City of Palo Alto
Peer Review of proposed Stanford University Hospital Projects
- Stanford Hospital and Clinics (SHC) – adult hospital
- Lucile Packard Children’s Hospital (LPCH)

Preliminary Peer Review Report
November 6, 2007

Presented below, organized by key issue, are factors, benchmark data, observations and comments relevant to areas of potential concern for the City of Palo Alto regarding both of Stanford’s facilities renewal and replacement projects. The Peer Review investigations are aimed at determining to what extent Stanford’s proposals fall within the norms of current-day hospital planning and construction, identifying areas where Stanford may be outside the norms, and analyzing the underlying rationales and impact of the proposed projects’ scope and variances from norms, where applicable.

A. Bed Numbers – the fundamental “driver” of space needs
Both of Stanford’s proposed projects are for inpatient hospital expansions and improvements. The number of inpatient beds is the most basic space driver, not only because the bed rooms themselves require space, but also because all the support services, from operating rooms to staff areas to food service and housekeeping, are calculated based on the number and types of patients being accommodated.

1. Bed Numbers – Existing and Proposed

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Proposed</th>
<th>Increase</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHC</td>
<td>456</td>
<td>600</td>
<td>144</td>
<td>32%</td>
</tr>
<tr>
<td>LPCH</td>
<td>257</td>
<td>361</td>
<td>104</td>
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<tr>
<td>Total</td>
<td>713</td>
<td>961</td>
<td>248</td>
<td>35%</td>
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</table>

Note 1: SHC is licensed for 613 beds, but only 456 are operational. The rest were converted to other functions years ago. The proposed number of beds, 600, will still be fewer than the original bed license.

Note 2: LPCH is in the process of building out the remainder of its current 257 beds, which were approved and are part of the first phase of work.

Note 3: The bed numbers are still slightly in flux – depending on final plan layouts. The order of magnitude is not intended to change in any significant way.

Note 4: LPCH also contracts with Sequoia, Washington (Fremont), and El Camino Hospitals where it locates additional beds (approx. 40) and will continue to do so.

2. Source of bed numbers
Stanford has done significant research and analyses to determine the appropriate number of beds to provide for each hospital. The details of these studies form part of Stanford’s business plan, the details of which are confidential information. Stanford is currently documenting and providing the information that can be shared with the public.
The process Stanford used to develop their bed number projections is as follows:

a. Stanford Strategic Business Development departments in each respective hospital analyzed relevant factors internally, from perspectives of service, operations, technology, staffing, regional market, current-day and future healthcare modalities and trends, and financial soundness.

b. Individual departments also examined patient volumes, health care trends, new technologies, etc., both internally and with the help of outside specialist consultants for their individual areas.

c. The Strategic Business Development departments then engaged reputable outside specialist consultants to review their internal assumptions and data, and to develop bed number projections:
   i. Accenture analyzed the situation for SHC
   ii. Chartis Group did the same for LPCH

d. Finally, the two space programming firms, KSA for SHC and SmithGroup for LPCH, also reviewed the bed projection numbers developed respectively by Accenture and Chartis.

e. The final bed numbers result from a consensus of all of these efforts and analyses.

3. Factors that influence bed number projections:
The factors that impact the determination of the bed numbers are as follows:

a. Demographics studies – indicating both an aging and a growing population
   i. A 2007 New Century Healthcare Institute report states that, in San Mateo and Santa Clara counties, “the number of people over age 65 will triple in the next 40 years” and that age group “will have four times the utilization of hospitals as people under 65.” The report states that this will significantly affect demand for healthcare services by 2011.

b. Disease types and medical conditions:
   i. Longer lived population, more multi-system failures, medical problems of greater acuity, more inpatient hospitalizations and more critical care required
   ii. Increased frequency of different medical conditions – diabetes, bariatrics (obesity)

c. ALOS (average length of stay) has “flat-lined.” It had been decreasing for some time, as patient were discharged from hospitals with shorter inpatient stays, or treated as outpatients, not inpatients. Decreasing ALOS meant more beds were available for use. That situation has turned around now for the following reasons:
   i. Outpatient care has already siphoned off about all that can be done that way
   ii. Shorter inpatient stays have about reached the limit of discharge safety
   iii. An aging population means more elderly, frail and multi-system failure patients are now beginning to stay longer in the hospital.

