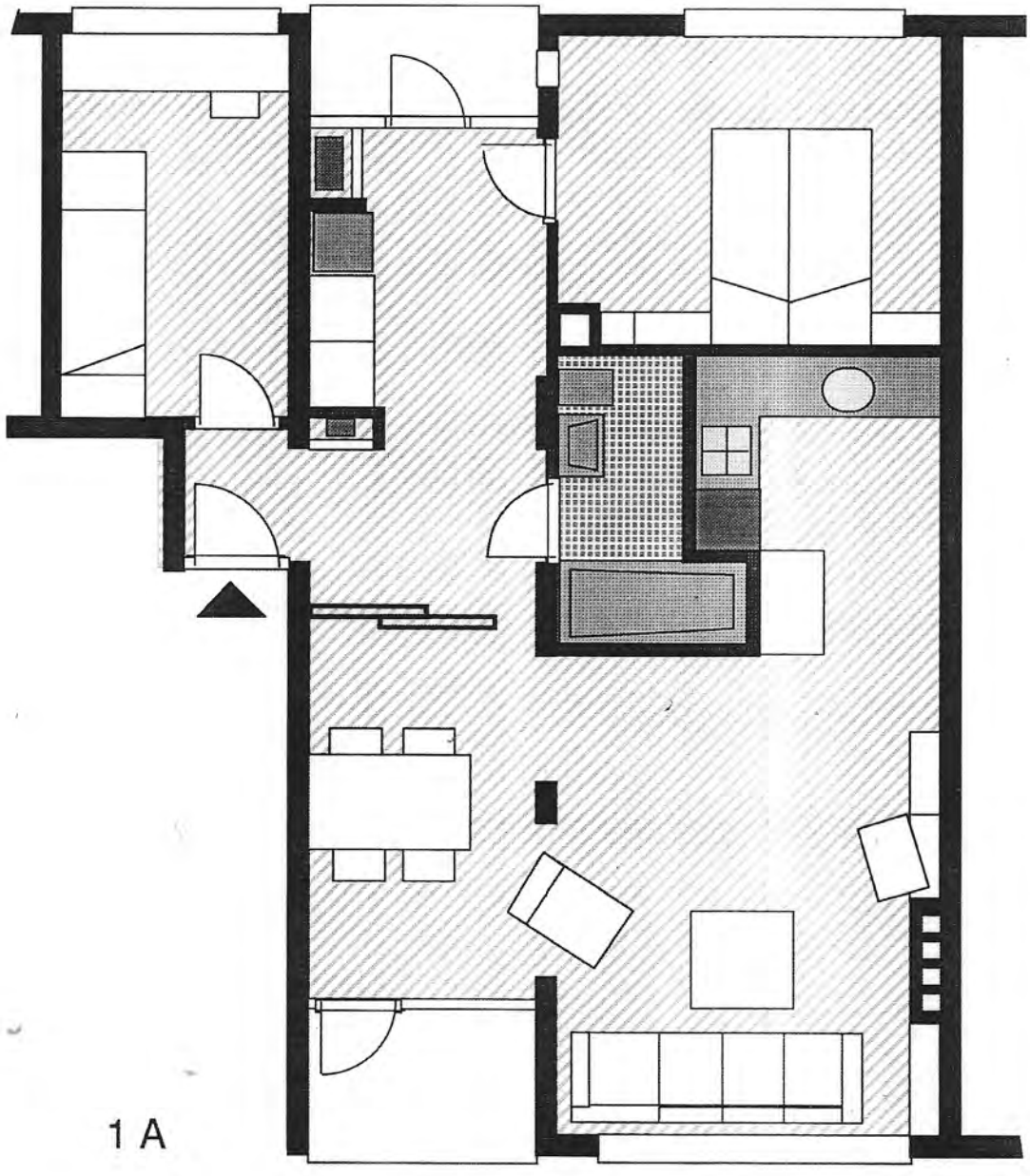
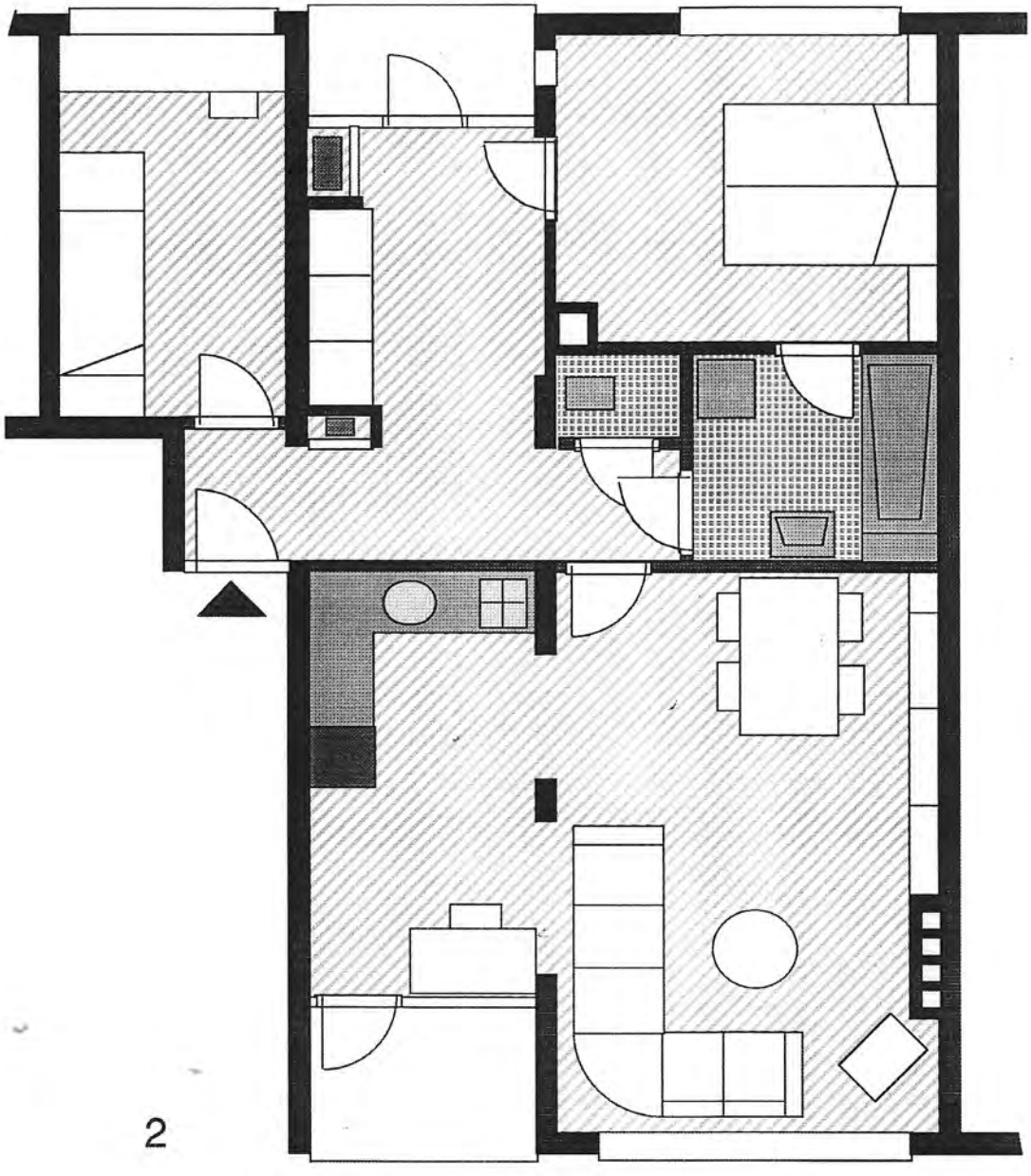
Unit plan option C



