Universiteit Utrecht

Considerations for the decision to redevelop the Hugo R. Kruyt building

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1. Summary

When the Strategic Housing Plan was approved in 2019, the decision was made to redevelop the Hugo R. Kruyt building for the Faculty of Science's Experimental Research Programme. This document sets out the arguments that led to the decision in 2019 to redevelop the Kruyt building. The decision arose from the challenge of reducing the university's steadily increasing housing expenses to no more than 15% of the total university budget (and therefore 85% for the primary process of education and research). Therefore we searched for the most effective way to house the experimental research activities of the Faculty of Science.

The Kruyt building has the potential to facilitate many aspects of our current and future housing needs, so the decision was made to retain and redevelop the building.

First, it presents opportunities for facilitating growth. The Faculty of Science expects considerable growth and an important part of the faculty strategy is meeting and multidisciplinary collaborations. Housing must support this strategy. The Kruyt building can house the Experimental Research Programme and has the possibility of further growth in one location. Utilising the space between the wings of the Kruyt building can create the desired open floor plan to facilitate meetings and interactions and invite people to participate in multidisciplinary collaborations.

The Kruyt building also occupies a central position in Utrecht Science Park, along the future central boulevard (Heidelberglaan). The building will act as a junction between other important university locations in the Science Park, such as the Botanic Gardens, David de Wied building and the buildings in the northwest cluster. The university believes it is important to concentrate much of our pioneering UU-research in this prominent, central and well accessible location.

The financial considerations for choosing for redevelopment arise from the savings on the investment and operational costs for the building. This is a significant amount: 10% to 20% of the building costs and up to around € 200,000 to € 300,000 per year. Considering relocation costs, costs for nuisance reduction, higher construction site costs due to the phasing and possibly costs for temporary housing and possible delay of research, the bottom line is that redevelopment is still the more financially attractive option.

Retaining the building also presents a significant sustainability benefit. A one-time savings of at least 9% of Utrecht University's total CO2 footprint will provide a major boost to the university's goal of being climate-neutral by 2030. The building must be energy-neutral, regardless of whether the current building is retained or a new one is built in its place.

The feasibility of redeveloping the Kruyt building while occupied and in use is an important necessary condition. The bureaus ABT and Royal HaskoningDHV studied this question in 2019. By simulating building activities without any nuisance control measures, they measured whether the noise and vibrations would be observable enough to cause problems. With the exception of operating a bobcat, the noise level of the simulated work is equal to or lower than the current noise level in the building (benchmark level). That does not mean that the work will be unnoticed, but that it does not produce more noise than is already the case in the current situation. The same applies to work in the central core of the building. Vibrations were not observable in the other wings. It is, however, necessary to phase the renovation per wing and the re-occupation of the wing upon completion of building work that produces noise.

The strategic frameworks referred to above, the arguments and the feasibility of redevelopment while the building is occupied together led to the decision to redevelop the Kruyt building for the Faculty of Science's Experimental Research Programme.

2. Introduction

When the Strategic Housing Plan was drawn up in 2019, the decision was made to redevelop the Hugo R. Kruyt building for the Faculty of Science's Experimental Research Programme, rather than to build two new buildings for Life Science (LSL) and Materials Science (MSL). This memorandum explains the reasoning behind the 2019 decision to redevelop the Kruyt building.

2.1. Reading guide

This memorandum will first explain the context and conditions stipulated by the university's real estate strategy and the Strategic Housing Plan. Then the arguments will be summarised one by one. We will also deal with the conclusions regarding the feasibility of redevelopment while the building is occupied. Appendix 1 to this memorandum features a list of questions and answers that deal with the arguments in greater detail. Appendix 2 includes a summary of the feasibility survey for redevelopment while the building is occupied.

2.2. What does housing mean for the Faculty of Science?

The Faculty of Science is a world leader in research, and its scientific impact is significant. That is reflected in its rankings in the international research community, and the number of Spinoza's, ERC's, VICI's and NWO Roadmaps it has received. But equally important is its direct link with the university's teaching responsibilities and its social impact. It is vital for the faculty's continued success to have a future-proof home for education and research. Its housing must facilitate (spontaneous) interaction and new collaborations. The faculty must also be able to continue growing in order to maintain its position among the world's top institutions. Any new housing challenges we face must therefore allow the faculty to continue its world-class research and education activities.

