conclusion

Following an exploration of the relationship between architecture and film, as well as a study of the current technologies used in the film industry, a building was designed which incorporates the facilities necessary to teach motion picture production. The locality of the chosen site emphasizes the transition from public to private. An understanding of the site generated a building designed to act as a threshold. Therefore, the proposed building aims to achieve a visual display of identity on the South Campus. Members of the public and private users are all invited to experience the learning process and the process of motion picture production. Through the dissertation I have gained an awareness of the spatial experiences generated through movement, and the technical competence necessary to design an interactive building.

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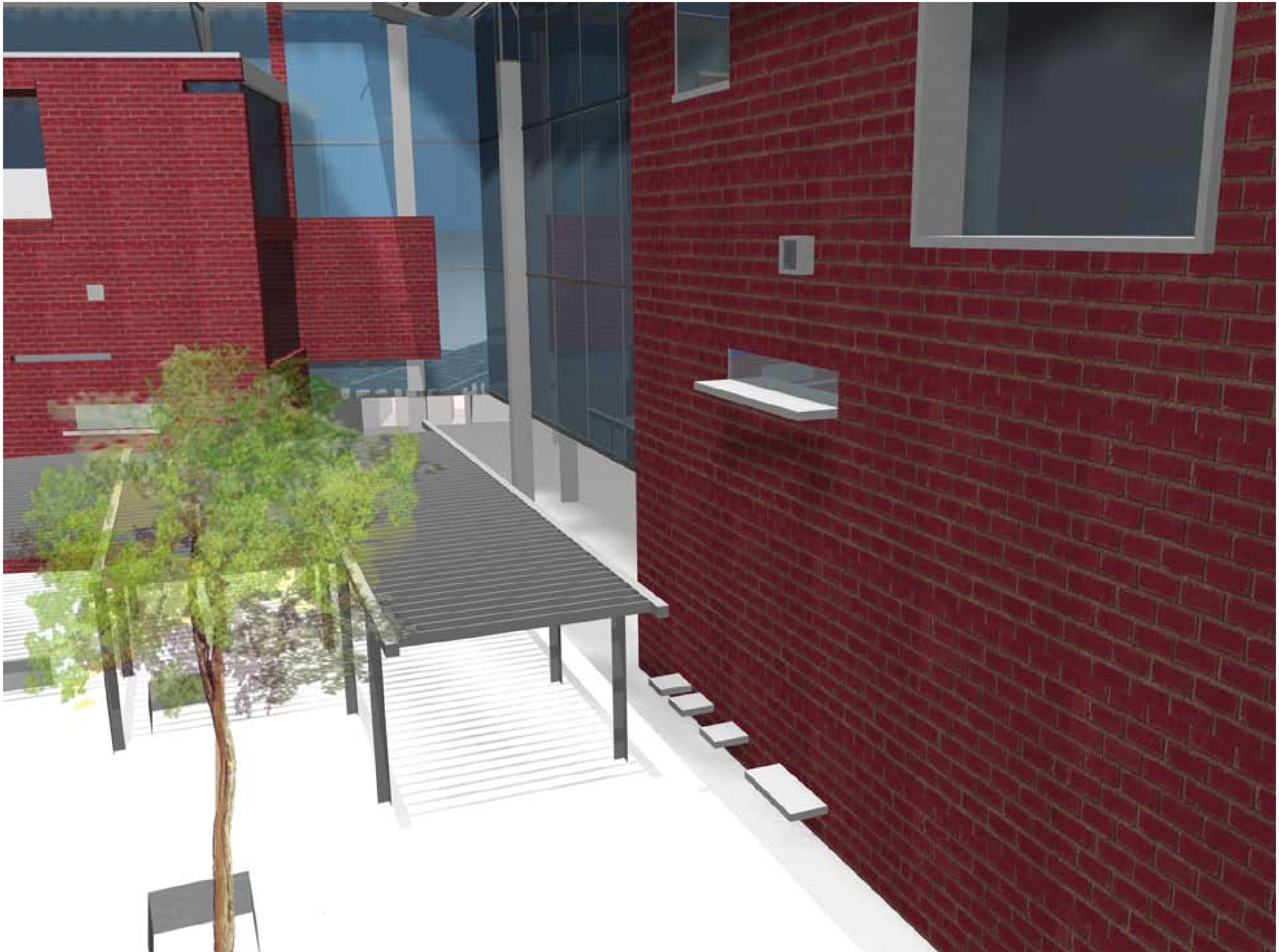

Figure 242: Proposed perspective view of the internal courtyard.