1 A

Grundrissoption



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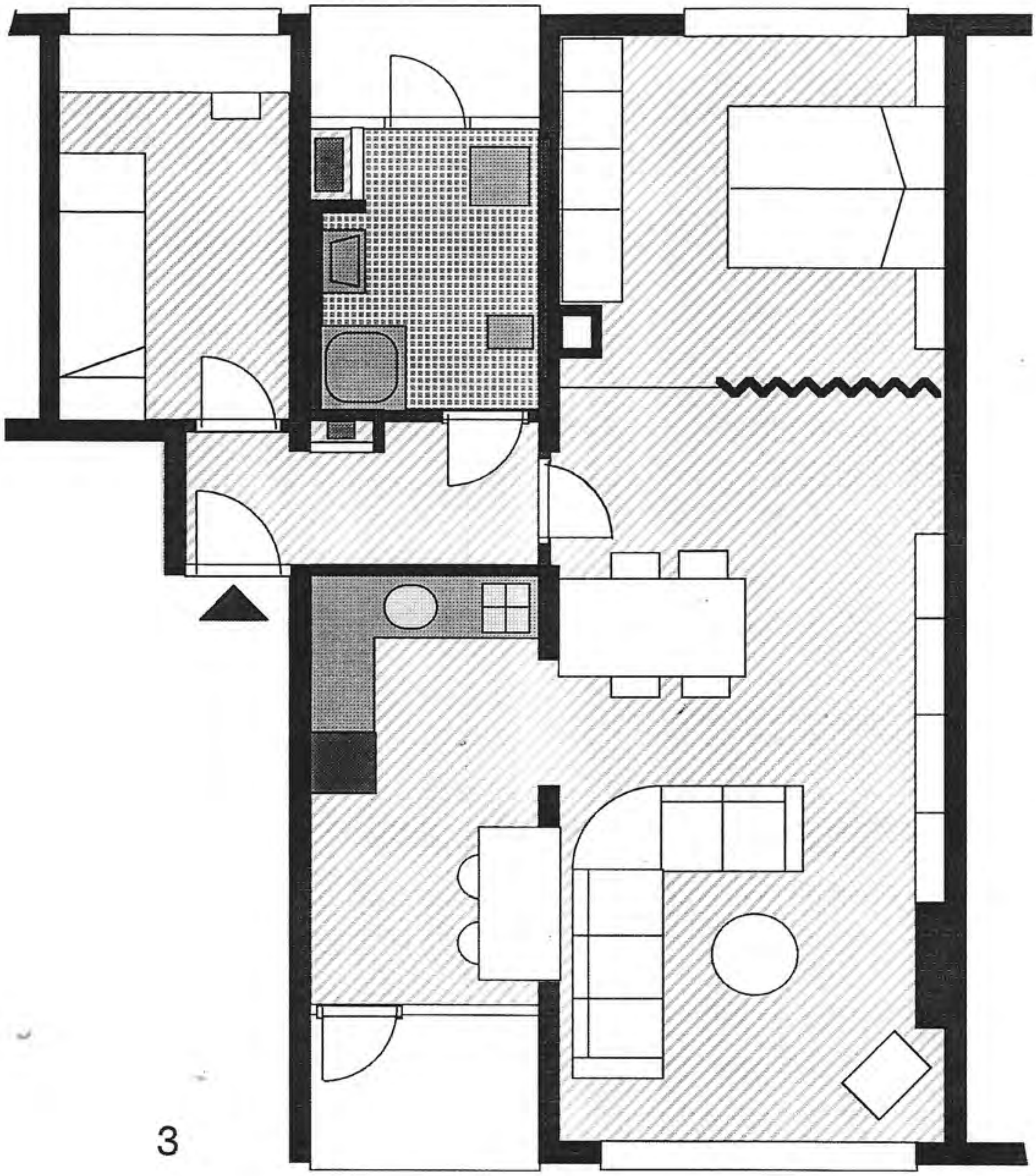
unit plan option A



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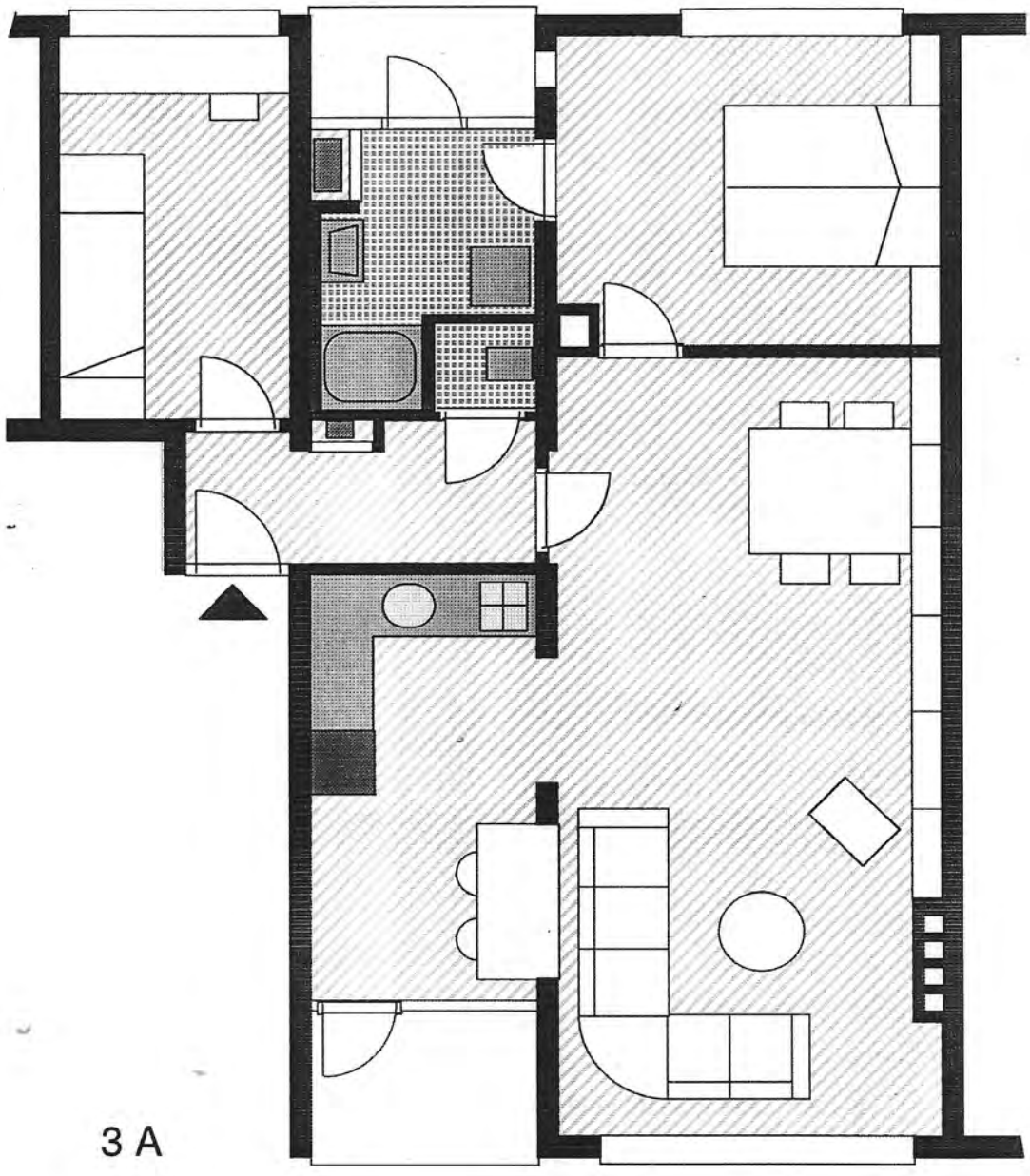
unit plan option B



3 A

Grundriss D

Open Building

Installation in Voorburg, NL
August, 1990
Matura International, BV.