3. Strategic framework

The decision to redevelop the Kruyt building arose from two framework documents: the university's real estate strategy (Sturen op Waarde, approved by the Executive Board in January 2019) and the housing strategy (Strategic Housing Plan, approved by the Executive Board in September 2019).

These documents describe how Utrecht University faced a major challenge regarding its real estate portfolio in 2017 - 2019. The poor condition of the real estate portfolio presented risks to our operational continuity. Short-term investments from the past had led to the need for new investments, with increasingly high operational costs as a result. In other words, Utrecht University's housing was becoming more expensive. Money spent on housing cannot be spent on the primary processes of education and research. The university therefore challenged itself to reduce our real estate operational costs to a maximum of 15% of the total budget. That meant the university has to retrench its real estate portfolio, with each of the faculties making their share of the necessary reductions. With that in mind, the university went looking for the best solutions to house our research and education, and the Faculty of Science was no exception.

4. Arguments in favour of the decision for redevelopment

These considerations led to the decision to retain the Hugo R. Kruyt building for the university, based on four categories of arguments in favour of redevelopment: flexibility for growth and shrinkage, position in Utrecht Science Park, financial considerations, and sustainability.

4.1. Flexibility for growth and shrinkage

The Kruyt building has a combination of characteristics that make it extremely useful as a laboratory building. Its high ceilings and many ducts and shafts, along with its stable, vibration-proof construction, make it suitable for laboratory work. The spaces between the building's wings also offer the potential to open up the structure to facilitate (spontaneous) contacts and interaction. The wings can either be connected, divided or even closed off. That gives it the flexibility to adapt to future growth or shrinkage. For the university, it also offers the advantage of keeping its real estate affordable in the future. At the moment, the Experimental Research Programme occupies around 75% of the Kruyt building, which is equivalent to three of the four wings. Without filling in the spaces between the wings, this leaves one wing flexibly available to accommodate growth or housing shortages elsewhere. The wing structure and the phased approach also offer enough time to adjust or expand the programme at a later date. Because of the limited footprint (area that can/may be built on), flexibility is more difficult to achieve for new buildings (Bleeker & Kavel 32). Horizontally, it is not efficient to add a piece on every floor in the future. Vertically, it would mean that in the future you might build extra floors. This would have to be taken into account in the construction and the inconvenience to the floors already in use would be considerable. This means that these extra storeys will have to be built right away. This does not benefit flexibility (and affordability).

4.2. Position in the Utrecht Science Park

Utrecht University is working for a better world by studying complex issues across the boundaries of scientific disciplines. Our buildings should facilitate these multi-disciplinary collaborations, both between researchers and between faculties. They should be recognisable and accessible, and located at the heart of the effervescent Utrecht Science Park. In late 2020, the university drew up a spatial planning vision that expresses these values. In the vision, the Heidelberglaan will serve as an important central artery through Utrecht Science Park. Within the next 10 years, it will become a lively boulevard with plenty of space for interaction and a diverse range of facilities. The Kruyt building is one of the first university properties along this boulevard, forming a link between the Botanic Gardens, David de Wied and the buildings in the northwest cluster (Minnaert, Koningsberger, Veining Meinesz, etc.). The Kruyt building's location is important to Utrecht University, as it presents the opportunity to bring together an important part of the Faculty of Science's research in a single, centralised location, with space for interactions between students, lecturers and researchers, and for offices, research and education. Keeping the Kruyt building will prevent the scattering of a significant portion of the Experimental Research Programme among other locations. New construction would actually exacerbate the fragmentation of the programme.

4.3. Financial considerations

The financial considerations were detailed in 2019. The main question at the time was whether redeveloping the Kruyt building would cost more or less than new construction. Three issues played a role in these considerations: the initial investment, revenues, and operational costs. One financial benefit of redevelopment is that the building's structure would remain erect. This is a major cost post for both the investment (one-time building costs) and depreciation (operational costs per year). We expect that the building costs will be 10%-20% less than those for new construction. No new foundations will be needed, no new superstructure, and no demolition costs for either.

The savings on operational costs (the costs of using the building, which is included in the depreciation calculation) around €200,000 to €300,000 per year for the Experimental Research Programme (three wings).