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appendix

appendix a: proposed Bus Rapid Transport route

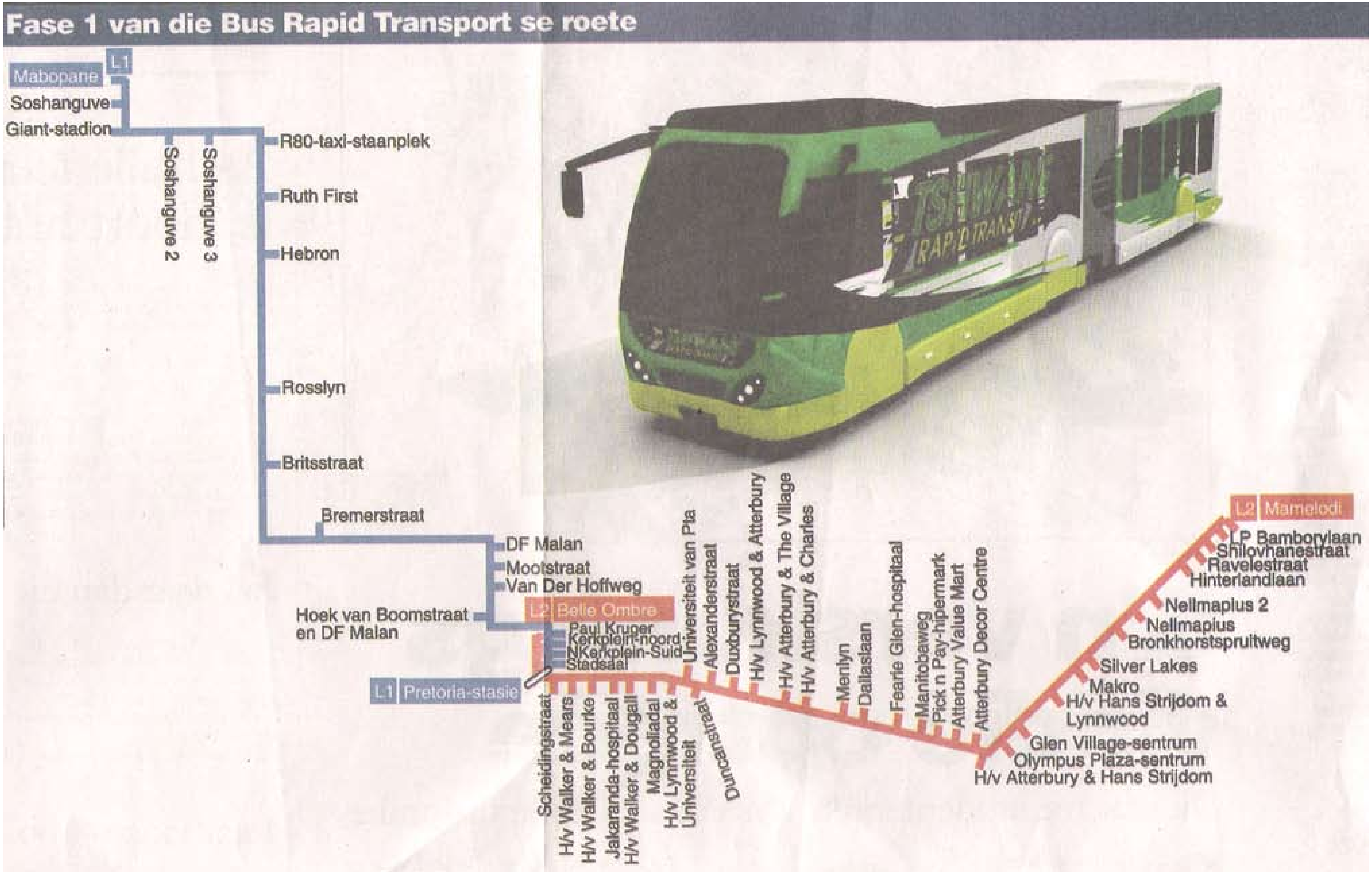

Figure 245: Newspaper article indicating proposed BRT route.

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appendix b: group framework

The framework developed by the master's thesis graduate group of 2008 has the following aims: To transform the University of Pretoria and the Hatfield precinct into a **UNIVERSITY CITY**, an integrated, networked city of innovation and social cohesion, where the public sector interfaces with the private sector and the academic sector; to remove physical, social and virtual boundaries that are constraining the growth of both the university and the Hatfield precincts, and create a social amalgam that celebrates and empowers the uniqueness, vitality, potential and culture of South Africa's premier academic community.

