Landspitali

Space Gab Analysis - *DRAFT*
Development Plan, phase 2
08.03.2001

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1 Introduction

Landspitali and Sjukrahus Reykjavikur have merged to one hospital: Landspitali University Hospital (LSH).

The new hospital is located at various building complexes in the Reykjavik area, where the two main locations are Hringbraut and Fossvogur. Other important locations are Vifilstadir, Kopavogur, Kleppur, Grensás and Landakot.

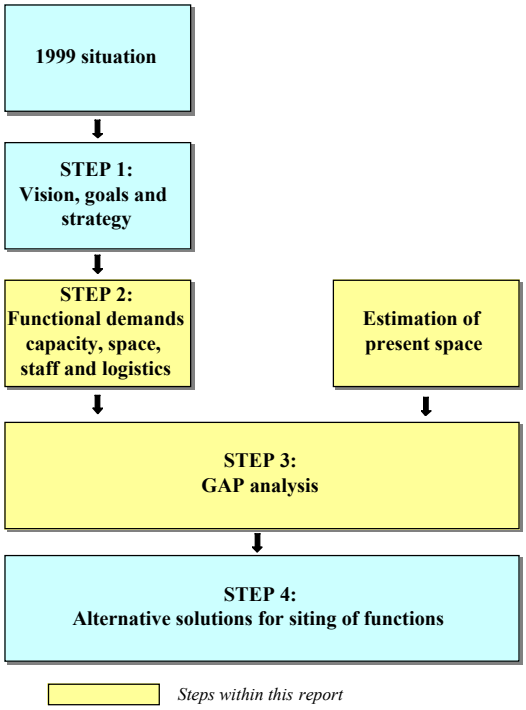
In order to analyze the physical building situation for the new university hospital for Iceland, the Management has engaged Ementor Denmark A/S to assist in the process and to prepare a Functional Development Plan for LSH, concentrating on the two main complexes at Fossvogur and Hringbraut.

The purpose of a Functional Development Plan for Landspitali is to

- create a long term (until year 2020) integrated plan for the functional and building development of the hospital, in order to remove bottlenecks, achieve good logistics, minimise the investment costs and to support the operational procedures in the most efficient way
- to create an instrument for project and cost control in the building/implementation period

Furthermore the plan must consider the future patientprofile and volume of the hospital, the flow of the main processes (logistical demands), the capacity needed and the existing buildings (conditions and capacity).

This planning process is shown in the illustration below:



As shown the project is carried out in four steps:

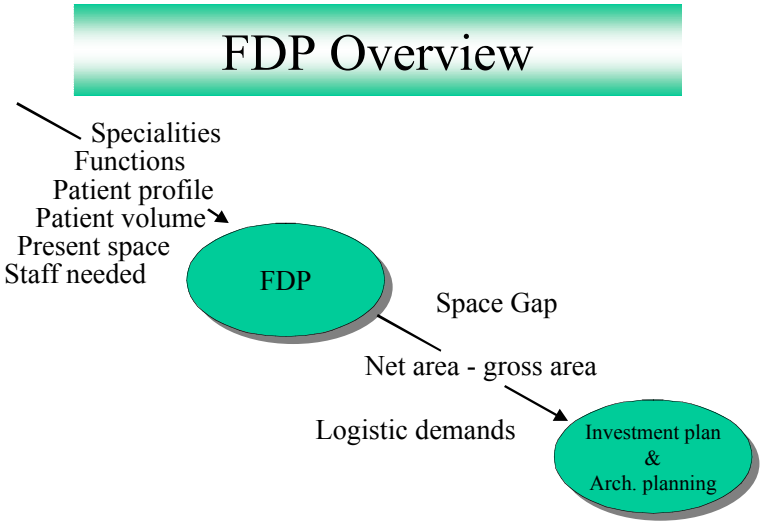
1. A strategical plan with goals and visions for the new hospital (report from Ementor 04.01.2001), including an extrapolation of the patient volume for 2020 and some overall suggestions for physical locations of the different functions.

2. An estimation of the present space and a theoretical calculation of the future space needed. Plus an estimation of the staff needed in 2020. (This report) The future space and the staff need is calculated on the basis of the future patient volume stated in step 1 and the present space is stated from drawings and estimations made by the technical department at Landspitali.

3. A space gap analysis where the present space and the future needed space are compared in order to find the best possible solution for the main complexes of Landspitali. (This report).

4. Alternative solutions for localization of functions

The following illustration shows in overall terms the scope of this project the two circles representing the present project and the following phase, working with the investments and architectural planning.



The analysis and results in this report are based on

- The Functional Development Plan, developed for SHR in 1999
- Step 1: The report on visions, goals and strategy, Ementor 04.01.2001
- Estimation of existing space in Hringbraut
- Staffing data for Landspitali in 1999

At this point the estimations of the present space at Hringbraut is rather rough, which makes the gap analysis less precise.

During our upcoming visit we will walk around Hringbraut in order to improve the present space estimate and thereby provide more valid data for the gap analysis.

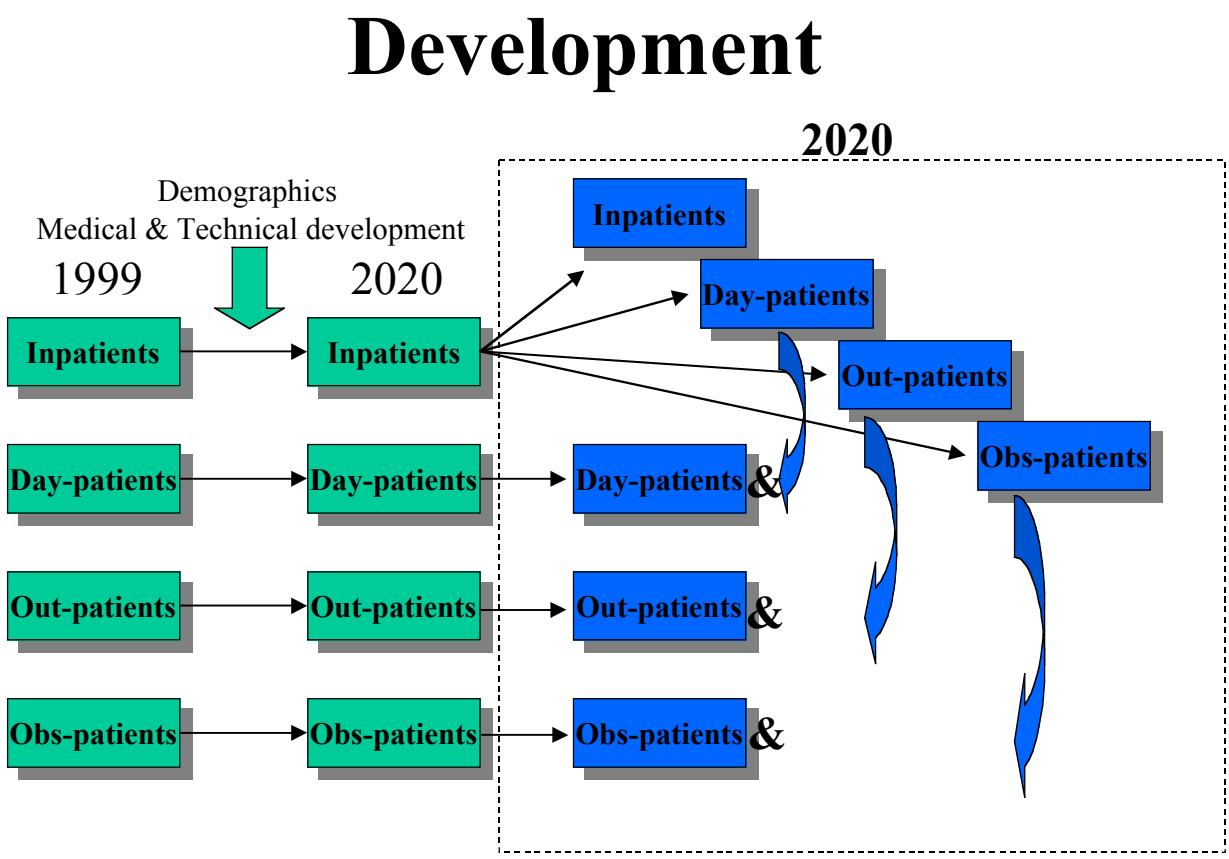
Also we need a quality assurance of the staffing data for 1999, in order to validate the estimation of future staff needed.

This report will therefore summarize the preliminary results of Step 2 and 3, and can serve as a base for the first discussions in the Steering Group regarding locations of functions in the main building complexes at Hringbraut and Fossvogur.

2 Patient Profile and Volume

As already described in the report from 04. January 2001 Ementor has extrapolated the patient volume to 2020. These data has been further elaborated with some new information and with some minor adjustments and are therefor shown in this report again in order to provide the reader a total picture of the methods used here.

The following illustration shows the extrapolation in two steps.



Step one is a simple extrapolation due to the demographic development. The fact that more and more citizens move into Reykjavik as well as the general population development has been taken into account (36% for somatic and 11% for psychiatry). But the development as to a higher number of elderly people in the population has not been taken into account.

Step two is a more advanced extrapolation where the inpatients are moved to a lower grade of care (from bed to chair). We base this recommendation on the trends that are seen in the Scandinavian hospitals – and other European hospitals – where patients are transferred from in-patient care to day care and/or outpatient care. We also recommend that some of the long-term patients be moved out of the two buildings into other houses e.g. Kopavogur in order to let these buildings contain only acute functions.

In Appendix 1 and 2 of this report the updated version of both steps in the extrapolation is shown.

Some of the figures have been further qualificated. The differences in the calculations is as follows:

- one inpatient now is converted into an average of 1,5 day patient + 1 out patient visit (previously 2 day pat. and one out pat.)