In the case of redevelopment, in addition to relocation costs, there are also costs for nuisance measures, higher construction site costs due to the phasing and possibly costs for temporary housing and possible delays to research. Nevertheless, the bottom line is that redevelopment is more attractive financially than new construction. This is mainly due to the integral picture for the UU, namely the reduction in operating costs and the additional income generated by the issue of lot 32 and Bleeker.

4.4. Sustainability

Utrecht University has high ambitions in the area of sustainability, and that naturally applies to our real estate portfolio as well. Our goal is for all of our buildings to be completely CO2-neutral by 2030. The guiding principle for the redevelopment of the Kruyt building is that the building must be (at least) energy-neutral. One benefit to redevelopment is that it would produce significantly less CO2 emissions, due to the retention of the building. This is because the production of concrete is one of the building activities that produces the most CO2. Based on the figures for the redevelopment of the Van Unnik building, the redevelopment of the Kruyt building would realise a one-time CO2 reduction of at least 5,500 tonnes (and perhaps even double that amount). That is equivalent to a one-time 9% reduction of the university's entire CO2 footprint. We will also add value by using fewer primary and secondary raw materials.

5. Feasibility of redevelopment while in use

An integral element of the decision to redevelop the building is that it must be feasible. Education and research must be able to continue at the same top-level throughout the redevelopment work. In 2019, bureaus ABT and Royal HaskoningDHV conducted a survey of the impact of redevelopment on the area with regard to vibrations and noise. This involved simulated building work, observed by various measurement installations throughout the building. No mitigating measures were used, such as fitting the wing with noise insulation. These measurements showed that the simulated building work did not result in higher noise levels than are already present in the other wings (the benchmark). However, the simulations did cause higher noise levels in the same wing. That means the work will have to be conducted in phases per wing, and that the wing can only be re-occupied after the noise-inducing work is complete.

The simulated building work did not produce observable vibrations in the other wings, and therefore does not present an obstacle to the conduct of research and education. Appendix 2 features a more detailed summary of this survey.

The details of the project phases will be determined at a later date, as more information becomes available about the layout of the building site. Naturally, the work will be planned in such a way to ensure easy access to the building and as neat an appearance as possible.

6. In conclusion

This memorandum was drafted to provide insight into the strategic frameworks and the arguments that led to the decision to redevelop the Kruyt building for the Faculty of Science's Experimental Research Programme. If you have any questions after reading this memorandum, please feel free to ask them before or after the meeting on 3 June, or send an e-mail to Kruytgebouw@uu.nl.

7. Appendix 1: Q&A

Q&A Flexibility for growth

Q	*The wing structure provides flexibility. But couldn't we break through the wing structure to realise the desired modern architecture?*
A	Even if the wing structure is updated to use contemporary architecture, the building is still easily adjustable to address changes to the scale and type of the programme.

Q	*Isn't a phased approach per wing a huge obstacle for the desired modern architecture, since it will maintain the wing structure?*
A	The phased approach does not affect the building's final appearance. The ideal building will be designed first, and then we will examine how the work can be divided into different phases.

Q	*Wouldn't a new building make it easier to take potential future expansions into consideration? Why do people say that it would be easier with the existing Kruyt building than with a new one?*
A	The layout and the space available around the Kruyt building presents plenty of opportunities to combine wings and floors, to split them up, or to expand them. That would be more difficult with any conceivable new design. The limited footprint (the area where construction is permitted and possible) makes it difficult to achieve the desired flexibility with a new building. In the horizontal axis, it would not be efficient to add a piece to every floor as needed, and vertical expansion would mean adding extra floors on top of the existing ones. These possibilities would have to be designed into the building, and their realisation in the future would cause considerable obstructions and irritations for the parts of the building that are occupied. It would be more efficient to just build the extra floors now, but that negates the entire goal of facilitating flexibility (and affordability).

Q	*Is it even possible to convert Kruyt into a contemporary building?*
A	Only the foundations, load-bearing columns and floor slabs will remain. An entirely new facade and interior will be built around this skeleton to accommodate Utrecht University's vision for the future, the faculty's vision for housing, and its future users. So yes, the Kruyt building can definitely be converted into a contemporary building. The current structure does have a limitation in the form of its enclosed, massive central core. But the space around the building, between the wings, presents opportunities to realise expansive views and easy connections.