This transformation entails a two-phased proposal with a single vision as driving force: it consists of the transformation of the university into a "University City" and concurrently the transformation of Hatfield into a diverse, vibrant and regenerative social hub that facilitates the conception of this University City.

University village

The University of the Future is the University of Pretoria is a City of Knowledge. The UP as a village is the first step in achieving the vision of the university as a city: a village that is the "brain" of the "University City", a village where the urban fabric is designed at a human scale, where the buildings become nodes of human and social interaction, and exterior spaces act as outdoor rooms for academic discourse and social play; a village that has its own tangible and definable character, identity and vitality; a village that has clarity of circulation dominated by pedestrians; a village that is designed to have a vibrant and cultural night life. The university village will function as a community, working as an interrelated whole, as a symbolic relationship of allied units. The transformation of the university into a village will prepare it to continue functioning as a holistic entity when integrated with the "University City" precinct.

Social hub

The Hatfield precinct is to be developed to create a destination, a place of continual social, cultural and civic regeneration; a place that defines itself as the vibrant, multifunctional "body" of the "University City". Hatfield is to be the gateway of the "University City" precinct. Hatfield's continual transformation will be driven by the creation of interdependent nodes, including transport, mixed use, culture, commerce and political activities, allowing a dynamic interface for social expression. Hatfield must become a place for the people – for businessmen, academics, students, professionals, politicians, workers; Hatfield must be a place for all.

The University City

To achieve the University of Pretoria's strategic objective of becoming a world class research institute, two vibrant, successful, independent and isolated entities – the Hatfield "social hub" and the "university village" – need to merge into a coherent, spatially integrated community without boundaries and borders. The future is now and this brings with it the world of virtual places, virtual lectures, virtual libraries and virtual paths. Thus there is an urgent need to allow the surrounding community to enter the campus grounds to fully utilize those facilities that may become obsolete in the virtual age. The unification of these two distinct identities must not allow the dissolution of either entity's unique identity, but must rather reinforce each other's key strengths and increase opportunities to allow a true city of knowledge to be born, a "UNIVERSITY CITY" (Graduate class, 2008).

Figure 246: Aerial photograph of Hatfield indicating the group framework proposal.

appendix c: natural daylight calculations

	Room	Openings (m²)	Floor area (m²)	% Openings
Ground floor				
1	Lecture 1 & 2	18.0	180.0	10.0%
2	Sound stage	60.8	332.0	18.3%