An Efficient Response to User's Individual Preferences.

A paper for the Housing Design 2000 Conference.
Singapore, September 1992
by N. John Habraken.
Professor of Architecture Emeritus
Massachusetts Institute of Technology
Cambridge, Massachusetts.

AN EFFICIENT RESPONSE TO USER'S INDIVIDUAL PREFERENCES.

Introduction.

In this paper I present a new way of outfitting residential units by means of a so called 'Infill System'. An Infill System allows the rapid installation of partitioning walls, central heating, kitchen and bathroom equipment with all piping and wiring related to such equipment. Installation is done per unit according to the floor plan chosen for that particular unit.

The infill system approach is not only of interest because it offers an individualized approach to

large residential construction projects involving apartment buildings and townhouses. Its major attraction is that it is also economically competitive compared to existing modes of outfitting dwelling units. It therefore constitutes a breakthrough combining increased adaptability with more efficient production.

I will first discuss how infill systems offer an efficient and user friendly approach to the renovation of existing housing stock. Next I will discuss briefly about the commerical advantages of infill systems in new residential construction. (Page 4) I will then say more about the specific infill system from which I derive the information given in this paper with the development of which I am personally involved. (Page 5) Finally I will also briefly sketch the development of this new approach as it evolved in the past twenty years in the Netherlands. (Page 8)

Renovation, social dimensions of the Infill Approach.

The following scenarios are what actually happened recently with two units installed by the way of a pilot project in the Netherlands. They illustrate how the use of infill systems can change the traditional ways of dealing with the problem of renovation of existing residential property in large projects.

First scenario

A unit in a public housing estate is vacated by users who move to another town. The housing authority in charge of the estate contacts new users from a waiting list. They are informed that the authority wishes to renovate the unit before they move in.

The prospective users, a young couple who both work, are given a number of alternative floor plans for their unit as worked out by an architect commissioned by the authority. They meet with the architect. As a result they decide that a variation on one of the initial alternatives answers their needs.

The new floorplan is very different from that of the unit which is now vacant. The original apartment (Fig. 1) was designed in the early sixties for a family with two to four children. It had three bedrooms, a very small bathroom with only a sink and no shower or bath, and a narrow kitchen. There was no central heating. All rooms were around a small hallway. The new apartment (Fig. 4) has a single large bedroom with an adjacent bathroom with shower and laundry machine. The kitchen is in a new location in open relation to the living room. There is also a small guest room.

The new floorplan is approved by the housing authority and new monthly rent is agreed upon. The authority sends the floorplan to a company that specializes in installing infill systems for residential construction and requests a price. Agreement is quickly reached because this job is part of an ongoing contract between housing authority and infill systems company for the renovation of the entire housing estate over a period of time. As part of the same overall contract a small local contractor is called in to clear the existing apartment and prepare it for new infill. A

job that takes about a week.

Beginning the second week a container is delivered in front of the apartment building. A small conveyor of the type as is also used by furniture movers is installed to hoist parts from the container towards the unit's balcony on the fourth floor.

A crew of three people now installs the infill system. Within ten workdays they deliver the finished apartment to the users. The next few days the users have curtains and floor covering of their choice installed by a local interior decorator and their furniture is brought in.

Second scenario

A couple in their late fifties, users of an apartment in the same rental public housing estate as mentioned in the first scenario, decides that their apartment no longer fits their needs. However, they are reluctant to relocate to another, newer housing estate because they have lived in the present apartment for a long time. They like the neighborhood where they have friends and relatives and are familiar with shops and other public facilities. They decide they prefer to have their old apartment renovated and ask for the cooperation of the housing authority. (Fig. 4)

This is the start of a procedure similar to the one described above, but in this case the couple moves out of their apartment to stay with their daughter and son in law for three weeks. Their furniture is put in storage. In the first week the apartment is prepared for infill. In the next two weeks the infill package is installed.

Within a month they live in a completely new apartment fitted out exactly according to their wishes.

Voluntary expanses.

As part of the normal procedure for renovation the users are asked to select the bathroom equipment and kitchen equipment to be installed in the new floorplan. The elder couple can afford to spend more compared to the young couple who are just starting. They select a very well equipped kitchen. Also the bathroom equipment they want is of high quality. The representative of the housing authority informs them that with their selection the costs of the infill package far exceeds the estimated costs on which the rent for the new unit was calculated. The couple responds that they are well aware of this and are prepared to cover the diffrence*1). Accordingly they pay the authority a lump sum and the equipment they selected is installed in their rental unit *1).

Advantages for the user

Seen from the perspective of the users the procedure described in the scenarios is the course attractive. It gives them an opportunity to select their own floor plan and they are free to decide on the quality level of the equipment to be installed. Moreover the process is quick. Within several weeks after the rental contract is agreed upon the units are ready.

Advantage for the owner.

It can be expected that the owner of rental property will appreciate the procedure as sketched

above for social reasons. Tenants who have selected their own interior accommodations can be expected to complain less and will treat their environment with respect. Moreover, serving their tenants on a one on one basis makes it possible to take into consideration the differences of income among them. Those who can spend more, and are indeed willing to do so, can have more. It is no longer necessary for the owner to expect all users, regardless of their differences in life systle and income, to accept the same single floor plan equipped on a level that is just affordable to those with the lowest income.

Economically attractive.
Less obvious is that the owner of rental property also will find this way of working economically attractive compared to the alternatives available to him.

First of all, custom floor plans by means of infill systems as sketched in the two scenarios are not more expensive in direct costs. The price of the single infill unit to be installed independently, including cleaning out of the building shell and preparing it for the infill system, is competitive with the price paid to contractors for a comparable job in traditional renovation processes.

If here things are equal, economic advantages for the owner follow because the whole process becomes much easier to control and can be done in a more gradual fashion. To illustrate this we may first consider the alternatives against which the new infill system approach should be compared.

Traditional alternatives.
Without the infill systems option the owner of an apartment building has basically two alternatives where renovation was concerned:

- In a first alternative the building will be vacated and gutted completely to be refitted, after which new tenants are admitted or former tenants may return. This procedure is inevitably socially destructive. It also takes extensive planning and a good deal of social engineering before the building is empty. Even if the owner tries to help tenants to find new places to live there will be those who find it difficult to leave but equally difficult to stay in a gradually emptying building.

- In a second alternative the building is renovated while the tenants stay in place, in which case they are submitted to a longer period of discomfort and noise when workers go in and out to redo bathrooms and kitchens and electric circuitry, taking apart most of the house before they put it back together again. This procedure asks much patience and endurance of all parties involved and also a good deal of cooperation between owner and contractor. It is not uncommon that a full time social worker is occupied with helping tenants to cope. Inevitably there are older people and those who are ill or already under stress for other reasons who now have to live through all this for months on end.

Compared to these traditional ways for renovation we now may consider from the owner's point of view the advantages of the new alternative offered by infill systems.

User friendly adaptation as a result.