Q	*Has anyone started thinking about a moving plan?*
A	First, we will work on a comprehensive final situation for the appearance and layout of the building and the place each group occupies within it. Then we will draw up a plan on how to achieve that final situation. The number of moves will not necessary be leading in the drafting of the moving plan.

Q&A Position in Utrecht Science Park

Q	*Why is the Kruyt building's location so important to Utrecht University? And why is that important to the Faculty of Science?*
A	The Kruyt building is located on the road that will eventually become the beating heart of Utrecht Science Park: a lively boulevard that connects the university's various buildings. We feel that such an important part of our experimental research deserves such an iconic and prominent location.

Q	*What are the benefits of a single building over multiple new buildings?*
A	New construction plans would only further fragment the Experimental Research Programme among other locations. The buildings would have an extremely mono-functional layout, while the Kruyt building facilitates multi-functional use with more spontaneous and scheduled interactions.

Q&A Financial considerations

Q	*Is redevelopment really less expensive than new construction?*
A	With redevelopment, we won't need to invest in a new foundation, pillars and floors (the building skeleton). This should cut building costs by 10%-20% compared to the cost of new construction. A comparison between new construction and the redevelopment of the Kruyt building should take extra investments into consideration, as parts of the building will remain in use. This will require a phased approach (with longer building times, and therefore higher building site costs), as well as costs for measures to reduce hindrances and irritations and temporary facilities for the continuity of education and research. Nevertheless, the bottom line is that it is less expensive to redevelop the Kruyt building, especially considering the lower operational costs (see below).
Q	*Are the operational costs for new construction actually higher than those for redevelopment, considering the fact that energy costs could be significantly lower?*
A	The guiding principle for both new construction and redevelopment is that the building must be energy-neutral. That makes the energy costs the same for both new construction and redevelopment. But the depreciation costs for redevelopment are 4% lower than for new construction.

Operational cost overview:

Depreciation	56% → of which approx. 4% depreciation for the structure
Maintenance	14%
Energy	8.5%
Soft facilities	11%
Other	4%
Cleaning	6%

Q	*Will the proceeds from the sale of lots be posted to the development of the Kruyt building or future Faculty of Science facilities?*
A	No, these are revenues from real estate operations. All revenues and costs for the area are in principle posted to a separate operation. The funds from real estate operations will be used for the rest of the area, as explained in the ambitions in the spatial planning vision. Thus it will help to facilitate spontaneous meetings outside the buildings.
Q	*Why would the Kruyt building probably have been demolished if the Faculty of Science wasn't housed there? Couldn't it just be redeveloped and leased out?*
A	The building's dimensions and its solid construction, with many shafts and ducts, make the building ideal for use as a laboratory. That does entail a higher price per m2, however. This does not mean that the building cannot be given a different function, but it would be less attractive to a commercial developer due to the expensive, non-functional square meters. That makes partial or full demolition a more likely option. Moreover, retaining the structure only has value for the university if we develop it for our own use. That value would be lost if a commercial developer were to do it, because then we would have to arrange for an entirely new building.

Q&A Sustainability

Q	*Is redevelopment really more sustainable than new construction?*
A	The guiding principle for both options is that the building must be energy-neutral. The main sustainability benefit to redevelopment is the retention of the structure. On the one hand, no raw materials will be needed to build it, and on the other we retain value because the building does not need to be demolished. See the answer above for more details.

8. Appendix 2: Feasibility survey summary

An integral element of the project is that a plan will be drawn up to conduct the work while ensuring the continuity of research and education at the same level. To that end, in 2019 bureaus ABT and RHDHV conducted a survey of the impact of building activities on noise and vibrations inside the building. This survey was used to draw up a plan to mitigate any obstructions and irritation.

8.1. Method

To determine the degree of potential irritation, the building work was simulated to measure the resulting noise and vibrations. This involved simulating heavy construction activities without noise insulation or other control measures (worst case scenario simulation). An overview of the test methods is provided below.