d. Stanford reports that both hospitals are turning patients away due to lack of beds to put them in.
   i. In fiscal 2005, LPCH turned away 200 patients
   ii. In fiscal 2005, SHC turned away 500 patients

e. Increased focus on disaster preparedness and emergency response to potential mass disasters in the region
   i. Review of capacities of all hospitals in the region
   ii. Consideration of the fact that Stanford is a Level I Trauma Center serving several surrounding counties
4. **Conclusion:**
   a. Based on the information provided to date, it appears that the bed numbers proposed for the new hospitals seem reasonable and that thorough analyses have taken place at several levels.
      i. The increase of approximately 35% in bed numbers for hospitals that were planned over 25 years ago (SHC) and nearly 20 years ago (LPCH) does not seem out of line with what might be expected, given the time lapse, the changes in demographics, the increasingly renown expertise at both SHC and LPCH, and the need to look to the future.

B. **Private Patient Bed Rooms**
A major factor in the size of the new hospital additions and improvements is the fact that nearly all replacement and renovated patient bedrooms will be private, single rooms, each with their own toilet room. This is a significant change from the existing situation and leads to the need for considerably more square footage.

**Comparative Patient Bed distribution**

<table>
<thead>
<tr>
<th></th>
<th>Existing Beds</th>
<th>Proposed Beds</th>
<th>Increase in Privates</th>
<th>% of Beds in Private Rooms</th>
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</thead>
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<tr>
<td></td>
<td>Private</td>
<td>Semi-Private</td>
<td>Total</td>
<td>Private</td>
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<tr>
<td>SHC</td>
<td>199</td>
<td>257</td>
<td>456</td>
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<tr>
<td>LPCH</td>
<td>50</td>
<td>207</td>
<td>257</td>
<td>345</td>
</tr>
<tr>
<td>Totals</td>
<td>249</td>
<td>464</td>
<td>713</td>
<td>857</td>
</tr>
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</table>

1. **Bed Number Comparison**
   Whereas the hospital planning proposes a total increase of 248 patient beds (SHC plus LPCH), in fact the increase in private rooms will be a total of 608 beds. That means approximately 368 beds that are now located in semi-private patient rooms, with shared toilet/shower rooms, will be renovated to be in single patient rooms with individual toilet/shower rooms, in addition to the 248 new patient beds which will all be in singles.

2. **Industry Standard**
   Almost all new hospitals across the nation are being planned for single patient, private bedrooms, with individual toilet/shower rooms. This research found no hospital or consultant who was planning for other than private rooms or had done so in recent years. The reasons for this are as follows:
   a. Reduction of hospital-acquired infections – a major industry-wide problem today
   b. Reduced likelihood of medication errors – also a major problem
   c. Reduction of patient transfers from room to room due to inability to match
      i. Patient disease / level of acuity / level of infectiousness
      ii. Patient gender / age
   d. Reduction of patient falls and nurse injuries resulting from patient transfers
e. Higher bed occupancy / improved space and staff utilization — eliminates necessity
to leave some beds empty due to inappropriate mix of gender, age or disease

f. Increase operational efficiency — improved bed utilization (no empty beds due to
incompatible roommates.)

g. Patient preference and satisfaction

   Section 3.1.1.1 (1): “In new construction, the maximum number of beds per room shall be
   one unless the functional program demonstrates the necessity of a two-bed arrangement.
   Approval of a two-bed arrangement shall be obtained from the licensing authority.”