In both traditional cases the contractor insists on some economy of scale where the same parts can be installed in the same way in all units. Uniform floor plans are required. For the owner it is difficult and very time consuming to come to a single proposal acceptable to all tenants. Usually the emphasis is on equipment. The original plan is maintained as much as possible while better bathrooms and kitchens somehow are installed. Differences in life style, occupancy, and income can not be taken into consideration. In the end no one is satisfied. The lowest income tenants feel they cannot afford the new rents. Those with a higher income feel they do not get what they want.

In case of infill renewal, on the other hand, variety of floor plans is the natural outcome of the process and not more expensive than uniform floor plans. This is because the infill process treats each unit separately. All subsystems are installed by the same crew in a single procedure. Making two or more identical plans does not offer any advantages in terms of installation time or costs. Neither does it matter if several units must be renovated at the same time or in the same building. At all times the infill system for each unit is delivered in its own container and installed by a separate crew.

No gradual deterioration.

Whereas the infill system does not care if floor plans are uniform or different, the benefits of personal adaptation are considerable for both tenants and owner. Tenants get what they want within the limits of what they can afford. Having been involved in choosing the environment they live in, they will be more responsible users. Demand for repair and maintenance will decrease. For the owner of the property this means that overall quality remains good with less effort.

Most important, however, is that in the one-on-one infill renovation process overall deterioration of the property is avoided. Renewal is now a continuous process of gradual adaptation to tenants' needs. Each time when a tenant leaves renewal and adaptation is possible. Because infill time is short vacated units can be renovated and rented again within a month. As we have seen in the second scenario, renovation of a unit can happen while a tenant takes a three weeks vacation. In this way renovation and adaptation become a form of continuous maintenance and violent swings in the condition of a rental property, from massive renewal after years of overall stagnation can be avoided.

Separation of 'Support' and 'Infill'.

To renovate a housing estate not only the interior of the units must be renewed. The customized infill of single units must be complemented by improvement of the facilities shared by users like stairs, elevators, entry ways, parking facilities and landscaping.

Essential to the infill approach is that a clear distinction is made between the infill proper which is done in response to individual user's needs on the one hand, and the so called 'support' building that holds the individual units on the other hand. For the latter the owner must take initiative. In the case of two scenarios sketched earlier for instance, the housing authority has planned complete replacement of the existing stairwells and the addition of elevators for the four story apartment block. (Fig.3). It also plans for the replacement of some garage and storage

space on the ground floor with new dwelling units. These works will be done in consultation with the group of tenants involved, but the work itself remains outside the units and is done at its own pace. In the same way the facades are cleaned and treated against moisture penetration and window frames are repaired at the outside.

These more general activities concerning the building as a whole for the benefit of all tenants no longer relate to the renovation of the units themselves. Bids can be put out independently and contractors know much better what is expected and find it easier to determine prices.

**

New Construction: commercial dimensions of the Infill Approach.

What has been said so far shows that the infill approach is not only a technical innovation but has important social implications. However, these go hand in hand with commercial aspects. This becomes particularly clear when we consider the use of this approach as applied in new construction in the up-scale market.

Differences of supply and demand.
Developers know that prospective buyers always demand changes in the floor plan of the units offered to them. Even when they like the floorplan they may want a door to be displaced to accommodate a beloved piece of furniture which otherwise will not fit in. Or they may want a wall replaced or taken out. Usually they like to choose their own bathroom and kitchen equipment as well as the colors of tiles and other surface finishing.

The response of developers to such demands for change and adaptation varies with the market situation. If competition is strong they may have to give in more readily than when there is a great deal of demand.

But, if they had their way, developers would prefer not to offer any choice to buyers at all for the simple reason that it will cost them money. It is not at all certain that the costs of customization can be passed on to the buyer. The contractor's price is based on fixed predetermined floorplans and specifications. Any change will disrupt his planning, will cost more money and take more time. Contractors are well aware that the developer demands a change because otherwise the unit will not sell. This puts them in an advantageous position to negotiate the price of the adaptation. But it is also true that it is difficult for the contractor to manage such changes and to determine their exact costs. Prices will be established accordingly.

This situation which is familiar enough to all of us, basically puts developers, buyers and builders, on a collision course.

Reconciliation of Conflict.
The infill approach reconciles this conflict. The developer now asks for bids on the support building only and will be supplied with a finished building complete with facade, and all such facilities as are offered to all users: entrance lobbies, elevators, public stairs and corridors, parking facilities and landscaping. In short, the building as finished will clearly establish the

kind of lifestyle and quality of services that the buyer needs to know before he can decide if the location is of interest to him. But the inside of the apartments will remain empty and ready to be filled in. Floors are smooth and ceilings finished and painted. At a fixed place in each unit there is access to electricity, water, gas, and sewage for the infill system to connect to for further distribution in the unit.

Building this 'support building' should not offer any surprises to the builder. He will be in control of logistics for a well defined job. The builder is in fact freed from the part of the construction process that usually constitutes the greater risk to him and takes most of the overhead for on-site management and for coordination of subcontractors. It is well known that money is easily lost on finishing the interiors of dwelling units where it is gained in setting up the larger structure holding them. The builder, in short, now can do more with less overhead costs.

The developer from his part, now knows precisely what he can expect from the builder in terms of product and timing. For the infill he contracts the infill systems company. He is now in a position to offer the buyers exactly what they want and can structure his prices accordingly.

We can conclude that the infill approach sets free all parties involved: the buyer, the developer, and the builder. It may also show how the system is not only a technical innovation but has very interesting commercial implications, putting developer and builder in a mode of operation that offers superior service to the buyer in a way that can be logistically and financially well controlled. This, of course, gives them a decidedly competitive advantage over those who operate in a traditional mode.

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Open Systems, technological dimensions of the Infill Approach.

In this context it is important to mention that the infill system providing this commercial breakthrough is a so called Open System. Open systems in building technology utilize as much as possible materials and components that are already on the market. For the infill system this means that partition walls and wall finishes, door frames and doors, kitchen and bathroom equipment, all are taken from the open market. This is radically different from what many people have in mind when they think of a industrialized system. The infill system we are talking about here is not so much hardware oriented as software oriented. It is based on a few important principles:

<u>Separation of Support and Infill.</u>
The first and foremost principle on which the approach is based is that the infill system is clearly distinguished from the rest of the building in which it is installed. What is not infill is by definition 'Support'. This comprises not only the shell of the building, including facade and roof, but also all load bearing parts as well as the major conduits that feed the individual dwelling units: those for gas, electricity, water and sewage. These conduits run to a specific point in each unit from where further deployment is done by means of the infill system.

Once the infill system is separated from the support it can be studied on its own. As far as the particular system is concerned on which I report here, we established the following principles for its development:

Re-ordering of the deployment of conduits.
We found that the bulk of the costs of an infill package is in the technical equipment needed for the unit, including all the piping and wiring that go with it. This comprises at least the following technical subsystems: heating, ventilation, sewage, hot and cold water supply, electricity, telephone, television, and various safety and control systems.

We found that a significant part of the costs of these systems is not their hardware but their installation. Installation demands multiple visits by different crews for different subsystems. It is a very difficult task for the job manager to orchestrate these visits successfully. We also know that very often one crew's work interferes with that of another and that the earlier crew must return to repair what got damaged later on.

The key to a successful infill system is therefore to find a new way to distribute all the conduits of the technical systems assuring that interfaces are eliminated as much as possible. In other words: we want to make sure that conduits can run through the unit without getting in the way of each other. Moreover we want to make sure that conduits can be installed without workers having to cut open walls or having to leave walls partly finished, waiting for conduits to be installed.