- an observation patients has a LOS of 1,5 beddays (previously 2 beddays).

We recommend that an observation unit as seen in both Hringbraut and Fossvogi today – also in the future will be used as a "gate keeper" function for the wards.

We recommend that this unit is enlarged in order to prevent a lager number of patients from being admitted to the traditional wards and to ensure a quicker diagnostic and treatment services.

In the following calculations we look at the collective patient volume in the two complexes Hringbraut (incl. Eriksgata and Torfinnsgata) and Fossvogur. The suggested movements of specialities (from step 1 report) have also been taken into account. This means that we now refer to a total Hringbraut & Fossvogur

- Incl. acute neurology, dermatology, venerology, pulmonology, and allergic diseases

- Exc. rehabilitation and long term beds and long term geriatrics

2.1 Inpatients 2020

Ementor recommend increasing day and outpatient care, as well as observation care, and at the same time reducing number of in-patients in the different sub-specialities as follows

Division	Admissions 2020 simp.ex	Transferred to Day care		Transferred to Obs. Unit		Remaining admissions [4]
General pediatrics	3309	662	20%	993	30%	1654
Neonatology	510	0	0%	0	0%	510
Pediatric surgery	1635	409	25%	327	20%	899
Total pediatrics	**5453**	**1070**	**20%**	**1320**	**24%**	**3063**
Obstetrics	4948	1237	25%	990	20%	2721
Gynecology	1417	354	25%	283	20%	779
Total gyn/obs	**6364**	**1591**	**25%**	**1273**	**20%**	**3500**
Gen. int. medicine	900	180	20%	270	30%	450
Gastroenterology	801	160	20%	240	30%	401
Dermatology [1]	229	46	20%	0	0%	183
Cardiology	4000	800	20%	1200	30%	2000
Rheumatology	1003	201	20%	301	30%	502
Nephrology	195	39	20%	59	30%	98
Pulmonary & allergical dis. [1]	2334	467	20%	700	30%	1167
Endocrinology	190	38	20%	57	30%	95
Infection	968	0	0%	290	30%	678
Neurology [2]	1248	250	20%	0	0%	999
Total Internal medicine I	**11869**	**2180**	**18%**	**3118**	**26%**	**6571**
Oncology + Hematology	1486	297	20%	0	0%	1189
Total Internal medicine II	**1486**	**297**	**20%**	**0**	**0%**	**1189**
Gen. surgery	3922	980	25%	784	20%	2157
Vascular	336	0	0%	0	0%	336
Urology	1495	374	25%	299	20%	822
Plastic surgery	328	82	25%	0	0%	246
Ophthalmology	305	76	25%	0	0%	229
Orthopedics	2649	662	25%	530	20%	1457
ENT	1160	290	25%	0	0%	870
Neurosurgery	1282	0	0%	256	20%	1026
Thoracic surgery	455	0	0%	0	0%	455
Total surgery	**11933**	**2465**	**21%**	**1870**	**16%**	**7599**
Geriatrics	558					558
TOTAL SOMATIC	**37664**	**7604**	**20%**	**7580**	**20%**	**22481**
PSYCHIATRY	1567	313	20%	313	20%	940
GRAND TOTAL	**39231**	**7917**	**20%**	**7893**	**20%**	**23421**

[1] Inclusive today's numbers from Vífilsstaðir/?verholt
[2] Inclusive today's numbers from Grensas
[3] These patients will get their LOS reduced with 3 as they are transferred to units outside F&H
[4] Admissions from simple extrapolation minus the ones transferred to day care unit and to observation unit.

2.2 LOS 2020

As for the length of stay (LOS), the future conditions can be calculated in various ways. We chose to let the future LOS to be determined by the house with the best practice. This means that we have used the lowest LOS of the specialities that today is located in both complexes. For those specialities that are located in one place the LOS has been used directly, except for geriatrics where a maximum LOS of 14 days is recommended. Since this is an acute hospital we find it reasonable that patients admitted longer than 14 day are transferred to other locations. Please see appendix 1, page 1 – LOS marked with green colour.

The groups of patients transferred to day care/out patient clinic and the observation unit are more "light" in the sense of length of stay. This means that a new LOS for 2020 will have to be longer than the ones of today. To see the calculation for LOS 2020, please see at appendix 2, page 4 and 5 or the above table.

2.3 Day patients 2020

At the same time as the number of inpatients decreases the total number of appearances of day patients will increase. In the following table the future total number of day patients in 2020 is shown.

Division		Day-patients			
		Appearances 1999	Increase in app 2020 - simp.ex.	Increase in appearances from inpatients	Day patient appearances 2020
	General pediatrics [1)]	1.908	678	993	3.579
	Neonatology	0	0	0	0
	Pediatric surgery	0	0	613	613
Total pediatrics		**1.908**	**678**	**1.606**	**4.192**
	Obstetrics	5.976	2.125	1.855	9.956
	Gynecology	2.186	777	531	3.494
Total gyn/obs		**8.162**	**2.902**	**2.387**	**13.451**
	Gen. int. medicine	1.051	374	270	1.695
	Gastroenterology	115	41	240	396
	Dermatology	0	0	69	69
	Cardiology	766	272	1.200	2.238
	Rheumatology	81	29	301	411
	Nephrology	3.631	1.291	59	4.981
	Pulmonary & allergical dis.	146	52	700	898
	Endocrinology	8	3	57	68
	Infection	20	7	0	27
	Neurology	7	2	375	384
Total Internal medicine I		**5.825**	**2.071**	**3.270**	**11.167**
	Oncology + Hematology	2.530	900	446	3.875
Total Internal medicine II		**2.530**	**900**	**446**	**3.875**
	Gen. surgery	550	196	1.471	2.216
	Vascular	0	0	0	0
	Urology	231	82	561	874
	Plastic surgery	11	4	123	138
	Ophthalmology	1.116	397	114	1.627
	Orthopedics	238	85	993	1.316
	ENT	440	156	435	1.032
	Neurosurgery	0	0	0	0
	Thoracic surgery	8	3	0	11
	Re-visit from ER [1)]	0	0	0	0
Total surgery		**2.594**	**922**	**3.697**	**7.213**
	Geriatrics	0	0	0	0
	Rehabilitation / long term	0	0	0	0
Total medicine		**8.355**	**2.971**	**3.716**	**15.042**
SOMATIC		**21.019**	**7.474**	**11.406**	**39.898**
PSYCHIATRY		6.045	690	3.133	9.868
GRAND TOTAL		**27.064**	**8.164**	**14.539**	**49.766**

For all inpatients transferred to day care we have calculated 1_ appearances per patient.

2.4 Outpatients 2005

At the same time as the numbers of inpatient decreases and the number of day patients increases, the total number of visits to the out patient clinic will increase. In the following table the future total number of out patients in 2020 is shown.

Division		Outpatient clinic			
		Outpat. clinic visit 1999	Increase of outpatient visits simp.ex	Increase due to increase in day patients	Outpat. clinic visits 2020
	General pediatrics [1)]	11.536	4.102	496	16.134
	Neonatology		0	0	0
	Pediatric surgery		0	307	307
Total pediatrics		**11.536**	**4.102**	**803**	**16.441**
	Obstetrics	14.271	5.074	928	20.273
	Gynecology	5.480	1.948	266	7.694
Total gyn/obs		**19.751**	**7.023**	**1.193**	**27.967**
	Gen. int. medicine	8.884	3.159	135	12.178
	Gastroenterology	3.860	1.372	120	5.353
	Dermatology	21.126	7.512	34	28.672
	Cardiology	19.075	6.782	600	26.457
	Rheumatology	225	80	150	455
	Nephrology	0	0	29	29
	Pulmonary & allergical dis.	2.621	932	350	3.903
	Endocrinology	4.928	1.752	28	6.709
	Infection	639	227	0	866
	Neurology	2.452	872	187	3.511
Total Internal medicine I		**63.810**	**22.688**	**1.635**	**88.133**
	Oncology + Hematology	14.895	5.296	223	20.414
Total Internal medicine II		**14.895**	**5.296**	**223**	**20.414**
	Gen. surgery	3.508	1.247	735	5.491
	Vascular	0	0	0	0
	Urology	4.270	1.518	280	6.069
	Plastic surgery	0	0	62	62
	Ophthalmology	4.223	1.502	57	5.782
	Orthopedics	9.054	3.219	497	12.770
	ENT	8.405	2.988	218	11.611
	Neurosurgery	91	32	0	123
	Thoracic surgery	0	0	0	0
	Re-visit from ER [1)]	14.406	5.122	0	19.528
Total surgery		**43.957**	**15.629**	**1.849**	**61.435**
	Geriatrics	0	0	0	0
	Rehabilitation / long term	0	0	0	0
Total medicine		**54.202**	**19.272**	**1.858**	**75.332**
SOMATIC		**153.949**	**54.738**	**5.703**	**214.390**
PSYCHIATRY		20.059	2.290	1.567	23.915
GRAND TOTAL		**174.008**	**57.028**	**7.269**	**238.305**

This table is exclusive of the first visit of emergency patients. Ementor have suggested that the revisits from ER were moved out of the hospital into the primary health care system, but this option has been evaluated to be impossible at the present time.

2.5 Summery of patient transfer

The present way of financing the health care system in Iceland does actually not support this transfer from inpatient to day patient status. But due to our experiences from other countries, e.g. as mentioned Norway, where the same complex of problems is known, Ementor will maintain the above stated suggestions as a way of "stressing" the system in order to persuade the financial system to follow.

In order to show the total ratio of transfers the following illustration shows the figures in a total.

Movements of patients from 1999 to 2020.