Many states, including CA, base their state codes on the AIA Guidelines. Some states,
including CA, are currently using older versions of the Guidelines, which do not recommend
single rooms as the standard. Many states, including CA, are in the process of transition.
The current status is as follows:

a. According to the AIA Guidelines authority in Washington, DC, 9 states have
   adopted the 2006 Guidelines in total, meaning they are now requiring single patient
   rooms in all new inpatient hospital facilities.
   i. Those states are: Georgia, Virginia, W. Virginia, Tenn., Kansas, N. Dakota,
      Louisiana, Arizona, and Montana.

b. 11 additional states are also using the 2006 Guidelines, but use them with
   amendments, so without reading all the individual state codes, it is not possible to tell
   if they have included or excluded the recommendation for all single rooms.

c. 12 more states are currently considering adoption of these Guidelines, and 9 more
   (including CA) are already in the process of doing so.

d. California is one of 24 states that writes its own code (including New York and
   Illinois);
   i. 17 of these states, including CA, NY and IL, base their codes on AIA Guidelines;
   ii. The highly populous states of NY and IL are currently considering adopting the
       2006 Guidelines
   iii. CA is already in the process of doing so.

e. Since CA writes its own code, it is impossible to state when or if they will ultimately
   adopt some or all of the Guidelines — and whether or not this will include the all-
   single-room recommendation and make it a requirement.
   i. This action is scheduled for decision sometime in 2008, but evidently this has
      been debated for some years and a decision still may not actually occur in 2008.

4. Hospital of the Future, Lessons for Inpatient Facility Planning and Strategy
   This document is a 2007 publication of the Health Care Advisory Board, a multidisciplinary
   national organization comprised of numerous hospitals, architects, planners and
   construction experts across the nation. Hospital contributors include Johns Hopkins, Sutter
   Health, UC Davis Medical Center, UC Irvine, UCLA, Univ. of Michigan Health System and
   Kaiser Permanente.

a. The report states that “Private Med-Surg Rooms (are) the New Baseline” and
   provide “Widely-Acknowledged Benefits.”
5. **Discussions with colleagues and health care providers:**
   Summary of comments:
   a. Kaiser – single rooms are the current “industry standard” – being used in all Kaiser template hospital plans and designs
   b. Colleagues in national planning and architectural firms state they have planned and designed only single patient rooms in new hospital developments:
      i. Ellerbe Becket, HDR, KSA, SmithGroup, KMD, HOK, Fong & Chan

6. **A sampling of hospitals that have planned and/or recently constructed all new patient beds in private room (and converted most old doubles to privates):**
   a. In CA: UCLA, UCSF Mission Bay, Santa Clara Valley Medical Center, CPMC, Kaiser, San Francisco General, PAMF San Carlos, Sutter Eden Medical Center
   b. Other locations: Ohio State, University of Florida-Shands, University of Michigan, Duke, TriHealth Hospitals (Cincinnati).

7. **Problems and Issues with All Single-bedded Patient Rooms**
   a. In some cases, it is not possible or feasible to renovate existing semi-private rooms into singles
      i. Structural barriers – walls that cannot be reasonably relocated
      ii. Operational barriers – too few beds on nursing unit would result if existing doubles are converted to singles, making nursing care costly and inefficient
      iii. Cost barriers – the institution simply cannot afford the construction costs
   b. When it is possible to convert existing double rooms to singles, the resulting space is often not exactly what would be planned if starting from scratch.
      i. Existing interior walls are often left in place – structure, infrastructure, and costs make relocation prohibitive
      ii. Resulting space may be slightly larger or differently configured than ideal
   c. When new single patient rooms are added to a hospital, but some existing rooms are left as semi-privates, a hospital is faced with “two classes of care.”
      i. Patients object – 2nd class feeling – lowers satisfaction, public image
      ii. Lack of standardization can lead to increased medical errors
      iii. Undesirable situation – typically tolerated as an unavoidable transition step
      iv. Current plans for both SHC & LPCH avoid this problem. All rooms will become private, except a very few where this is not medically preferable.
   d. Costs
      i. Single patient rooms take more space than doubles on a per/patient basis, and each requires its own toilet room. This adds to construction cost.
   e. **Staffing**
      Nursing units with all single rooms are larger, use more space than the older semi-private room layouts. Corridors are longer and rooms more spread out.
      i. Typically staffed by a more decentralized nursing system – but not necessarily an increase in nursing staff. The ratio of nurses to patients can remain the same.
      ii. There may be a marginal growth in support staff – more delivery personnel, more space for housekeeping to clean.
8. **Conclusion**
Given the pervasive attitude and evidence-based research favoring private patient rooms, it would be unreasonable to expect Stanford to plan for anything other than private patient rooms.