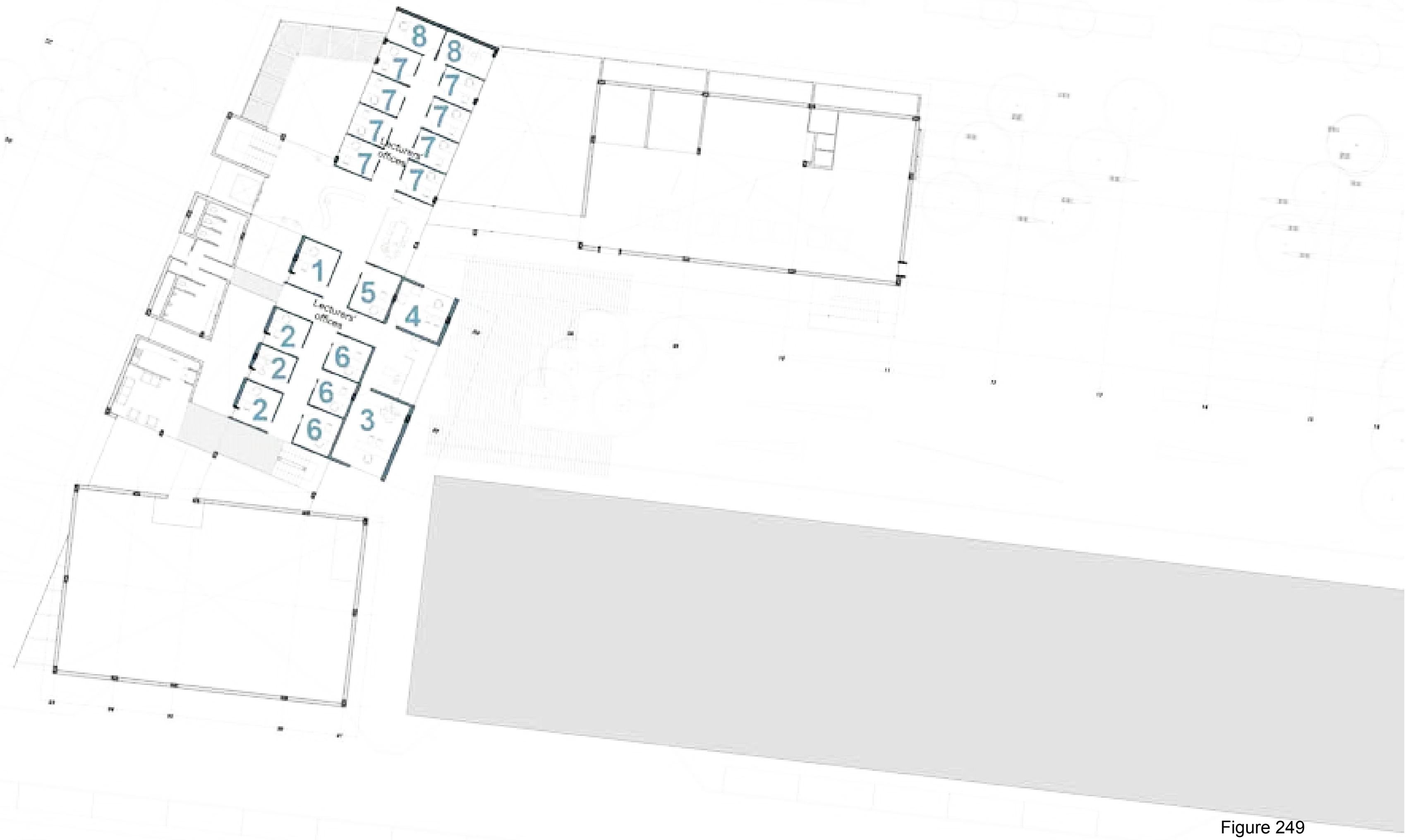
Figure 247

	Room	Openings (m²)	Floor area (m²)	% Openings
First floor				
1	Video editing	4.3	37.4	11.6%
2	Sound editing	12.6	11.8	107.1%
3	Server room	5.0	34.0	14.8%
4	Meeting room	14.4	17.6	81.8%
5	Meeting room	5.4	17.6	30.7%
6	Production design studio	63.5	288.5	22.0%

First floor plan 1:500

Figure 248

	Room	Openings (m²)	Floor area (m²)	% Openings
Second floor				
1	Office	2.5	11.4	21.7%
2	Office	2.5	9.0	27.4%
3	Office	7.0	26.6	26.4%
4	Office	7.0	15.7	44.6%
5	Office	1.6	11.4	13.8%
6	Office	1.2	9.0	13.3%
7	Office	6.3	7.8	80.6%
8	Office	6.3	10.0	62.5%



Second floor plan 1:500

Figure 249

appendix d: water harvesting calculations

Usage / day

	Actual
Students	300
Hours in building / person	8
Staff + cleaners	25
Hours in building / person	8
Daily visitors (cinema)	180
Hours in building / person	3
Man hours occupied per day	3140
Effective number of people per 24h day	130.8
% of males	50%
% of females	50%
Effective number of males per day	65.4
Effective number of females per day	65.4

Usage / day

	Actual	Liters/ day
Toilets		
Liters per flush (Kohler, 2008)	6.0	
Flushes per man per day (Kohler, 2008)	1.0	392.4
Flushes per woman per day (Kohler, 2008)	3.0	1177.2
Urinals		
Liters per flush	4.0	
Flushes per man per day	3.0	784.8
Bathroom sink		
Liters per minute	8.0	
Seconds per hand wash	15.0	
Number of bathroom visits/ day (man)	261.6	523.2
Number of bathroom visits/ day (woman)	196.2	392.4
Kitchen / snack bar		
Liters per dishwasher by hand	30	
Hand washes per day	5	150.0
Liters per steam dishwasher	10	
Steam washes per day	20	200.0
Other		
Building washing + cleaning	200	200.0
Model building	50	50.0
		3870.0 liters/day
		3.87 kl/ day = m3 / day
		6.0 occupied days / week

Roof catchments

Catchments area (m^2)	1404.39
Precipitation average annual in PTA (mm)	674
Catchable	75%
Total usable precipitation (mm)	505.5
Total usable precipitation (m)	0.5055
Volume of water (m^3)	710
Liters	709,919