	1999	2020	Difference	Differnce in %
Inpatients	29.191	23.421	-5.770	-24,6%
LOS	5,7	7,1	1,4	19,9%
Beddays	166.561	166.871	310	0,2%
Observation pat.	*4.800*	*14.421*	*9.621*	*66,7%*
In pat + Obs pat.	33.991	37.842	3851	10,2%
Beddays incl obs pat.	171.361	188.502	17141	9,1%
LOS incl. obs pat.	5,0	5,0	-0,1	-1,2%
Day patients appear.	27.064	49.766	22.702	45,6%
Out pat. visits	174.008	238.305	64.297	27,0%
Normal	*159.602*	*218.777*	*59.175*	*27,0%*
Re-visits	*14.406*	*19.528*	*5.122*	*26,2%*

3 Estimation of the Staff volume 2020

In this chapter the analysis and calculations for an estimation of the future staff volume for year 2020 will be stated.

The used staffmodel will be described using the present staff volume and activities to calculate the future staff needed based on the future activities as described in chapter 2 above.

3.1 The staffing model

3.1.1 Input to the model

The input for the model can be split into three areas: Activity data (patients), the present staff data and preconditions for the standards used in the model.

- The activity data is based on the present patientdata from LSH in 1999 and the extrapolated figures for Landspitali in 2020 (appendix 2).
  - The patient activity data includes number of inpatients and beddays, number of day patients, observation patients, and number of visits to the outpatient clinics. In addition to this the number of diagnostic imaging examinations.
- Staff volume from 1999 for both Hringbraut and Fossvogur (appendix 3). The data in the model have been divided into doctors including one department director for each department and other staff including the other director of that department. The figures have been provided by the HR function of Landspitali.
- The preconditions for the calculation are based on re-estimated beddays and admissions in 1999. The estimations are:
  - Day patients and observation patients are recalculated into admissions with a factor 1/3 admission
  - Outpatient clinic visits are recalculated into admissions with a factor 1/12 admission
  - Day patients and observation patients are recalculated into beddays with a factor 2 beddays
  - Outpatient clinic visits are recalculated into beddays with a factor _ bedday

3.1.2 Calculations in the model

From the input data the model will calculate the re-estimated number of admissions and beddays for each department and as a total. In addition a number of productivity data is calculated, e.g. inpatients/bedday per employee in each department, this is use to estimate some keyfigures.

By choosing a set of productivity standards for 2020 and feeding the model with the extrapolated figures for 2020 it will calculate an estimate of the future staff volume for 2020. The sug-

gested number of staff for 2020 can be evaluated by comparing it for similar departments with those of 1999.

In the model two alternatives for calculating the future staff in 2020 is shown.

- Model A: a calculation of the future staff volume based on unchanged productivity standards in 2020 compare to 1999, e.g. one doctor treats as many patients as today.

- Model B: a calculation of the future staff volume based on a higher productivity in the clinical functions. The calculation is based on a simple comparison to a number of other hospitals in the Scandinavian region. Further more the merger between Reykjavik sjukehus and the previous Landspitali is bound to reduce some of the overlapping functions e.g. in the service departments.

For both alternatives it is important to look at this, as an overall calculation thus the future staff volume should not be considered as "correct" for at each department.

In the following the two calculations are described.

3.2 Clinical functions

The doctors' work is dependent on how many patients he and her have to treat and this goes for both inpatients, day patients and outpatients. For all other staff groups (which mainly is nurses and secretaries) will workload will be more dependent on the length of stay (number of bed-days).

For the clinical departments the model will calculate

- The total number of weighted patients per doctor in 1999 and weighted beddays per other employee in 1999.

3.2.1 Model A – unchanged productivity (the 1999-level is kept unchanged)

In model A we use the same productivity-standards in 2020 as in 1999. On the basis of the number of weighted patients and beddays in the clinical departments the model will calculate the new number of employees for 2020.

We assume that there in 1999 was collective staff of Fossvogur and Hringbraut of 251 FTE doctors and 739 FTE others for the somatic clinical functions. For psychiatry there was 39 doctors and 70 others.

In model A (with unchanged productivity) the model will calculate a need for 338 doctors (284 for somatic and 54 for psychiatry) in year 2020. Equally a total of 1.046 others is calculated.

3.2.2 Model B – improved productivity inspired by benchmarking

In model B standards for 1999 has been benchmarked with other somatic departments in Scandinavia, mostly Norway and one hospital in Denmark. The four hospitals that are included in the benchmarking is as follows:

- Sykehuset Østfold (Østfold) 1999
- Telemark Sentralsykehus (Telemark) 1998
- Kolding Sygehus (Kolding) 1999/2000
- Nordland Sentralsykehus (Nordland) 1998

In the tables below the result of this benchmarking is shown. Best-practice for each specialty is marked with a yellow color. Please note that it has been necessary to look at some of the specialties in a more overall manner in order to make the data more comparable. This also indicates that this method only can give us some indications for where to look for improvements in the matter of staff efficiency.

Benchmarking of weighted patients per doctor and weighted beddays per other staff

Benchmarking - standards staff	Weighted patients per doctors					Weighted beddays per other staffs				
	Landspitali	Østfold	Telemark	Kolding	Nordland	Landspitali	Østfold	Telemark	Kolding	Nordland
Total medicin (I & II)	188	238	184	242	145	529	323	235	368	238
Total surgery	131	249	195	195	232	253	356	281	320	258
Gynecology/obstetrics	472	348	353	190	250	337	338	-	276	240
Pediatrics	186	196	271	183	158	273	274	228	181	137
Opthalmology	47	317	-	-	282	277	469	-	-	296
Psyciatry	128	109	-	-	-	631	196	-	-	-

Benchmarking of inpatients per doctor and per other staff

Benchmarking - standards staff	Inpatients per doctors					Inpatients per other staffs				
	Landspitali	Østfold	Telemark	Kolding	Nordland	Landspitali	Østfold	Telemark	Kolding	Nordland
Total medicin	100	176	133	169	112	45	40	25	37	26
Total surgery	87	149	143	133	160	30	38	41	37	34
Gynecology/obstetrics	247	221	278	140	189	38	44	34	42	36
Pediatrics	134	155	209	150	135	40	40	38	28	21
Opthalmology	11	62	-	-	110	12	17	-	-	24
Psyciatry	36	42	-	-	-	20	4	-	-	-

Benchmarking of daypatients per doctor and per other staff

Benchmarking - standards staff	Daycare per doctors					Daycare per other staffs				
	Landspitali	Østfold	Telemark	Kolding	Nordland	Landspitali	Østfold	Telemark	Kolding	Nordland
Total medicin	82	52	62	132	21	36	12	12	29	5
Total surgery	26	47	22	67	40	9	12	6	19	9
Gynecology/obstetrics	430	49	88	24	51	67	10	11	7	10
Pediatrics	64	13	109	-	2	19	3	20	-	-
Opthalmology	56	389	-	-	297	59	106	-	-	65
Psyciatry	155	149	-	-	-	86	14	-	-	-

Benchmarking of outpatient visits per doctor and per other staff

Benchmarking - standards staff	Outpatient clinic per doctors					Outpatient clinic per other staffs				
	Landspitali	Østfold	Telemark	Kolding	Nordland	Landspitali	Østfold	Telemark	Kolding	Nordland
Total medicin	768	524	389	363	318	342	119	75	80	73
Total surgery	444	568	568	495	735	154	147	164	139	158
Gynecology/obstetrics	1040	816	567	527	552	162	162	68	159	105
Pediatrics	385	394	322	409	271	114	102	59	76	41
Opthalmology	211	1593	-	-	936	222	434	-	-	204
Psyciatry	514	224	-	-	-	287	22	-	-	-

In the following table the number of weighted patients per doctor and weighted beddays per others are shown again with a clear indication best-practice and the chosen standards for calculating the staff need for LSH 2020 (Bold, Italic and with a higher font).

Benchmarking of weighted patients per doctor and weighted beddays per other staff

Benchmarking - standards staff	Weighted patients per doctors					Weighted beddays per other staffs				
	Landspitali	Østfold	Telemark	Kolding	Nordland	Landspitali	Østfold	Telemark	Kolding	Nordland
Total medicin	188	***238***	186	242	145	***529***	323	237	368	238
Total surgery	131	***249***	184	195	198	253	***356***	269	320	258
Gynecology/obstetrics	***472***	348	353	190	250	337	***338***	-	276	240
Pediatrics	186	196	***271***	183	158	273	***274***	228	181	137
Opthalmology	47	***317***	-	-	282	277	***469***	-	-	296
Psyciatry	***128***	109	-	-	-	***631***	196	-	-	-

	Weighted patients per doctors			Weighted beddays per other staffs		
	Landspitali 1999	Landspitali 2020	Ændr.	Landspitali 1999	Landspitali 2020	Ændr.
Total medicin	188	238	26%	529	529	0%
Total surgery, excl. eye	131	249	90%	253	356	41%
Gynecology/obstetrics	472	472	0%	337	338	0%
Pediatrics	186	271	46%	273	274	0%
Opthalmology	47	317	581%	277	469	69%
Psyciatry	128	128	0%	631	631	0%

The following standards has been chosen for LSH in 2020:

- Medicine I+II: 238 weighted patients per doctor (Østfold) and 529 weighted beddays per others (Lanspitali). For the first standard actually Kolding Sygehus has the best practice but in order to be more moderate we chose the best Norwegian hospital.

- Total surgery excl. eye: 249 weighted patients per doctor (Østfold) and 356 weighted beddays per others (Østfold). This is due to the fact that there in LSH is a high potential for improving the efficiency in the surgical departments. We know there is a rather low rate of day surgery and also there is the possibility to split the elective and acute patients in order to get a higher efficiency.