Our search for disentanglement of subsystems resulted in the invention of two new hardware components: the 'Matrix Tile' and the 'Base Profile'. The two together serve as context for almost all other subsystems. In other words they are the embodiment of the chosen ordering principle. (Fig.5).

Dimensions and Positions.
Having re-ordered the distribution of the conduits and, by doing so having minimized the interference of subsystems among each other, we now had to codify this ordering principle in exact positional and dimensional terms. Once a certain subsystem is deployed we want to know precisely where all its parts are and what dimensions they have. This is achieved by the use of a so called 'band grid' as has been applied already for many years by those interested in open building systematization. A band grid allows for positioning rules for each subsystem thus formalizing the ordering principle that is chosen.

Contrary to modernist ideas of systematization our approach does not demand a dimensional standardization of parts but is based on positioning rules relating each subsystem, and each part in it, to the grid. Some parts, like door frames, have a range of fixed dimensions as determined by the manufacturer. Other parts, like a pipe or a stretch of wall, have variable dimensions. Variable dimensions result from a part's position in a larger configuration. They may also depend on the position of parts from other systems that it must connect to. The latter also being deployed according to their own rules in the overall ordering concept.

Variable dimensions are not random, however. When the positions of all parts in the grid are known, dimensions can be calculated from the position information available and, consequently, each particular part with its own particular dimensions can be individually known and therefore produced.

This way of working makes it also possible to apply the infill system in buildings that follow their own dimensioning system or have no clear dimensioning system at all. In other words: the application of the infill system does not require that the building in which it is applied be designed in any systematic way. All that is needed is that eventually the positions of the building's parts are determined in the infill grid. These positions may not be subject to any rules but nevertheless can be determined. Once this is done the dimension of infill parts connecting to them can be calculated.

Although knowledge about the use of positioning rules in a band grid is already in the public domain for many years, the specific method of calculating actual dimensions of parts from given deployment rules is not. It has been developed for the benefit of the particular infill system I am reporting on here.

Production and Installation.

Given an exact dimensional drawing of the desired floor plan our method allows for its translation in a technical design based on the positioning rules as discussed above. This translation is done with the help of a specially developed computer program. It is a kind of dedicated cads program which understands deployment rules and can calculate dimensions in the way explained earlier. The result is not only a set of technical drawings but a specification list of all parts needed for the particular infill package at hand. This information is fed into the production phase of the infill package itself. Parts are subsequently selected from stock, cut to size if needed and/or otherwise worked upon, sometimes combined with other parts, and finally packaged to be stored in a container.

This process, beginning with the technical translation of a submitted floorplan and ending with the container ready for shipping, is what is called the production phase. It is a phase that requires a highly sophisticated production process where each single product is a unique combination of a large number (about twenty) of well defined subsystems.

But the product is not assembled. Its parts are transported to be put together in the building for which the floor plan was designed in the first place.

This second phase is the installation phase. It is basically a building job in which a fully prefabricated kit of parts is put together.

The separation between a production phase and an installation phase is important because each phase represents a very different way of working and organizing.

The net result, however, is that the installation phase becomes relatively easy and can be done within a very short time, reducing labor costs dramatically.

Saving on-site labor costs.
It should be noted that the savings in labor costs on the site are not the result of repetition of tasks as is the case in the traditional building technology but of principles already discussed that may be summarized as follows:

1) The minimization of the interface between subsystems. This facilitates installation. Each subsystem can be laid out in one act and need not be dealt with again.
2) The prefabrication of all parts so that on-site cutting and adjusting of dimensions is almost eliminated.
3) The elimination of on site measuring. Because of the use of the matrix tile no measuring is needed for the installation of any parts after the first few matrix tiles have been put in place.
4) The elimination of on-site mistakes. Because deployment of subsystems is done following clear positioning rules in the base grid, workers can easily read drawings and understand how things go together, thus reducing the risk for mistakes.
5) The elimination of the need for ad-hoc problem solving. Workers need not solve detail problems on the spot. The way things come together is fully predetermined.

Balance of costs.
The gain from saved labor costs in the installation phase pays for the production phase, resulting in a total for direct costs which is not more than what is needed with the traditional way of outfitting a dwelling unit. But at the same time the important social and logistical advantages explained earlier are gained, giving those who adopt the infill approach a competitive advantage in the market.

This shift from on-site labor costs to costs of industrial production also allows the utilization of subsystems that are deemed too expensive in the traditional mode of residential construction. For example, throughout our infill system we use electric cables and connectors that were originally designed for application in office furniture. The higher costs of these superior parts are easily compensated for by the fact that laying out these cables - in the appropriate channels without interference with other systems - can be done so fast that much more is saved in labour time than is paid in additional costs in hardware.

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Past developments.

A breakthrough as is represented by the infill systems approach does not come overnight. It should be expected that it is the result of a long period of gestation and development. The original idea of the distinction between support and infill was suggested in the early sixties *2). The basic methods used in our system for the distribution of all parts by means of positioning rules related to a modular grid have been pioneered by the SAR research group *3). In the late sixties and early seventies with financial support of architects offices and building manufacturers. In the early eighties modular positioning as advocate by SAR became formally

recognized in the Dutch standards for modular coordination. The most important aspect of this development was, in my personal opinion, that it resulted from a concerted effort of a small number of dedicated individuals who succeeded in making positional coordination the topic of a broad based debate involving representatives of all parts of the building industry *4). This was the beginning of an industry wide debate on first principles of residential construction.

Meanwhile other architects had implemented the support/infill distinction in a number of housing projects in the Netherlands. Their work demonstrated that the application of the distinction, with its advantages for user and owner, even without a sophisticated infill technology could be done within the constraints of costs and regulations of public housing *5).

One important result of the pilot support/infill projects was that they triggered the interest of some builders who began to see the potential for cost efficiency in this approach. The topic became particularly relevant when in the late seventies a severe recession in the Netherlands triggered by the international oil crisis forced the government to reduce substantially its financial support of housing construction. This, for the first time after the second world war, forced competition among builders in the lucrative field of public housing. As usually happens in times re-examination, different directions were taken by different parties. Where some sought to achieve are of a better competitive position by drastic cost cutting in management and materials combined with more economic design, others recognized that Dutch housing was already among the cheapest in Europe and decided that only a new approach could open a promising future. They organized themselves in a not-for-profit foundation called Open Bouwen (= Open Building) to push for an alternative way *6). Open Bouwen advocates the distinction of different levels of intervention in the built environment, the general concept on which the support/infill separation is based. It also promotes the clear distinction of independent subsystems and their coordination by means of positioning rules in a common grid. The Open Bouwen movement has members from all branches of the building industry, from architects to developers, builders, and manufacturers, to managers of public housing estates. It operates on the assumption that the basic principles are sufficiently clear but that now practical implementation needs to be encouraged.

Among the more notable results of the Open Bouwen initiative was the organization of a center for technical and design studies, by the name of OBOM, in the Technical University of Delft, financed by this university and the government *7). In a separate development a number of studies about the economics and management of open building projects were done under the supervision of committees formed by representatives from the building industry and their consultants and financed by the ministry of economic affairs. *8).

It eventually became clear that a more sophisticated infill system was needed to replace the ad-hoc systems that had been applied in the support / infill projects done so far. In the course of time technical developments in the Netherlands had already produced a number of more advanced subsystems for residential construction. Among those can be mentioned a number of partitioning wall systems, industrially produced door frames that can be installed in a few minutes, and hot water heating systems that serve a single unit and fit in a closet. In brief, the time was there for a more comprehensive approach utilizing recent technological innovations as

well as the methodological knowledge developed so far.