Geluidsbronnen	Materiaal
Hakken met Bobcat met beitel	Stenen binnenwand
	Dekvloer loshakken
Gaten boren met een klopboormachine	Betonnen kolom
	Betonnen vloer
Elektrisch hakken met Kango	Dekvloer loshakken
	Betonnen kolom
Slijpen met een slijptol	Metaal slijpen
	Beton slijpen
Hameren	Kloppen op radiatoren
	Betonnen kolom

8.2. Results of noise and vibration survey

The main conclusions and recommendations from the survey are summarised below.

Vertical noise transmission within a single wing

Various building activities exceeded the maximum allowable noise levels. Housing the primary process in the same wing where noise-producing building work is being conducted is therefore not an option.

➢ The principle should be to renovate wing-by-wing, and not floor-by-floor, and to reoccupy the wing only after the noise-producing activities have been completed.

Noise transmission to other wings

With the exception of operating a bobcat, the noise level of the simulated work is equal to or lower than the current noise level in the building (benchmark level). That does not mean that the work went unnoticed, but that it does not produce more noise than is already the case in the current situation. The same applies to work in the central core of the building.

Facade sound insulation

The sound insulation in the current facade is rated at around 23 dB. A simulation has shown that without a facade, work with a minimum noise production (80 dB) can exceed the target values in some places in the opposite wing, and the maximum noise production (110 dB) exceeds the target values even with the facade.

➢ the demolition and renovation work must be conducted using a facade or noise insulation around the wing or work, in order to reduce the noise transmission to the adjacent (old) facade. The demolition and replacement of the facade should be conducted consecutively if possible.

Vibrations

The vibrations resulting from the work are not observable, with the exception of work using a bobcat. The building's performance in this regard approaches level VC-A.

Screeds
The demolition of the screeds plays a major role in both the time needed to complete the work and the production of noise. ABT has tested screed samples for quality. The screeds are suitable for re-use, and the screed samples do not contain asbestos. That means the work that caused the most irritation and obstructions in the simulation (the bobcat) need not be conducted.

8.3. Conclusion

The noise measurements showed that the simulated building work did not result in higher noise levels than are already present in the other wings (the benchmark). That does not apply to the measurements in the same wing where the work was conducted, however. But this problem can be addressed by phasing the work so that the renovation is conducted wing-by-wing, and by only reoccupying the wing once the noise-producing work is complete. Maintain the screeds will also eliminate a major source of external noise production (the bobcat). The transfer of noise via the facades remains an area of concern that must be addressed with nuisance control measures.

The simulated building work did not produce observable vibrations in the other wings, and therefore does not present an obstacle to the conduct of research.

8.4. Possible control measures

Although the measurements showed that the noise levels remain below the target figures, or even current noise levels, the building occupants may still experience irritation due to noise. Noise-mitigating measures are currently under consideration, and this issue will be evaluated and corrected as necessary over the course of the project. There are several control measures available that can be used to reduce irritation due to noise. The necessity and effectiveness of these measures will be taken into consideration as the project progresses, along with how they will affect the time and expense needed to complete the project. For example, some measures may result in less noise irritation, but a longer building period - less noise, but for longer.

Examples of possible control measures:

Sound-insulated partition (airborne noise)

- Installing a sound-insulated partition can prevent airborne noise, for example to reduce the noise transmitted through a facade.

Working after office hours

- If necessary, specific agreements can be made with the contractor regarding noise-inducing work that is difficult to mitigate.

Using different materials

- If necessary, specific agreements can be made with the contractor regarding the materials to be used. This can include using a grinder instead of a pneumatic drill to demolish interior walls.

Noise-mitigating design

- The design of the building can include detail solutions to mitigate noise. This can include installing a rail system on the ceiling to which modular components can be mounted, instead of anchoring each individual component to the concrete ceiling.

Communications with users

- An important condition for increasing tolerance for the temporary building work-related irritations involves clear communications about the work and the resulting noise/vibrations. Communications with research groups must be designed in the same manner as is currently the case with the Business Continuity Team: short lines of communication with familiar faces, timely coordination and scheduling especially irritating projects in consultation with them.

In addition to studying the feasibility of continuing our education and research activities in the rest of the building, another precondition has been studied: specifically, whether the structural condition of the building is suitable for re-use (technical quality) and whether the project can be completed in phases (phase-ability and duration). The main conclusions are summarised below.