- Gynecology and obstetrics: 472 weighted patients per doctor (LSH) and 338 weighted beddays per others (Østfold), which is very close to the present standards in LSH.

- Pediatrics: 271 weighted patients per doctor (Østfold) and 274 weighted beddays per others (Telemark). This means a significant higher productivity for the doctors and a standard for other staff very close to the present situation.

- Eye: 317 weighted patients per doctor (Østfold) and 631 weighted beddays per others (LSH). The difference in these figures indicates that there could be an error in the figures

we have for ophthalmology today. We would like to discuss this issue further on our up-coming meeting.

- Psychiatry. The present standards at LSH have best practice and are therefor keep also in 2020. 128 weighted patients per doctor and 631 weighted beddays per others.

By using the above stated standards for LSH the total sum of employees for 2020 will be 3157 in total 350 doctors and 2807 others.

3.2.3 Comparison of model A and B

In the following table the calculations of model A and B is shown and compared with the 1999 staffing

Comparison of the staff need for the clinical functions in 1999 and 2020 model A & B

Clinical functions	Staffs 1999			Staffs 2020 - unchanged standards Model A			Staffs 2020 - Model B		
	Doctors	Other staffs	Total	Doctors	Other staffs	Total	Doctors	Other staffs	Total
Total medicine	103	230	333	117	283	400	92	283	375
Eye (ophthalmology)	20	19	39	26	26	52	10	15	25
Total surgery, excl. ophthalmology	79	267	346	88	336	424	55	240	295
Gynecology/obstetrics	19	122	141	22	168	189	22	167	189
Pediatrics	30	101	131	31	136	167	18	135	153
Total gyn/obs.	49	223	272	53	303	356	40	302	342
Total somatic	**251**	**739**	**990**	**284**	**949**	**1.233**	**197**	**841**	**1.038**
Psychiatry	39	70	109	54	97	151	48	97	145
Clinical functions	**290**	**809**	**1.099**	**338**	**1.046**	**1.384**	**244**	**939**	**1.183**

3.3 Clinical service functions and other service functions

Likewise we have calculated two models for the clinical and non-clinical service functions. The total calculation can been seen in details in appendix 4.

In the table below a comparison of the two models are shown for both clinical service functions and non-clinical service functions.

Cross service functions	Staffs 1999			Staffs 2020 - unchanged standards Model A			Staffs 2020 - Model B		
	Doctors	Other staffs	Total	Doctors	Other staffs	Total	Doctors	Other staffs	Total
Anesthesiology/OP/intensive	37	125	162	32	107	139	32	107	139
Anesthesiology/OP/intensive	13	38	51	18	52	69	18	52	69
Pharmacy	0	36	36	0	41	41	0	41	41
Emergency/acute reception	19	99	118	21	111	132	21	111	132
Occupational- and physiotherapy	5	58	63	6	75	81	6	75	81
Laboratory, incl. isotopes	0	48	48	0	39	39	0	43	43
Clinical chemistry	2	130	132	2	146	148	2	117	119
Immunology	6	17	23	7	19	26	5	15	21
Pathology	17	36	53	19	40	59	15	32	48
Microbiology	7	49	56	8	55	63	6	44	50
Medical record archives etc.	0	9	9	0	10	10	0	8	8
Social workers	0	29	29	0	37	37	0	26	26
Div. service department	0	994	994	0	1.284	1.284	0	895	895
Engineering, architect, incl. adm.	0	270	270	0	349	349	0	243	243
Priest	0	5	5	0	6	6	0	5	5
Student	0	60	60	0	78	78	0	54	54
Total cross service functions	**106**	**2.003**	**2.109**	**113**	**2.450**	**2.563**	**106**	**1.868**	**1.974**

3.4 **Staffing 2020**

In total the two models are shown in the following table.

	Staffs 1999			Staffs 2020 - unchanged standards Model A			Staffs 2020 - Model B		
	Doctors	Other staffs	Total	Doctors	Other staffs	Total	Doctors	Other staffs	Total
Total clinical functions	290	809	1.099	338	1.046	1.384	244	939	1.183
Total cross service functions	106	2.003	2.109	113	2.450	2.563	106	1.868	1.974
Landspitali (V+H) i alt	**396**	**2.812**	**3.208**	**451**	**3.496**	**3.947**	**350**	**2.807**	**3.157**

It will be necessary to go through a quality check for the 1999 data, as these figures are vitiated with some uncertainties. In single functions we find very large differences from what we have experienced in our resent projects in Norway, e.g. clinical biochemistry and the administration. We would like to discuss these differences with the steering committee at our next meeting.

4 Determination of Present Space

4.1 Determination of present space

The present space has been determined from building drawings provided by the technical department of Landspitali (Fossvogur and Hringbraut).

The present space of Fossvogur, has already been determined in our previous work (Functional Development Plan for Fossvogur from 22.12.1999) and has now for this purpose been slightly modified, see below. The present space of Hringbraut consists of many different smaller buildings and includes property on Eriksgata, Torfinnsgata, Rauðarárstigur, and the new children's hospital.

In order to make the figures comparable with the calculations of future needs, where the calculations are made per function (see chapter 5.2), we have divided the different functions into small fractions on each floor of each building. This is due to the fact that mainly the service functions are spread across the hospital as it is today.

The offices are mostly included in the same wings and floors as the departments. It has thus not been possible for us extract the office areas in Hringbraut as we had done earlier in Fossvogur and we have therefore decided to include the offices and meetingrooms in the departments where they are located. This fact has been modified for the Fossvogur figures from 1999. And this fact also means that the future calculations of space for offices and meeting rooms are included in the various clinical functions in order to get a comparable set of figures.

Because of the fragmentation and the natural integration of the functions in the present environments of the wards, the present space is vitiated by some uncertainty on the functional level.

This is primary due to the fact that some functions are not completely separated; e.g. the offices and some of the sleeping quarters for the doctors are integrated into office areas or other secondary rooms of a bed ward, and has therefore not been registered as staff service. Secondary the net area is not a normal parameter on building drawings, and thus it has been a challenge to calculate the exact net square meters of each function on the basis of the official drawings.

4.2 Presentation of the present space - Fossvogur

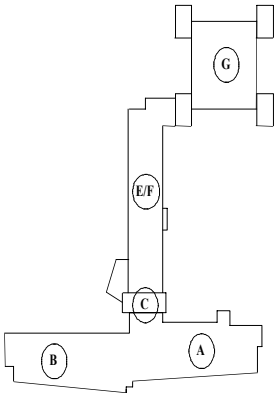
The complex at Fossvogur is divided into five buildings A, B, C, E/F and G.

Both A and B has today seven floors plus basement. The E/F wing has seven floors plus basement. The top floor is new on this wing, and has recently been taken into use.

The C wing is the tower located between the A/B and E wings. On the first seven floors this building have mainly functions as Hallway, room for elevators and stairs some meeting rooms and offices. From the 8th floor and up to the 13th floor, the C wing is used for offices (management and accounting) and the hospital library. The top floor (the 14th floor) is not used presently due to the fact that it is not accessible from the inside. Because of the space required for elevators and staircase there is rather few "functional" squaremeters on each floor in the C wing.

The G wing has three floors of which the first is in level with the basement of the E wing. The Emergency department is placed on the second floor of the G wing, which is in ground level and thus has entrances for ambulances and patients arriving with helicopter.

The proportional locations of the wings are shown below.



In order to find the right net area of the wings the areas has been divided according to their functions.

This is shown in the table below with each function represented by a different color.

	M² Net.	M² Gross	No of beds/ rooms 1999	Net sqm. pr unit
Clinical functions somatic	5.737		223	25,73
New floor	616			
Clinical functions psychiatry	347		24	14,47
Emergency/acute reception	339			
Intensive care	564		11	51,28
OP	1.194		9	132,65
Recovery	104		13	8,00
X-ray	823		11	74,79
Lab/pharmacy	1.083			
Administration & management	433			
Patient service	356			
Other functions [1]	4.092			
Total net area	15.688	29.263		
Gross/Net factor		1,87		

[1)] Incl. two buildings outside the main buildings. The buildings ~ 286 m^2 net and a technical room on the 8th floor of the E- wing - 220 m^2 net

The total gross area of the hospital is 29.263 m^2 and the total net area is calculated to 15.688 m^2. This gives a Gross/Net factor of 1,87.

The gross/net factor is usually somewhere between 1.75 and 2.0, so this sounds very reasonable.

In some of the squaremeters stated on the technical drawings of the hospital the inner walls were included. As in fact the walls can represent a significant number of m^2, the space has been reduced accordingly.

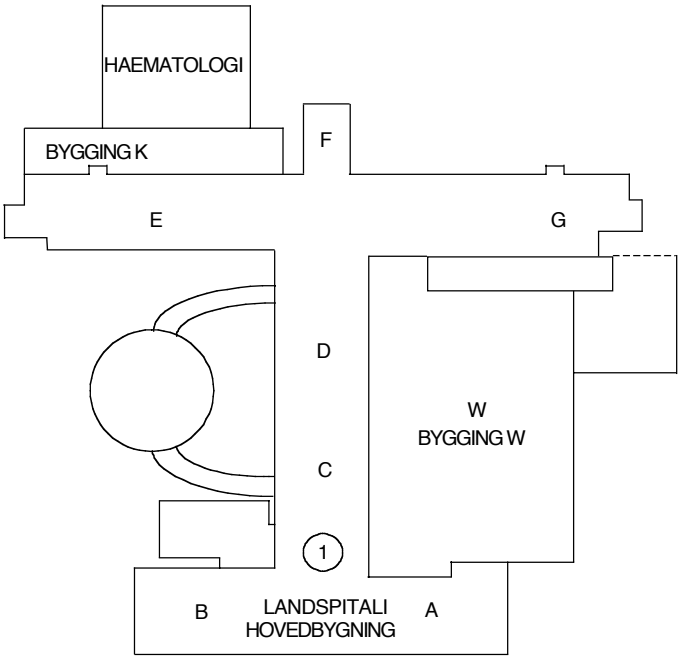
The factor by which we have reduced the given net areas, has been calculated individually for each building, see the following page. Appendix 6 shows the split of functions per floor in each building and the reductions made due to hallways etc. in details.