The Matura infill system about which I have reported here was a response to this need for a 'second generation' infill system. Its development took about five years and it is presently licensed for commercial production in the Netherlands. *9).

However, this is not the only infill system presently under scrutiny in that country. In another initiative, a combined effort by a number of manufacturers is under way under the name 'Esprit' *6). Esprit advocates a 'plug in' solution maximizing flexibility for the user, It aims for more advanced subsystems and new designs for integrated equipment in bathrooms and kitchen. Pilot projects have been implemented. Commercial production on a continuous basis is expected within a few years.

Another, much more pragmatic system has been applied in a few small office buildings and will be demonstrated for residential use in a project that presently is under way. Under the name of 'Interlevel' this system offers a very affordable raised floor of minimum height (about 10cm) under which conduits can run freely and on top of which partitioning systems and kitchen and sanitary equipment from the open market can be installed *6).

This brief sketch may suffice to show that the approach I have spoken of comes from a broad-based development that was under way in the Netherlands for several decades. It is against the background of this steady development that I hope my paper may now inform a larger audience of what is afoot.

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Notes.

1) In this particular case the lump sum paid by the tenants exceeded 20% of the costs of the infill package as delivered. Some observers believe that rental users as an average would be prepared to contribute 15% of the infill package price out of pocket. This extra money is not needed to make the infill package competitive with the traditional way of outfitting renovation units, but it is an indication of the willingness of users to invest in their dwelling environment if they get what they really want.

2) First suggested in the Dutch publication: De Dragers en de Mensen, Scheltema & Holkema, Amsterdam, 1962. First English edition under the title Supports, an Alternative for Mass Housing, the Architectural Press, London, and Praeger, New York, 1972.

3) SAR, Stichiting Architecten Research. (Architects Research Foundation), Eindhoven 1965-1991, of which the author was director until 1975.

4) Major players were, among others, Ir. John Carp, at the time director of SAR, Prof. Age van Randen at the Technical University Delft, and architect Frans van der Werf, Rotterdam.

5) Most advanced among the many attempts to implement the support/infill idea were the projects by architect Frans van der Werf. Particularly the Molenvliet project in Papendrecht, the Lunetten project in Utrecht and the Keyenburg project in Rotterdam influenced the Open Building approach.

6) For more detailed information about any of the organizations and systems mentioned in this article readers are advised to write to the Open Bouwen foundation: Stichting Open Bouwen.Post address:De Vries van Heystplantsoen 2628RZ Delft, The Netherlands.

7) OBOM ('Open Bouwen Ontwikkelings Model ' or 'Open Building Development Model'). Founded 1985. Prof. A.van Randen director until 1992. Presently led by Prof. R. Brouwer.

8) Among many others a major role was played by Karel Dekker, finance and management consultant, who authored a number of pathbreaking studies on new ways for financing and budgeting housing projects based on the support infill distinction.

9) The Matura system is licensed by Matura International bv, Delft, The Netherlands. It was developed by Infill Systems bv. a partnership of N.J. Habraken, Prof. A van Randen, Mr. Ir.F.J.M. de Vries, J. van Vonderen.

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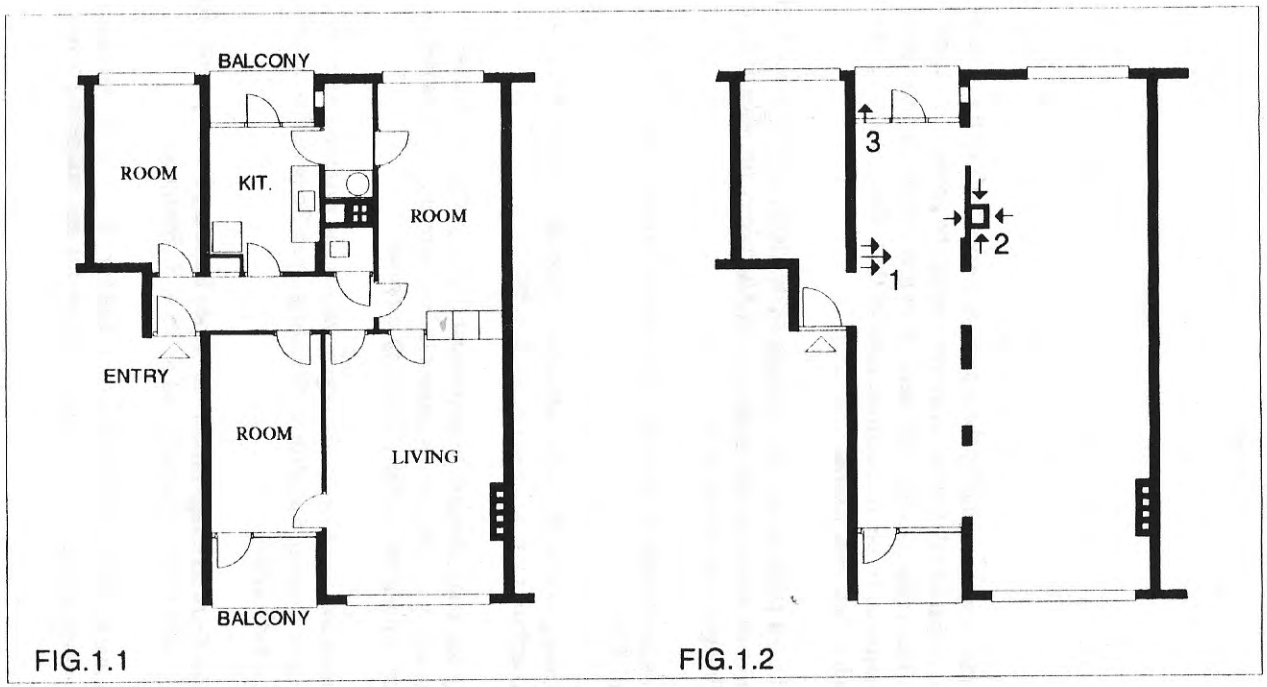


FIG.1.1

FIG.1.2

Fig.1.1: The original plan

Fig.1.2: The support building prepared for infill.
1. Connecting points for gas, electricity, and water
2. Sewage main and ventilation shaft.
3. exhaust for gas heater.