8.5. Technical quality

In addition to studying the feasibility of redevelopment while the building is occupied, the surveyors also examined whether structural condition of the building is suitable for re-use and whether the project can be completed in phases. The main conclusions are summarised below:

- The existing clear building structure presents plenty of potential for redevelopment. The structure is generally in a good technical condition. The structure has a clear layout of rows of openings, there is sufficient ceiling height, and the column structure of the floor plan presents a relatively high degree of flexibility. These are the characteristics of the existing structure.
- The existing concrete structure meets current norms and performance requirements for strength, equivalent to the level of new construction. There is no evidence to assume that the building is not suitable for another period of 50 years of use.
- The original imposed loads were higher than required by the norms at the time. This means that the variable loads used present considerable flexibility, which is one of the building's characteristics.
- The building was designed in 1969 with a fire resistance rating of 180 minutes for the load-bearing structure. According to today's norms, the available information indicates that the building achieves a fire resistance rating of 90 minutes. The structure therefore more than satisfies contemporary requirements for the level of new construction.
- The screeds inspected are free of asbestos and suitable for re-use in the same function.

8.6. Phaseability

Phaseability is one of the guiding principles for limiting noise irritation. The feasibility study examined the feasibility of phasing, but this depends largely on the final design. The most efficient phases can be determined at a later date, once it the final design has been decided upon.

- Small building sites can be realised on four sides of the building, taking certain areas of concern into consideration for each quadrant. These areas of concern are: the limits for vibrations and disruptions of the magnetic field in the Nicolaas Bloembergen building, the user traffic flows, the building traffic flows, storage and parking facilities, the Sjoerd Groenman building, the surrounding trees, and later the NPEC as well.
- The building features a clear structure of entrances and evacuation routes that offer more than enough capacity, even during the phased implementation of the building work.
- The phased, simultaneous renovation of the central core and one wing would be the most efficient use of time. However, there are some areas of concern in this method, such as the noise produced by work on the central core, the lift capacity, and the phases of the installations in the central core.
- The phased installation/replacement of the technical infrastructure would be feasible without many additional complex facilities, but this approach would require considerable ground work before and after the work on the project.

8.7. Time requirements

Based on a phased, wing-by-wing renovation, the project would in principle consist of four phases. The time required to complete each wing is estimated to require 72 to 96 working weeks per wing, or six to nine quarter-years.

This time requirement includes asbestos removal, which is estimated to take 20 to 25 weeks per wing. That means the complete renovation of the Kruyt building is estimated to require six to nine years of work. Three quarters of this period will be necessary to complete the accommodations for

the current users' education and research activities. Further research is needed to identify opportunities for optimisation in this approach and the estimated time requirement.

8.8. Q&A Feasibility Survey

Q	*The noise produced by work in the central core is mentioned as an 'area of concern'. Does that mean it will cause irritation for the people working in the wings?*
A	This means that without control measures, there may be some noise irritation, so the preparations should consider which necessary building work activities may produce noise, what impact these activities will have on the parts of the building then in use, and which control measures can be taken to alleviate it.
Q	*Does the principle of 'wing-by-wing restoration' mean that the wing structure will be retained in the future, and is that not an architectural hindrance to a contemporary building with long lines of sight and opportunities for spontaneous interactions with colleagues?*
A	This principle only applies to the phases of the project, and not the final design (see previous answer at Flexibility).
Q	*The time estimate is 8 quarters x 4 wings = 32 quarters, which means a total of eight years to complete the entire building.*
A	That's correct. But the first wing will be completed and ready for occupation within 1.5-2 years, providing for around 30% of our housing needs. After 3-4 years, 65% of our housing needs will be met. The actual time requirements will only be known in a later phase, once we know the final design of the building and which programme will be housed in which part of the building.
Q	*Have any tests been conducted to measure the impact of vibrations on highly sensitive instruments?*
A	Measurements were conducted throughout the building to determine if the building work would cause more vibrations than normal. That is fortunately not the case. Additional surveys for extremely sensitive instruments can be conducted in consultation with the relevant research groups.
Q	*Will any control measures be implemented to reduce obstructions and irritations?*
A	Yes. In addition to the possible measures listed above, the building plan will explicitly separate building traffic flows from user traffic flows. This is a safety issue, and is therefore an important area of concern. The separation may take the form of temporary entrances, alternative routes through the building, etcetera.