4.3 Presentation of the present space – Hringbraut

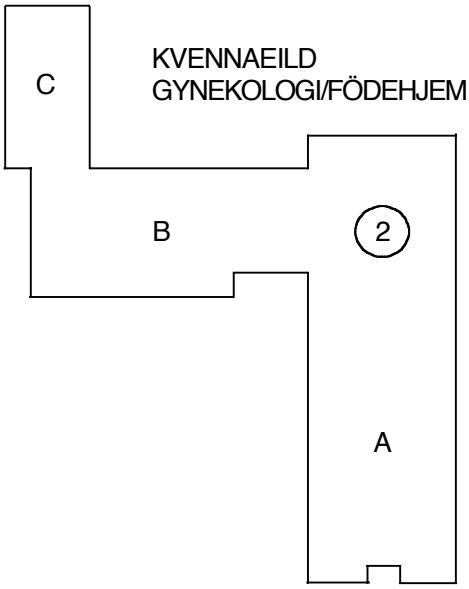
The complex at Landspitali, Hringbraut, is divided into different buildings in different areas. First we have the main area with building 1 as the main complex divided into ten wings: A, B, C, D, W, E, F, G and K.

Further there are nine buildings inside the complex of Hringbraut: building 2, 3, 6/7, 8, 9, 10/11, 13, 14 and 16 plus there are six other buildings separated from the main areas in the nearby areas: Torfinnsgata 14-16, Eriksgata 5, 19, 21 & 29 and Raudarárstigur. In addition comes the new children's hospital. Building 12 is not taken into account since it is gong to be demolished in the near future.

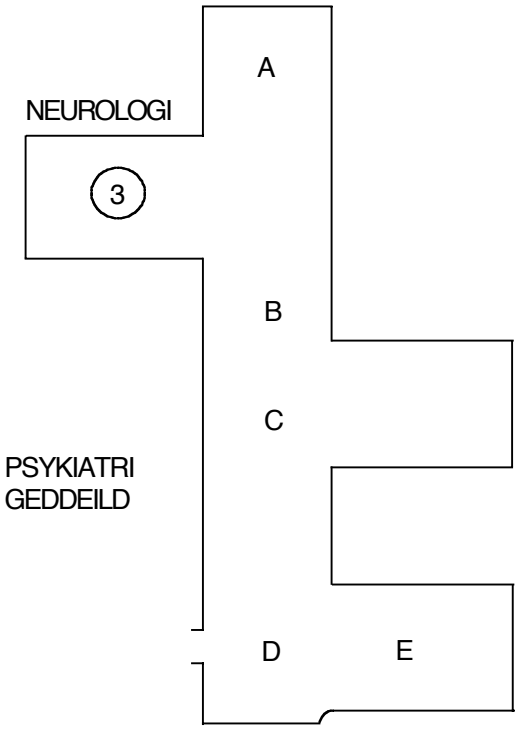
The proportional locations of the main buildings (1, 2 and 3) are shown below.



Building 1



Building 2



Building 3

In order to find the right net area of the buildings, the space has been divided according to their functions like it was done in Fossvogur. This is shown in the table below with each function represented by a different color.

	M² Net.	M² Gross	No of beds/ rooms 1999	Net sqm. pr unit
Clinical functions somatic [1]	11.815	20.071	334 [2]	35,38
New childrens hospital	3.579	6.800		
Clinical functions psychiatry [1]	3.821	6.969	60	63,69
Emergency/acute reception	289	520		
Intensive care	290	466	8	36,19
OP	953	1.460	6	158,83
Recovery	98	172	12	8,19
X-ray	1.299	2.165	8	162,35
Lab/pharmacy	3.107	3.919		
Administration & management	2.208	3.400		
Patient service	236	346		
Other functions	8.397	14.217		
Total net area	36.091	60.505		
Gross/Net factor		1,68		

[1] Incl. New building for children (Peadiatrics)

[2] 552 beds - 213 from Fossvogur - 15 neurology beds in psych. + 10 obs. beds

The total gross area of the hospital is 60.505 m^2 and the total net area is calculated to 36.091 m^2. This gives a Gross/Net factor of 1,68, which is not very likely to correspond with the actual situation. The gross/net factor is usually somewhere between 1.75 and 2.0, so this sounds very low.

This might be due to the same reason as in Fossvogur. Thus in some of the squaremeters stated on the technical drawings the inner walls or some other gross areas are included, e.g. corridors, ventilation rooms etc. In order to obviate this fact we have decided to reduce the net areas with an average of 10% for all the areas at Hringbraut. This is shown in the table below.

	M² Net.	M² Gross	No of beds/ rooms 1999	Net sqm. pr unit
Clinical functions somatic [1]	10.634	20.071	334 [2]	31,84
New childrens hospital	3.579	6.800		
Clinical functions psychiatry [1]	3.439	6.969	60	57,32
Emergency/acute reception	260	520		
Intensive care	261	466	8	32,57
OP	858	1.460	6	142,95
Recovery	88	172	12	7,37
X-ray	1.169	2.165	8	146,12
Lab/pharmacy	2.796	3.919		
Administration & management	1.987	3.400		
Patient service	212	346		
Other functions	7.557	14.217		
Total net area	32.840	60.505		
Gross/Net factor		1,84		

[1] Incl. New building for children (Peadiatrics)

[2] 552 beds - 213 from Fossvogur - 15 neurology beds in psych. + 10 obs. beds

Appendix 7 shows the split of functions per building in details.

4.4 Total present space

In the following table the total of the two complexes are shown now with the 10% reduction of the net squaremeters at Hringbraut.

	Fossvogur				Hringbraut				Landspitali			
	M^2 Net.	M^2 Gross	No of beds/ rooms 1999	Net sqm. pr unit	M^2 Net.	M^2 Gross	No of beds/ rooms 1999	Net sqm. pr unit	M^2 Net.	M^2 Gross	No of beds/ rooms 1999	Net sqm. pr unit
Clinical functions somatic	5.737		223	25,73	10.634	20.071	334	31,84	16.371		557	29,39
New floor + childerns hosp.	616				3.579	6.800			4.195			
Clinical functions psychiatry	347		24	14,47	3.439	6.969	60 1	57,32	3.786		84	45,08
Emergency/acute reception	339				260	520			599			
Intensive care	564		11	51,28	261	466	8	32,57	825		19	43,40
OP	1.194		9	132,65	858	1.460	6	142,95	2.052		15	136,77
Recovery	104		13	8,00	88	172	12	7,37	193		25	7,70
X-ray	823		11	74,79	1.169	2.165	8	146,12	1.992		19	104,82
Lab/pharmacy	1.083				2.796	3.919			3.879			
Administration & management	433				1.987	3.400			2.420			
Patient service	356				212	346			568			
Other functions	4.092				7.557	14.217			11.649			
Total net area	15.688	29.263			32.840	60.505			48.528	89.768		
Gross/Net factor		1,87				1,84				1,85		

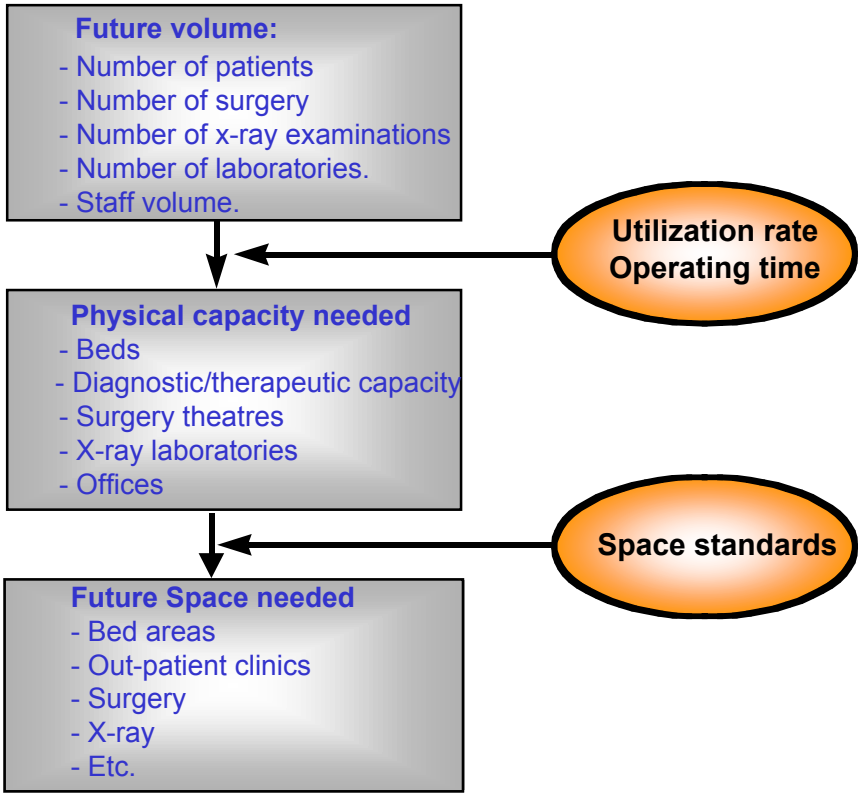
This shows a total net area for LSH of approx. 48.500 m^2.