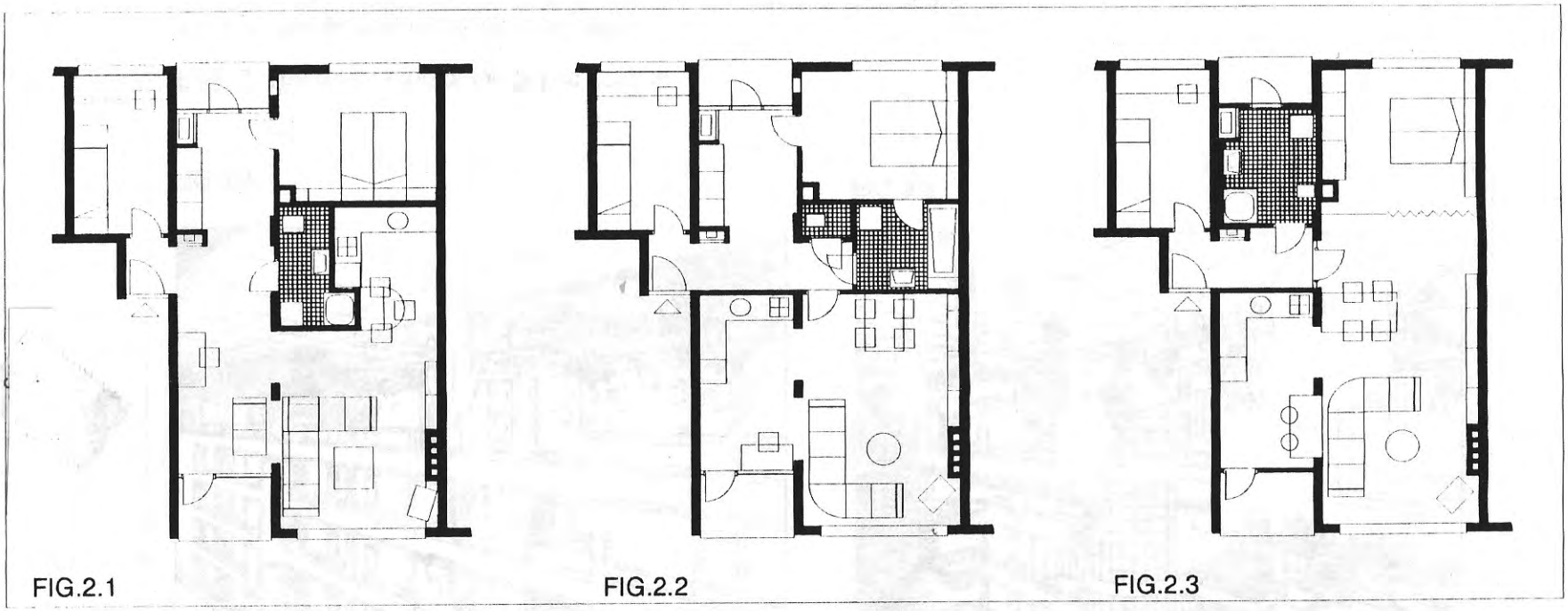


FIG.2.1 FIG.2.2 FIG.2.3

Figs.2: Three floorplan alternatives presented to the users.

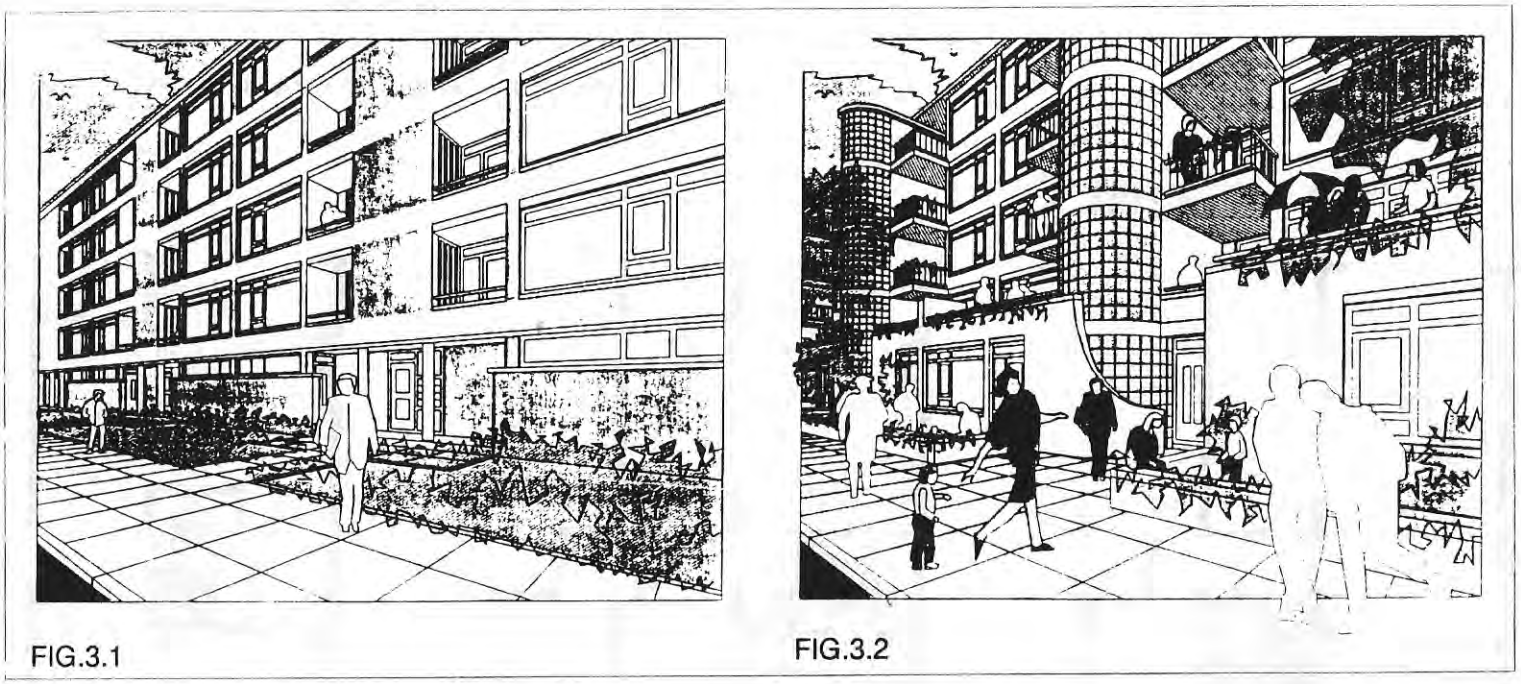


FIG.3.1

FIG.3.2

Figs. 3. The renovation of the public domain.

Fig. 3.1 The building in its present state
Fig. 3.2 The proposed renovation. In addition to a general face lift and improved landscaping, public stairs have been pushed out and glazed in while elevators are added inside. Balconies are enlarged and on ground level apartments for the elderly are added. All this is done independently from the individual renovations of the dwelling units.

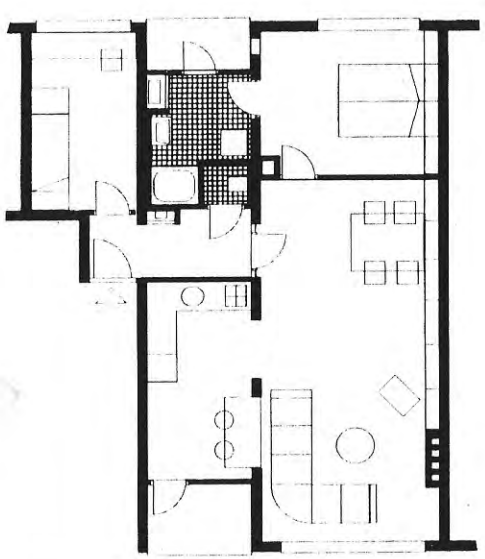
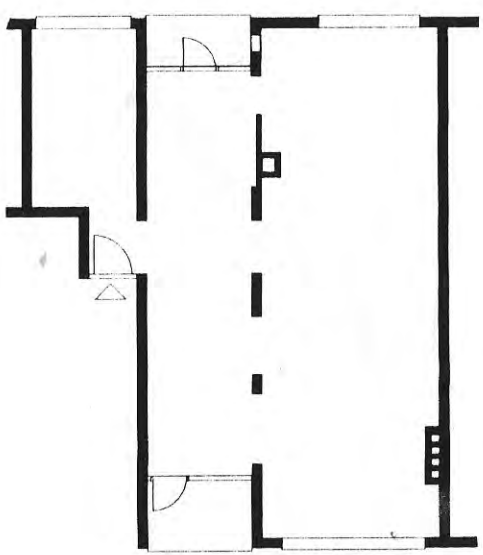


FIG.4.1



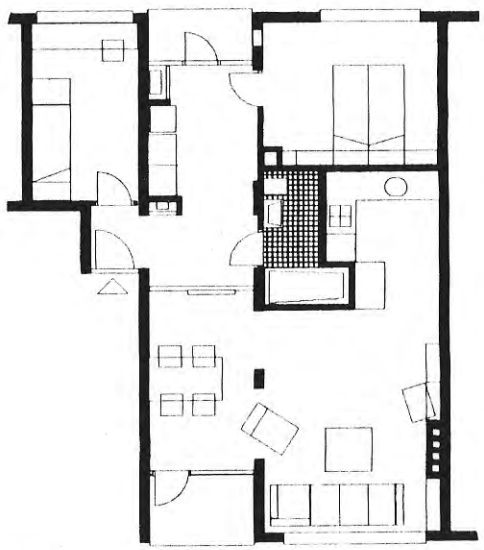


FIG.4.2

Figs. 4 : Plans as executed.