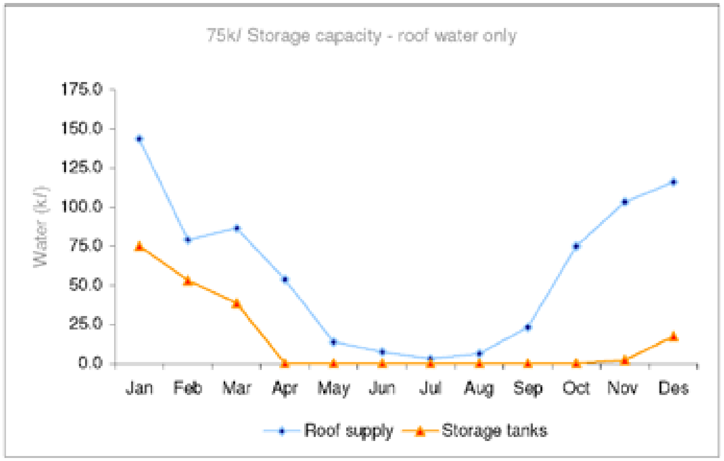
JOJO (diameter 2.6m, height 4.2m)

Storage	
JOJO volume (k*l*)	15
Amount of tanks	5
Total storage (k*l*)	75

Roof water only (k*l* water/ month)

	mm	Rain (*l*)	Roof supply	Wetland	Total in	Total out	Difference	Storage tanks
Jan	136	143,248	143.2	0.0	143.2	100.9	42.4	75.0
Feb	75	78,997	79.0	0.0	79.0	100.9	-21.9	53.1
Mar	82	86,370	86.4	0.0	86.4	100.9	-14.5	38.6
Apr	51	53,718	53.7	0.0	53.7	100.9	-47.2	0.0
May	13	13,693	13.7	0.0	13.7	100.9	-87.2	0.0
Jun	7	7,373	7.4	0.0	7.4	100.9	-93.5	0.0
Jul	3	3,160	3.2	0.0	3.2	100.9	-97.7	0.0
Aug	6	6,320	6.3	0.0	6.3	100.9	-94.6	0.0
Sep	22	23,172	23.2	0.0	23.2	100.9	-77.7	0.0
Oct	71	74,784	74.8	0.0	74.8	100.9	-26.1	0.0
Nov	98	103,223	103.2	0.0	103.2	100.9	2.3	2.3
Des	110	115,862	115.9	0.0	115.9	100.9	15.0	17.3
		709,919	709.9		709.9			

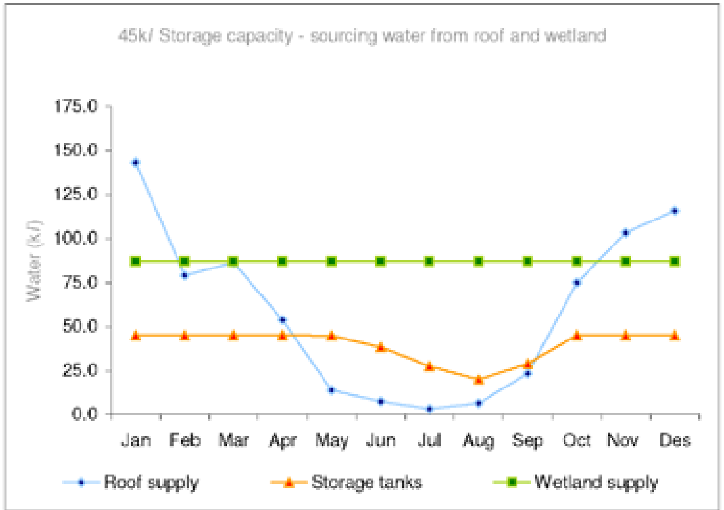
Figure 250



Roof water and wetland (k*l* water/ month)

	mm	Rain (*l*)	Roof supply	Wetland supply (12% of minimum flow in winter)	Total in	Total out	Difference	Storage tanks
Jan	136	143,248	143.2	86.9	230.2	100.9	129.3	45.0
Feb	75	78,997	79.0	86.9	165.9	100.9	65.0	45.0
Mar	82	86,370	86.4	86.9	173.3	100.9	72.4	45.0
Apr	51	53,718	53.7	86.9	140.7	100.9	39.8	45.0
May	13	13,693	13.7	86.9	100.6	100.9	-0.3	44.7
Jun	7	7,373	7.4	86.9	94.3	100.9	-6.6	38.2
Jul	3	3,160	3.2	86.9	90.1	100.9	-10.8	27.4
Aug	6	6,320	6.3	86.9	93.3	100.9	-7.6	19.7
Sep	22	23,172	23.2	86.9	110.1	100.9	9.2	28.9
Oct	71	74,784	74.8	86.9	161.7	100.9	60.8	45.0
Nov	98	103,223	103.2	86.9	190.2	100.9	89.3	45.0
Des	110	115,862	115.9	86.9	202.8	100.9	101.9	45.0
		709,919	709.9	1043.3	1753.2	1210.8		