5 Determination of Future Space

5.1 Methodology

The future needs for space in the different departments is based on the estimated future, number of beddays, visits to the outpatient clinics, examinations etc. and the number of staff according to the previous chapters.

The calculation is also based upon a number of predefined coefficients of utilisation and area standards for each function and/or speciality. The methodology for calculation of the future space is illustrated in the following figure.



All areas are calculated as ***Net areas in squaremeters***. Net areas are the total functional areas in a ward or department. The calculation adds up the inside measurements of each room. Thus the net areas are without walls, hallways, stairs, elevators, technical rooms for e.g. ventilation etc.

The gross areas are then all traffic areas, walls, hallways, elevators, stairs and technical areas

5.1.1 Utilization rate

The utilization rate represents the predefined percentages of occupancy per room or bed. The rate also shows the production time per visit, treatment or examination. In the following tables the suggested rates for LSH are shown.

Bed occupancy rate

	Utilization days/year
Beds	
Normal somatic beds	85%
Normal psyciatric beds	85%
Intensive Care beds	75%
Observation beds	75%

These suggestions have been chosen as a result of looking at the present ratios at LSH and comparing them to other resent hospital projects in Scandinavia.

In order to give an equal comparison of the different utilisation rates chosen for this project we have listed some selected average rates below.

The table compares the present rates (where we have them) and the future suggested rates for LSH with some reference rates taken from the new region hospital in Trondheim, Norway, RIT 2000 and the new Østfoldsykehuset in Norway.

Function	Present occupancy rate SHR	Occupancy rate future LSH	Hours per Day future LSH	Occupancy rate Østfold sykehuset	Hours per day Øst-foldsyke-huset	Occupancy rate RIT 2000	Hours per day RIT 2000
Somatic beds	72%	85%		85%		85%	
Psychiatric beds	88%	85%		85%			
Intensive care	52%	75%		75%		98%	
Observation		85%	24	70%	8/24	70%	
Day beds		-	6	-	6	-	6
Outpatient clinic		-	7	-	6	-	6
Radiology		-	8	-	7	-	6
Surgery, theatres		-	8	-	7	-	6

The present rates are very different from department to department on the somatic beds. The above shown figures are an average of all departments. The present rate for observation, outpatients, radiology and surgery are not known as we need to know the exact number of beds / rooms used for each function to be able to calculate this. For intensive care 19 (11 + 8) beds have been used. As can be seen from the above stated figures we have chosen some very competitive rates for LSH.

In the table below the different rates for examinations and treatments in the various departments are shown. These figures are equally based on experience from resent projects in Norway, Østfold and RIT 2000.

Utilization per function

	Days/year	Hours/day		Min. pr. examination/treatment
Daypatients				
Day beds	230		[1]	1 visit pr. day-patient
Outpatient clinics				
Medicine	230	7	[1]	45
Surgery and Orthopeadics	230	7	[1]	30
Psychiatry	230	7	[1]	75
Radiology and diag. imaging (planned)				
Radiology avarage	230	8	[1]	25
Operations (planned) & Recovery				
Orthopedics	230	7	[1]	180
General surgery	230	7	[1]	120
Urology	230	7	[1]	120
ENT	230	7	[1]	90
Opthalmology	230	7	[1]	60
Plastic Surgery	230	7	[1]	120
Gyn/obs	230	7	[1]	80
Children	230	7	[1]	100
Thoracic surgery	230	7	[1]	170
Neurosurgery	230	7	[1]	180
Vascular surgery	230	7	[1]	140
Day surgery	230	7	[1]	90
Recovery beds (inpat.)	230	7	[1]	Average LOS 3 hours
Emergency				
Acute Outpatient clinic	365	8		45
Emergency	365	8		60

[1] 230 = workdays (one year excl. weekends, holidays, etc.)

5.1.2 Space standards

The space standard refers to the primary rooms such as bedwards, examination and treatment rooms, office's, etc., and includes secondary rooms such as restrooms, storage's, tea-kitchens etc. See appendix 4.

All the standards, e.g. a standard for an outpatient room of 30 m^2, include both primary and secondary rooms. The standard represents an average, meaning that the exact size of each room and the number of secondary rooms can be varied during the later detailed planning of each department.

An example: For the outpatient room standard of 30 m^2, the first 20 m^2 is used for the primary examination and treatment room and the rest, the remaining 10 m^2, represents this room's part of patient areas, storage, room for cleaning service, staff areas, toilets etc.

In the following table a list of the suggested space standards for this project is shown.

	Standard m^2 net.	Comments
Clinical functions		
Beds (somatic)	21	See Specification
Cardiac monitoring beds & neonatology beds	30	Incl. part in secondary rooms - see appendix
Beds (psychiatry)	31	See Specification
Daybeds (somatic)	15	Incl. part in secondary rooms - see appendix
Daybeds (psychiatry)	20	Incl. part in secondary rooms - see appendix
Outpatient rooms	30	Incl. part in secondary rooms - see appendix
Special rooms for outpatients (somatic)	40	Incl. part in secondary rooms - see appendix
Special rooms for outpatients (psychiatry)	30	Incl. part in secondary rooms - see appendix
Observation beds	21	Incl. part in secondary rooms - see appendix
Delivery rooms	70	Incl. part in secondary rooms - see appendix
Clinical service functions		
Intensive care beds	40	Incl. part in secondary rooms - see appendix
Emergency	50	Incl. part in secondary rooms - see appendix
Recovery	15	Incl. part in secondary rooms - see appendix
Operation	120	Incl. part in secondary rooms - see appendix
Radiology & Diag. Image.	90	Incl. part in secondary rooms - see appendix
Service functions		
Offices management/head of depart. + adm.	10	Incl. Hardware room (printer, Xerox, fax etc.)
Offices other doctors and academic personnel	8	Incl. Hardware room (printer, Xerox, fax etc.)
Meeting rooms	1,7	Pr. seat (1/3 of staff during daytime)
Sleeping quarters/on call duty	15	Incl. toilet & bath and part of living room
Dress rooms	1	Pr. locker
Canteen	2	Pr. seat

5.2 Future space

The result of the future space is a manifestation of a theoretical calculation. And because in reality the departments and functions must fit into an existing frame of buildings the actual apportion between the departments and functions must be reviewed in a later state during the process of detailed programming.

Thus this calculation lays out a framework within which the proceeding work of rebuilding and reorganising LSH can take place.

As mentioned in the previous chapters the estimations are based upon a number of predetermined standards and utilization rates. E.g. in this project the space standard for a somatic bed is predefined to be 21 m^2. This is based on the theory that the beds are located in bedpools of 25 beds each, sharing secondary facilities for patients, staff and supply. An example of a detailed calculation is shown in the table below.

Somatic	
Bed pool - 25 beds	
15 sqm pr. bed (average incl. bath/WC) ***(1)***	375
Storage (medicine 4 sqm, clean 5 sqm, unclean 4 sqm, linen 4 sqm, equipment 8 sqm)	25
Disinfection room 10 sqm, cleaning 5 sqm.	15
1 examination room 15 sqm, 1 conversation room 8 sqm	23
Staff room (tea-kitchen & day room 12 sqm, toilet 2 sqm)	14
Expedition (head of dept. nurse 10 sqm, secretary and on call rooms 15 sqm)	25
Kitchen	15
Patients day room (1 sqm pr. patient incl tea-kitchen)	25
Total	**517**
Net. sqm. pr. bed	**21**
(1) e.g. 5 single-bedrooms of 15 sqm , 10 double bedrooms of 25 sqm	325
10 Sanitary rooms of each 5 sqm. (one pr single room and one pr 2 double rooms)	50

In the same way a calculation for psychiatric beds has been done, this is shown in the next table.

Psychiatry	
Bed pool - 25 beds	
18 sqm pr. bed (average incl. bath/WC) ***(1)***	450
Storage (medicine 6 sqm, linen 6 sqm, equipment 10 sqm)	22
Activation, group therapy (4 sqm. pr. pat.)	100
Laundry for patients	20
1 examination room 15 sqm, 2 conversation room 8 sqm	31
Staff room (tea-kitchen & day room 14 sqm, toilet 3 sqm)	17
Expedition (head of dept. nurse 10 sqm, secretary and on call rooms 15 sqm)	25
Workstations (2 x 8sqm)	14
Kitchen	20
Patients day room (3 sqm pr. patient incl tea-kitchen)	75
Total	**774**
Net. sqm. pr. bed	**31**
(1) e.g. 25 single-bedrooms of 13 sqm	325
25 Sanitary rooms of each 5 sqm.	125

In the following table the calculated total future space is shown for all the main functions within the hospital. To preserve the overview, the functions are divided into four overall groups:

- Clinical functions
- Medical service functions
- Education and university functions
- Non-medical service functions

The total future space is calculated due to the predefined assumptions given in the previous chapters.

	Units	Space needed sqm. net
Clinical functions		
Somatic beds incl. car.monotoring, neonath. etc.	552	13.661
Psychiatric beds incl. shielded beds	58	2.435
Daybeds (somatic)	176	2.640
Daybeds (psychiatry)	43	860
Outpatient clinics som. (standard and special rooms)	120	3.910
Outpatient clinics psych. (standard and special rooms)	6	180
Emergency/acute reception		1.056
Observation beds	47	987
Delivery rooms	9	630
Part result		**26.359**
Medical service functions		
Intensive care	18	1.053
Operation theatres	22	2.640
Recovery	14	210
Radiology and diagnostic imaging	32	3.045
Laboratory		4.772
Occupational- and physiotherapy		994
Pharmacy		598
Part result		**13.312**
Education and University functions		
Education patients and personell		800
Teaching med. students		470
Research functions + libary		1.130
Auditorium		400
Part result		**2.800**
Non-medical service functions		
Administration & management		2.703
Archives		300
Wardrobes/Canteen/sleeping quarters		3.595
Patient service		1.648
Supplies & maintenance		7.478
Part result		**15.724**
Hospital in total		
Hospital		58.195
Primary Health Care		260
Total net area in square meters		**58.455**

As shown the total space is calculated to 58.455 m^2. All the details of the calculation are shown in Appendix 8. In the following chapters a more detailed description of the various functions will explain the preconditions for these calculations.