Fig. 4.1 : The plan of scenario one, compare with fig. 2.3
Fig. 4.2 : The plan of scenario two, compare with fig. 2.1

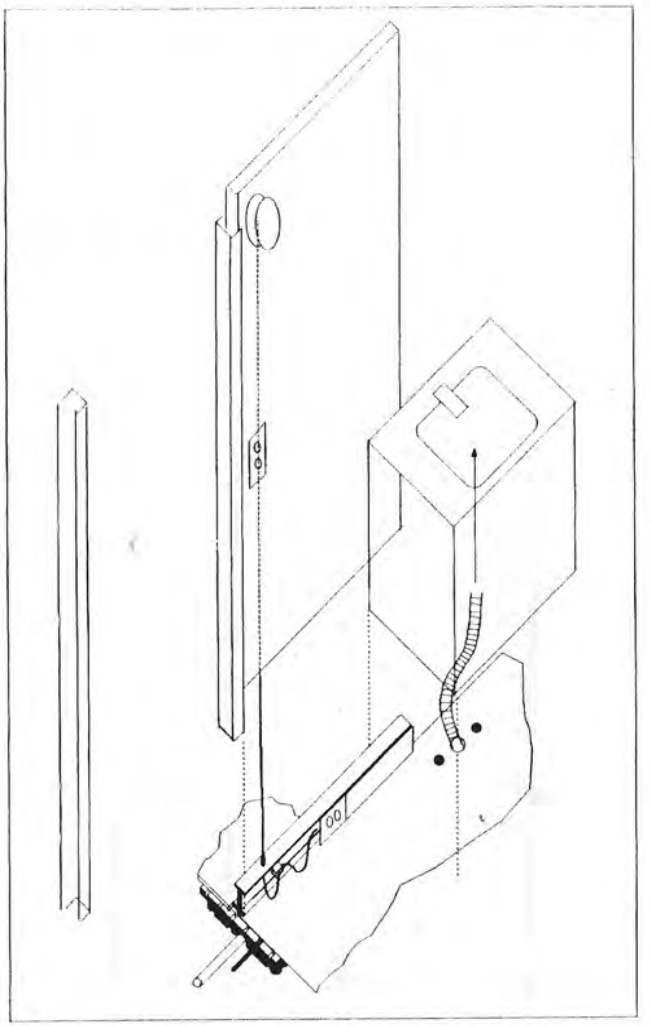


Fig. 5 : Organization of the Matura ® Infill System.

The so called lower system is structured by two new components.: 1. A Matrix tile holds conduits for water, central heating, and sewage, and is layd on the load bearing floor, and covered with a floor board. 2) A base profile holds all electricty and electronics. Elements of the upper system are from the open market and connected to the conduits of the lower system.

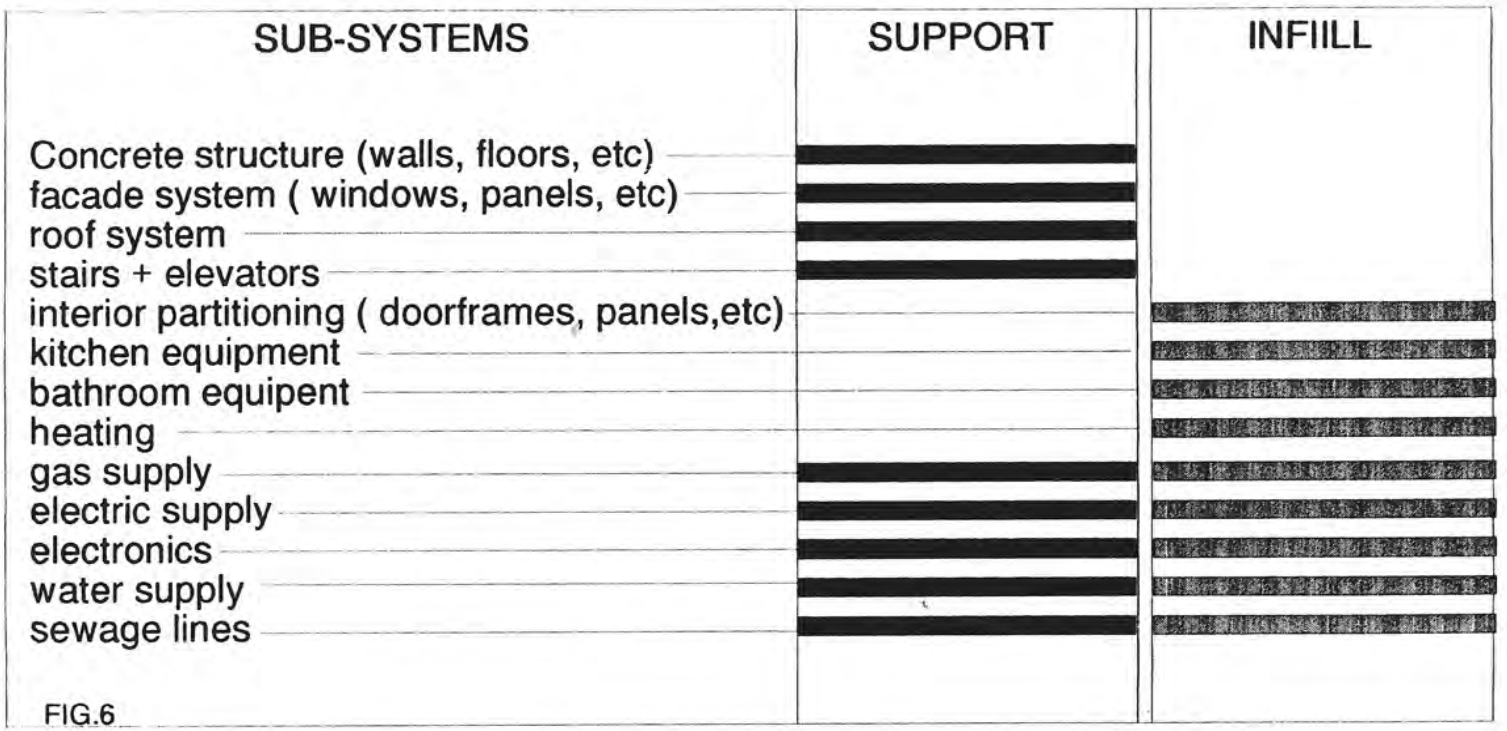


FIG.6: major sub-systems in a building and their relation to support and infill levels.