Figure 251



appendix e: acoustic absorption calculations

Absorption

Total room absorption = sum of all room surface areas times their respective sound absorption coefficients

$A = \Sigma S.\alpha$ A: total room absorption (Sabins) {or m^2}
S: surface area (m^2)
α: Sound absorption at given frequency

NRC (noise reduction coefficient) refers to a single number rating of the sound absorption coefficient of a material. Thus using NRC instead of α gives a good approximation of sound absorption over all frequencies.

Material (Reflecting / Absorbing)	NRC Number
Walls	
Brick / plaster / concrete (Zyl, 2005)	0.02
Glass (heavy, large panels, e.g. 6mm) (Egan, 1988:52)	0.05
Glass (ordinary windows, e.g. 4mm) (Egan, 1988:52)	0.15
10mm Carpet against brick wall (Zyl, 2005)	0.30
25mm Wood fibre cement bonded panel with 25mm cavity	0.46
Mellosorber Acoustic Panels 90mm	0.96
Roller shutter: RAUVOLET Acoustic Line (Rehau, 2007)	0.80
Floors	
Concrete / tiles (Egan, 1988:52)	0.01
20mm Thick plank floor on joists (Zyl, 2005)	0.10
10mm Carpet on concrete (Zyl, 2005)	0.30
10mm Carpet on wooden floor joists (Zyl, 2005)	0.35
6mm Carpet on 10mm underfelt (Zyl, 2005)	0.50

Material (Reflecting / Absorbing)	NRC Number
Ceilings	
Gypsum board (13mm) (Zyl, 2005)	0.05
25mm Wood fibre cement bonded panel with 25mm cavity	0.46
50mm Wood fibre cement bonded panel with 40mm cavity and mineral wool	0.87
Mellosorber Acoustic Panels 90mm	0.96
Seats & Audience:	
Well-upholstered seats (Egan, 1988:52)	0.59
Informally dressed students seated in table-arm chairs (Egan, 1988:52)	0.84
Audience seated in upholstered seats (Egan, 1988:52)	0.87

Reverberation time

$T = 0.16\ V/a$ T: reverberation time in seconds
V: room volume in m^3
a: room absorption in Sabins

Preferred range of reverberation time (seconds):

	Min	Ideal	Max
Recording: Voice booth (Egan, 1988:64)	0.3	0.5	0.7
Recording: Control Room (Lord & Templeton, 1986:91) (Doelle, 1972:120)		0.4	
Cinema		Max. absorption	
Lecture room (Egan, 1988:64)	0.6	0.9	1.5

Voice booth 1

Room	l (m)	b (m)	h (m)	Volume m³ (V)
Voice booth 1	**3.50**	**2.55**	**2.56**	22.85

Surface	Area (m^2)	Material	NRC	Absorption
Floor total	*8.93*			
Floor	8.93	20mm Plank floor on joist	0.10	0.89
Walls total	*30.98*			
Door 2.1 x 0.8m	1.68	2x Solid wood with 200mm cavity	0.1	0.17
Window 2.0 x 1.3m	2.60	Double pane glass	0.05	0.13
Walls	26.70	10mm Solid wood with 25mm cavity	0.10	2.67
Ceiling total	*8.93*			
Ceiling	8.93	25mm Wood fibre cement bonded panels with 25mm cavity	0.46	4.11

Total room absorption ($A = \Sigma S.\alpha$)	**7.97**	**Sabins**
Actual reverberation time ($T = 0.16\ V/a$)	**0.46**	Seconds
Min	*0.30*	
Ideal	*0.50*	
Max	*0.70*	