6 Clinical Functions

The number of beds for patient wards, day care unit, intensive care unit, etc. is based on a utilization rate of the bed as well as the future beddays as shown in the previous chapters.

6.1 Patient wards

We suggest that the beds could become a common resource for all specialties in the hospital. This means in more practical terms, that some beds are mainly dedicated to specialized surgical functions and some to medical, but that there is a rather broad overlapping zone between the departments, as it is known today with oncology and hematology at Fossvogur and nephrology and urology at Hringbraut. There will still be a need for specialized beds for psychiatry, children, obstetrics, monitored beds for cardiac patients etc.

To estimate the number of beds needed in the future, we have to decide a bed occupancy rate on utilization term of references.

- For the utilization % of beds: Ementor suggest 85 %, which is, as shown above, the "normal" efficiency goal for the use of hospital beds in Scandinavia.

Based on our suggestions for future in-patient activity, we estimate the future number of beds needed as follows:

- Internal Medicine, including all sub-specialities (Int. medicine I + Medicine II): 191 beds including 25 beds for cardiac monitoring. (today 192 beds)
- Surgery, including all sub-specialities: 158 beds (today 195 beds)
- Geriatrics 26 beds (today 25 beds)
- Women and Children 119 beds (today 140 beds)
- Psychiatry 58 beds (today 69 beds)

Besides the above we suggest increasing the number of beds for observation to 47 beds. These observation beds can be used up to max. 48 hours per patient.

The intensive care unit at Fossvogur is quite new with 11 beds. At Hringbraut there are 8-10 beds in the ICU. We suggest intensive care beds in the future LSH (18 beds) to be co-used with the recovery beds (16 beds), for cross-functional use of anaesthetic and nursing staff. This could also include the cardiac intensive beds.

6.2 Day patient services

We suggest gathering all functions for day patients in three units to achieve the most efficient use of the day capacity.

This could mean – depending of the location of functions -

- One dayhospital for all medical specialities
- One dayhospital for all surgery
- One for obstetrics located together with other obstetric functions
- One for paediatrics located together with other paediatric functions
- One for psychiatry located together with other psychiatric functions

From the dayhospital the patients will go to diagnostics and treatments in the special diagnostic functions (e.g. urology, gastrolaboratory, x-ray, surgery). This means that LSH could benefit from locating the dayhospital and the outpatient clinics very close together.

Therefore Ementor recommend placing these units closely together in order to increase flexibility, also in the future, and to share patients, equipment and staff.

Based on the suggested future day activity we estimate the number of day-beds/chairs to be

- Internal medicine I +II: 66 beds/chairs
- Surgery, incl. gynaecology and children: 50 beds/chairs
- Obstetrics: 44 beds/chairs
- Paediatrics: 16 beds/chairs
- Psychiatry: 43 beds/chairs

6.3 Out-patient services and specialised diagnostic services

Outpatient services can be organised in different ways:

- one area covering all out-patient functions with ordinary reception and waiting area for all specialities in the hospital
- each speciality has its own out-patient clinic located close to the ward, and where the same staff moves between ward and out-patient clinic

But as mentioned above Ementor recommend to keep all the clinics together and to locate the clinics in connection with the entrance area for walking patients. The clinics should as mentioned be closely together with the day care unit and with easy access to Radiology and other special diagnostic service.

In LSH there are several specialised diagnostic functions serving in-patients, day patients and outpatients e.g.:

- Urology: urodynamic and cystoscopia

- Gastro laboratory: endoscopic services
- Clinical physiology: spirometry, cardiac testing etc.
- HBO - Hyper Baric Oxygen Treatment
- Neurophysiology examinations, e.g. EEG, EMG etc.
- Gynaecology: Ultrasound, embryo diagnostics, IVF etc.
- Psychiatry: e.g. light therapy, ECT etc.

These functions could - if possible – to some extend be gathered in order to achieve synergy and cross-functional use of staff (nursing, administration) and space.

6.4 Offices and meetingrooms

The office area consists of offices for leading doctors, nurses and other leaders. Normally in Scandinavian hospitals an office location/desk is assigned to all doctors and other academical staff. Also all administrative staff needs an office location/desk. Meetingrooms are estimated from precondition that one third of all personnel working during daytime (70%) must be able to be in a meeting at the same time.

In this project we have calculated with two different room standards for offices:

- One space standard (10 m2 per office unit) is used for the executive staff and staff in the administration
- A lower space standard (8 m2 per office unit) for doctors, academic staff, secretaries etc.

The lower standard is based on a high rate of shared offices, e.g. as mobile offices in landscape.

In this calculation it has been necessary to include the office and meeting areas in the various departments as these figures in the gab analysis (chapter 10) has to be compared with the present space.

7 Clinical Service Functions

7.1 Emergency department

Only emergency patients and patients for acute admissions should come through emergency. All others such as elective admissions, outpatients and day-patients etc. will go directly to the relevant department.

The emergency department or departments receives the following patients:

- Trauma patients for emergency care and treatment, patients who thereafter are transferred to operational theatres, intensive care, cardiology unit etc.
- emergency patients for out-patient-treatment who can leave the hospital after treatment
- patients for acute admission preferably in the observations unit within the emergency department, alternatively transferred to intensive care, cardiology unit or wards

The emergency department has also special units for rape-victims and intoxicated patients.

Ementor suggests that the observation unit is strengthened in order to save a larger number of patients a traditional admission in the wards. Based on our estimations for the future activities, we suggest that a patient can stay in the observation unit up to 2 days, with an average LOS of 1,0, which gives a total of 47 observation beds.

The ambulance services are driven by the local fire department and the coast guard drives the helicopter service. The emergency department assigns a doctor to go out with the ambulance. All the ambulances and other vehicles and the necessary garages are placed in the fire department's building approx. 2 minutes away from both hospitals.

It is important only to have one area for the arriving ambulances per building.

7.2 Operational theatres

The operational theatres are presently located in both complexes on several different floors. The size of the individual theatres is very small compared to what is known as a reasonable size in a modern hospital. Some improvements seem mandatory to live up to the standards of today.

Some of the operational theatres must be placed with easy access from emergency and be located in close connection with intensive care and recovery. Some of the theatres should be reserved for elective operations in location close to the day units.

For some of the operational theatres that must serve both in-patient and day surgery the more simple and smaller size can still be reasonable. But as more and more complicated surgeries is possible as day surgery also this type of theatres requires more space. We have therefor in the future space for LSH calculated with an average standard for the theatres of 120 m^2 in order to give some flexibility in the further planning of the theatres.

The future surgical activity is a consequence of the patient related activity, and the suggestions made by Ementor regarding moving patients from in-patient stay to day care. We have extrapolated the number of surgeries with 36% and moved all the transferred inpatients for inpatient surgery to day surgery.

The total extrapolation is shown in the tables below:

In patients

Specialty	Operation 1999 Inpatient	Increase from simple extrappl.	Decrease due to transfer to daysur. [1]	Operation 2020 Inpatient
General surgery/vascular	1.891	672	-980	1.583
Urology	1.346	479	-374	1.451
Neurosurgery	632	225	0	857
Ear, nose, throat	1.025	364	-290	1.099
Orthopedics	2.072	737	-662	2.147
Ophthalmology	312	111	-76	347
Thorax	306	109	0	415
Plastic surgery	611	217	-82	746
Pediatric	738	262	-409	592
Gynecology	884	314	-354	844
In total	**9.817**	**3.491**	**-3.228**	**10.080**

Day patients

Specialty	Operation 1999 Day patient	Increase from simple extrappl.	Increase due to transfer to daysur. [1]	Operation 2020 Day patient
General surgery/vascular	112	40	980	1.132
Urology	170	60	374	604
Neurosurgery	2	1	0	3
Ear, nose, throat	292	104	290	686
Orthopedics	130	46	662	838
Ophthalmology	783	278	76	1.138
Thorax	0	0	0	0
Plastic surgery	0	0	82	82
Pediatric	0	0	409	409
Gynecology	2.738	974	354	4.066
In total	**4.227**	**1.503**	**3.228**	**8.958**

[1)] Inpatients transferred to day surgery

Below a table shows the future number of operations and operational theatres. The number of theatres is conclusively 22 rooms, which are 7 rooms more than today (7 rooms in Fossvogur, 7 rooms in Hringbraut and 1 in Eriksgata).

Specialty	Operations 1999	Operations 2020	Operations daytime 80%/100%	Operations pr. day	Minutes	OP Hours pr. day	Calculated number of theatres	Suggested number of theatres
General surgery/vascular	1.891	1.583	1.266	5,51	120	11,01	1,38	2
Urology	1.346	1.451	1.161	5,05	120	10,09	1,26	2
Neurosurgery	632	857	685	2,98	90	4,47	0,56	1
Ear, nose, throat	1.025	1.099	879	3,82	90	5,74	0,72	1
Orthopedics	2.072	2.147	1.717	7,47	180	22,40	2,80	3
Ophthalmology	312	347	277	1,21	60	1,21	0,15	1
Thorax	306	415	332	1,44	170	4,09	0,51	1
Plastic surgery	611	746	597	2,60	120	5,19	0,65	1
Pediatric	738	592	473	2,06	100	3,43	0,43	1
Gynecology	884	844	675	2,94	80	3,92	0,49	1
Day surgery	4.227	8.958	8.958	38,95	90	58,42	7,30	8
In total	**14.044**	**19.037**	**17.021**	**74**	**1220**	**130**	**16**	**22**

7.3 Recovery, Intensive care and Anaesthetics

At Fossvogur the intensive care has been renewed recently, the ward has 11 beds and will remain in close connection with recovery, which has 9 beds for adults and 4 for children. At Hringbraut there are 10 beds in the ICU on the same floor as recovery, with 11 beds, and the operation theatres.

With a simple extrapolation of the admitted patients in the ICUs with 36% and the same LOS as in 1999 2,8 days, the total number of beds in the ICU should be 18 in 2020. This means that there probably is an over-capacity in the ICUs at the present time. The table below shows the calculations for the ICU in 2020.

Department	Patients in 1999	Adm. days 1999	LOS 1999	Patients in 2020	Adm. days 2020	LOS 2020	Calculated number of beds	Suggested number of beds
Intensive	1311	3616	2,8	1783	4918	2,8	18,0	18

We suggest that in the future only inpatients will use the recovery beds as all day patients have their own day bed or chair. We assume that it will be possible to use these day beds as recovery from day surgery. The LOS for the inpatient in recovery is 3 hours. Thus the following calculation for the future need of recovery beds appears:

	Operations pr day	Average LOS in recovery	Hours pr day on recovery	Calculated number of beds	Suggested number of beds
Recovery	36,00	3	108,0	13,5	14,0

7.4 Radiology and diagnostic imaging

Radiology and diagnostic imaging is an important diagnostic tool. Generally we expect changes in the profile of services as follows

- more MR, CT, ultrasound diagnostics
- more intervention in diagnostic and treatment
- less conventional X-ray examination

It is hard to know exactly how this development will go as far as 2020 therefor we have chosen to extrapolate the resulting number of all examinations with the 36% collectively. Thus we suggest a total of 32 labs at LSH. In order to get a higher efficiency some these should be restricted to the acute functions and some to the elective. The calculation is shown in the table below.

Examination type	Examinations 2020	-85% in daytime	Examinations pr. day	Minutes pr. exam.	Exam. hours pr. day	Calculated no. of labs	Suggested no. of labs [2]
Radiology	163.734	139.174	605	25	252	31,5	32

7.5 Laboratory

LSH has a wide range of laboratory services within clinical biochemistry, microbiology, immunology, bloodbank functions and pathology.

Laboratory service “on location” is an advantage for quick testing of in-patients and patients admitted through Emergency in a hospital. But we recommend that this will be done in a different way than today.

We suggest gathering all the laboratory functions in one place in order to get a more efficient use of equipment and staff etc. But at the same time we suggest building up smaller satellite stations for taking simple tests gathering samples etc. in order to provide a good service for all departments.

Order of tests and receiving results could be administrated and supported by e-mail or other information technology. The physical transportation of samples could be organised by having a dedicated shuttle bus between the satellite stations and the main laboratories with the necessary material.

7.6 Occupational and physiotherapy

Services like physio- and occupational therapy should be in close connection to the specialities using their services, like psychiatry, orthopaedic, neurology, geriatrics etc. Therefore if possible Ementor suggest to integrate these service into the relevant wards or at least to locate their rooms very close by. This means transportation of staff instead of patients.

However, some functions will be centralised for all specialities (for instance some workout rooms).

7.7 Archives for Medical records and X-ray files

All hospitals are moving towards the electronic medical record and digital imaging (PACS).

However, we suggest assigning space for archiving, as this is not an issue at a present state. However, enlarging the archives will not encourage working more focused towards an electronic successor of the traditional records. We therefore suggest preserving records in some of the present rooms dedicated for this purpose and to move out records more than 3 years old to a remote archive in another location.

8 Education and university functions

At the new LSH the university and education functions has a high priority and therefore must be of some higher standard than today. In these functions there should be room for:

- Auditorium
- University functions for the medical students
- Research facilities
- Medical library

8.1 Auditorium

We suggest establishing one large auditorium for approx. 400 seats used for special occasions, seminars, staff meetings etc.

8.2 University functions for medical students

Regarding the medical students we assume the following figures:

- There are 40 new medical students per year
- The students have 3 years studies in the clinical part, i.e. 120 medical students in total in 40 weeks per year.
- We assume 30 education hours per student per week in average. Thus 120x30 = 3.600 student hours per week
    - 33 % of these hours are spent in a smaller auditorium (all 40 students)
    - 33 % of these hours are spent in smaller group rooms (of 10 students)
    - 33 % of these hours are spent in the hospital departments, labs etc

In the following the calculations for the m^2 is shown for the different units:

Small auditorium

1.200 student hours per week in a smaller auditorium, with 40 students in the room.

This gives 30 room hours per week, and requires one 1 auditorium of 40 seats.

We calculate with 1,2 m^2 per seat = 48 m^2. In addition secondary rooms are needed (wardrobes, toilets, storage)

In total 70 m^2

Group rooms

1200 student hours per week in a group room, with 10 students in each room.

This gives 120 room hours per week, i.e. 4 group rooms of each 10 seats (30 hours per room per week)

Each room is 20 m2, which gives 80 m2 in total for four rooms.

Other facilities for medical students

Other facilities are wardrobe (120 m^2), canteen (80 m^2), social rooms' (40 m^2) and reading rooms' (80 m^2). In total 320 m^2.

In total the net square area in total for the medical students will be 470 m^2.

8.3 Research

The most important factor for the research is the number of university employees. In Norwegian hospital there are approximately 0,7 FTE per student for teaching and research.

We have in total 120 student in the clinical part of the medical study, so if we assume that:

- 0,4 university employees per student, i.e. 48 FTE's
- The major part of theses university employees are academic staff, say 35 FTE's
- Each of these academic employees needs 10 m^2 of research area plus an office of 10 m^2, in total 20 m^2 per academic staff
- The rest of the university staff needs 10 m^2 per FTE.

This means that 700 m^2 is needed for the 35 academical personnel (research and offices) and 130 m^2 is needed for the rest of the universities staff (13 FTE). For research in total 830 m^2.

8.4 Medical Library

Furthermore there is a need for a medical library of approx. 300 m^2.

9 Service Functions

9.1 Kitchen

At LSH there are kitchens in various locations, at Hringbraut, Fossvogi, Landakot and Arnarholt.

Ementor suggest outsourcing the kitchen, e.g. to one of the units outside the two main complexes or even another third party in order. This is necessary in order to gain more room in the complex for other functions and in order to free the ground floor of the A wing, in Fossvogur which is very centrally placed in the house. In Hringbraut the kitchen and canteen areas are equally centrally placed in house 13, and this areas could preferably be used more efficiently.

9.2 Administration

Most of the joint administration for the two complexes is placed in Torfinnsgade. Only a few accounting and financial departments are still located at Fossvogi. We suggest gathering all top management functions and central administration in one location.

9.3 Patient service

We suggest establishing some patient services in connection with the central entrance areas such as cafeteria, newsstand etc. We also suggest considering other patient services such as information, patient's representative (ombud), library with internet connection etc.

9.4 Staff service

Staff services are mainly cloakrooms and canteen. It is common standard today in a modern hospital that every employee without an office shall have his or her own locker and that all employees have access to a canteen.

9.5 Other service functions

Other services are mainly related to supply services and transportation:

- Storage, distribution, waste
- Cleaning, sterilization
- Pharmacy services

All these services are in the complexes today, and we recommend LSH to consider the possibility to outsource any of these functions.

10 Gap Analysis

In order to illustrate the problems of locating the future functions within the existing building frame a gab analysis has been made on the main functions of the hospital.

The present space has been calculated and divided according to the same model, as we have calculated the future space, please see chapter 4. The future space has been calculated as stated in the previous chapter and can be found in total in appendix 8.

It shows a total gab of 9.900 m^2, mostly on the clinical functions and the non-medical service functions.

	Future space 1				Present space H & F				Space gap		
	M^2 Net.	M^2 Gross	No of beds/rooms 2020	Net./unit	M^2 Net.	M^2 Gross	No of beds/rooms 1999	Net./unit	M^2 Net.	M^2 Gross	Gap No of beds/rooms
Clinical functions somatic	21.828		541	40,35	16.371		557	29,39	-5.457		16
New floor + childrens hosp.					4.195				4.195		
Clinical functions psychiatry	3.475		58	59,91	3.786		84	45,08	311		26
Emergency/acute reception	1.056				599				-457		
Intensive care	1.053		18	58,48	825		19	43,40	-228		1
OP	2.640		22	120,00	2.052		15	136,77	-588		-7
Recovery	210		14	15,00	193		25	7,70	-17		11
X-ray	3.045		32	95,16	1.992		19	104,82	-1.053		-13
Lab/pharmacy	4.772				3.879				-893		
Administration & management	2.703				2.420				-283		
Patient service	1.648				568				-1.079		
Other functions	16.026				11.649				-4.376		
Total space	58.455	108.131			48.528	89.768			-9.927	-18.362	
Gross/Net factor		1,85				1,85					

As can be seen from the above figures a direct and uncritical realization of the future space would require a significant enlargement of the existing building frame. Somewhere in the amount of approx. 10.000 * 1,85 m^2 = 18.500 m^2 keeping the same gross/net factor of 1,85 as the average of the two buildings today.

We will in our upcoming work when some of all theses data and presumptions has been discussed with the steering committee look into the possibilities of compensating from some of the gap. We will thus try to come up with suggestions to how a remodeling of functions within the two complexes can be done including suggestions for improving logistics and flow though the hospital. The next chapter is used to outline some our thoughts at this point. These consideration has to considered with great cautiousness as there are still many uncertainties in the data used.