Recording 1

Room	l (m)	b (m)	h (m)	Volume m³ (V)
Recording 1	**5.10**	**3.70**	**2.56**	48.31
Surface	**Area (m²)**	**Material**	**NRC**	**Absorption**
Floor total	*18.87*			
Floor	18.87	10mm Carpet on concrete	0.30	5.66
Walls total	*45.06*			
Door 2.1 x 0.8m	1.68	2x Solid wood with 200mm cavity	0.1	0.17
Door 2.1 x 0.8m	1.68	Solid wood	0.1	0.17
Window 2.0 x 1.3m	2.60	Double pane glass	0.05	0.13
Window 2.0 x 1.3m	2.60	Double pane glass	0.05	0.13
4x Acoustic panels	2.88	Mellosober 1.2 x 0.6m	0.96	2.76
Walls	33.62	Plaster	0.02	0.67
Ceiling total	*18.87*			
Ceiling	18.87	25mm Wood fibre cement bonded panels with 25mm cavity	0.46	8.68

Total room absorption ($A = \Sigma S.\alpha$)	**18.37**	**Sabins**
Actual reverberation time ($T = 0.16\ V/a$)	**0.42**	Seconds
Ideal	*0.40*	

Voice booth 2

Room	l (m)	b (m)	h (m)	Volume m³ (V)
Voice booth 2	**8.30**	**3.50**	**2.56**	74.37

Surface	Area (m²)	Material	NRC	Absorption
Floor total	*29.05*			
Floor	29.05	20mm Plank floor on joist	0.10	2.91
Walls total	*60.42*			
Door 2.1 x 0.8m	1.68	2x Solid wood with 200mm cavity	0.1	0.17
Window 4.0 x 1.3m	5.20	Double pane glass	0.05	0.26
Window 4.0 x1.3m	5.20	Double pane glass	0.05	0.26
Walls	48.34	25mm Wood fibre cement bonded panels with 25mm cavity	0.46	22.23
Ceiling total	*29.05*			
Ceiling	29.05	25mm Wood fibre cement bonded panels with 25mm cavity	0.46	13.36

Total room absorption (A = Σ S.α)	**39.19**	**Sabins**
Actual reverberation time (T = 0.16 V/a)	**0.30**	Seconds
Min	*0.30*	
Ideal	*0.50*	

Recording 2

Room	l (m)	b (m)	h (m)	Volume m³ (V)
Recording 2	**8.30**	**2.90**	**2.62**	63.06
Surface	**Area (m²)**	**Material**	**NRC**	**Absorption**
Floor total	*24.07*			
Floor	24.07	10mm Carpet on concrete	0.30	7.22
Walls total	*58.69*			
Door 2.1 x 0.8m	1.68	2x Solid wood with 200mm cavity	0.1	0.17
Door 2.1 x 0.8m	1.68	Solid wood	0.1	0.17
Window 4.0 x 1.3m	5.20	Double pane glass	0.05	0.26
Window 2.0 x 1.3m	2.60	Double pane glass	0.05	0.13
6x Acoustic panels	4.32	Mellosober 1.2 x 0.6m	0.96	4.15
Walls	43.21	Plaster	0.02	0.86
Ceiling total	*24.07*			
Ceiling	24.07	25mm Wood fibre cement bonded panels with 25mm cavity	0.46	11.07

Total room absorption ($A = \Sigma S.\alpha$)	**24.03**	**Sabins**
Actual reverberation time ($T = 0.16\ V/a$)	**0.42**	Seconds
Ideal	*0.40*	

Dubbing

Room	l (m)	b (m)	h (m)	Volume m³ (V)
Dubbing	**8.30**	**5.00**	**2.65**	109.98

Surface	Area (m²)	Material	NRC	Absorption
Floor total	*41.50*			
Floor	41.50	10mm Carpet on concrete	0.30	12.45
Walls total	*70.49*			
Door 2.1 x 0.8m	1.68	Solid wood	0.1	0.17
Window 2.0 x 2.6m	5.20	Double pane glass	0.05	0.26
6x Acoustic panels	4.32	Mellosober 1.2 x 0.6m	0.96	4.15
Walls	59.29	Plaster	0.02	1.19
Ceiling total	*41.50*			
Ceiling	41.50	25mm Wood fibre cement bonded panels with 25mm cavity	0.46	19.09

Total room absorption ($A = \Sigma S.\alpha$)	**37.30**	**Sabins**
Actual reverberation time ($T = 0.16 V/a$)	**0.47**	Seconds
Ideal	*0.40*	

Cinema

Room	l (m)	b (m)	h (m)	Volume m³ (V)
Cinema	**21.50**	**13.00**	**5.16**	1443.00

Surface	Area (m²)	Material	NRC	Absorption
Floor total	*279.50*			
Seats	*94.50*	Well upholstered seats with audience	0.87	82.22
Floor	185.00	6mm Carpet on 10mm under felt	0.50	92.50
Walls total	*350.70*			
2x Door 2.1 x 1.7m	7.14	Solid wood	0.10	0.71
Behind screen 13 x 6m	78.00	50mm Wood fibre cement bonded panels with 50mm cavity	0.61	47.58
Back wall 6.5 x 3.9m	25.35	50mm Wood fibre cement bonded panels with 50mm cavity	0.61	15.46
Side Walls + Other	240.21	Carpet on concrete/brick	0.30	72.06
Ceiling total	*279.50*			
Ceiling	279.50	50mm Wood fibre cement bonded panels with mineral wool in 40mm cavity	0.87	243.17

Total room absorption ($A = \Sigma S.\alpha$) **553.70** **Sabins**

Actual reverberation time ($T = 0.16 V/a$) **0.42** Seconds

Ideal *Acoustically dead*

Lecture room

Room	l (m)	b (m)	h (m)	Volume m³ (V)
Lecture room	**11.80**	**15.00**	**4.47**	790.50

Surface	Area (m²)	Material	NRC	Absorption
Floor total	*177.00*			
Seats	*67.00*	Informally dressed students in table-arm chairs	0.84	56.28
Floor	110.00	Tiles	0.01	1.10
Walls total	*225.40*			
10x Acoustic panels	10.80	Mellosober 1.8 x 0.6m	0.96	10.37
Acoustic roller shutter	15.00	Rauvolet shutters	0.80	12.00
Walls	199.60	Plaster	0.02	3.99
Ceiling total	*177.00*			
Ceiling - reflective	88.50	Gypsum	0.05	4.43
Ceiling - absorptive	88.50	25mm Wood fibre cement bonded panels with 25mm cavity	0.46	40.71

Total room absorption ($A = \Sigma S.\alpha$)	**128.88**	**Sabins**
Actual reverberation time ($T = 0.16 V/a$)	**0.98**	Seconds
Min	*0.60*	
Ideal	*0.90*	
Max	*1.50*	

appendix f: traffic noise calculations

A traffic noise calculator was used to determine the noise levels generated by traffic (XS4All, 1998).

Inputs

- 1800 cars per hour
- 10 motorcycles per hour
- 10 heavy trucks per hour
- Speed of cars & trucks 60km/h
- Road surface: smooth asphalt
- Distance from centre of road: 25m
- Height of observer: 3m (1m landscape + 2m person)
- Assuming the ground absorbs none of the noise
- Assuming there is no reflection from the other side of the road
- Distance from intersection: 45m

Output

- **Calculated noise level = 65dB**

appendix g: acoustic isolation calculations

Construction	Ia Index (dB)
Walls	
115mm brick + 115mm cavity with glass fibre insulation + 115mm brick (Egan, 1988:204)	59
150mm solid concrete (Egan, 1988:204)	53
Floor / Ceiling	
150mm reinforced concrete (Egan, 1988:204)	55
Doors	
45mm solid core wood door (with gasket and drop seal) (Egan, 1988:204)	43
VK105 from AluGlass (AluGlass, 2007)	48
Roller Shutter	
Force Shield Roller Shutter (Rollashield, n.d.)	39

Noise design criteria:

Space	Recommended maximum background noise (dB)
Broadcast studios (Ramsey & Sleeper, 1981:43)	15-25
Movie theatres (Ramsey & Sleeper, 1981:43)	25-30
Lecture room (Farren, 2003)	< 35

Voice booth

Internal sound level ≈ External Noise Level – STC
≈ 70 dB (“loud”) - 59 dB (double brick + fibre glass cavity)
≈ 11 dB (“just audible”)

Cinema

Internal sound level ≈ External Noise Level (> traffic 65dB) – STC
≈ 70 dB (“loud”) - 45 dB (115mm single wall)
≈ 25 dB

Thus a single wall is good enough to eliminate traffic noise.

External sound level ≈ Internal Noise Level (war scene in movie) – STC
≈ 100 dB (“very loud”) - 59 dB (double brick + fibre glass cavity)
≈ 41 dB (“quiet”)

Thus a double wall is needed to eliminate internal noise from the lecture room and library.

Lecture room

Recommended noise level inside the lecture room < 35 dB

Internal sound level ≈ External Noise Level (room next door) – STC
≈ 70 dB (“loud”) - 39 dB (Single Force Shield roller shutter)
≈ 31 dB (“very quiet”)