a. The Health Care Advisory Board research assesses private patient rooms as having a strong positive health outcome benefit and a moderately positive cost benefit.

b. The patient health outcome benefits include:
   i. Reduced rates of infection.
   ii. Reduced falls, injuries – to nurses, staff and patients
   iii. More rapid discharges – incorporation of family, improved healing environment

c. Even though construction costs for additional area are larger, there are long-term operational cost savings as well as patient care benefits:
   i. Greater nursing efficiency with decentralized care system
   ii. Increased utilization of beds – no empty beds due to incompatible roommates
   iii. Reduced time spent in transport –shifting patients from one room to another
   iv. Reduced risk (and incidence) of infections, patient falls, and nurse injuries from moving patients

C. **Size of Patient Bedrooms**
Single rooms require more space per patient than semi-private rooms, plus each single room requires its own toilet/shower room. Room size varies, but is typically viewed as consisting of three separate zones of activity, in addition to the toilet room, each with its own requirements:

- The patient care zone – patient bed area
- The professional caregiver zone – the required space around the bed for physicians, nursing staff and medical equipment
- The family / care-giver zone – an increasingly important component of patient care.

Recent evidence-based design indicates faster patient recovery with family involvement.

1. **Factors to consider in analyzing the space "programmed" or planned for patient rooms**
Understanding the plans and space proposed for patient bedrooms is very important since patient rooms are significant repetitive elements throughout both hospitals, and account for a major part of the space in both the SHC and the LPCH projects.

- LPCH: Inpatient nursing units = 49% of total hospital area
- SHC: Inpatient nursing units = 50% of total hospital area

Inpatient nursing units include all nursing support space, nurse stations, staff support, medication, satellite pharmacy, clinical offices and work stations, in addition to the actual patient bedrooms. All these support spaces are critical to the functioning of the nursing units and are typically sized in relation to the number and acuity of patients in the unit.

a. Data is presented in Net Square Feet (nsf) – the actual area inside the walls of the patient rooms.
   i. Toilet rooms are included in the areas presented, as is the circulation area within the room. Outside corridors are not included.

b. Pediatric patient bedrooms are typically a little larger than adult bedrooms, primarily because one or even two family members are often included in the daily patient care, including sleeping overnight in the patient room.
c. Each nursing unit requires approximately 10% isolation rooms for patients with either highly infectious diseases, or patients who are themselves in a compromised situation and must be protected from airborne infection. Isolation rooms require ante-rooms and isolation alcoves in addition to the regular room space. This additional space has not been included in the space comparisons which follow, but it does add to overall area in each nursing unit.

d. There are several different types of patient rooms in each hospital. Each room type has some special requirements and sizes vary accordingly.
   i. Regular medical/surgical patient rooms (med/surg): These are the rooms used for the bed area comparisons with other hospitals.
   ii. Intermediate care – step-down units
   iii. Critical care, ICU’s for specialty services, Cardiovascular ICUs, Pediatric ICUs, NICUs (neonatal intensive care units), and Compromised Host units for immuno-suppressed patients.
   iv. Stanford has a greater proportion of specialized and high acuity rooms than a typical community hospital.
   v. This research has not tried to compare the specialized types of rooms with other hospitals. While not significantly larger than the typical med/surg rooms, they do have separate features, isolation alcoves, specialized airflow, and additional support areas which often occupy extra space or lead to different configurations.

e. Space for patient bedrooms is “programmed” – that is, defined in area – before actual plan layouts are developed. This programmed area is a space target. The actual room may not end up being exactly that size (could be smaller or larger), but it will be within a very close range of the target number.

f. The plan layout of patient rooms within the building affects the space used:
   i. Older hospitals typically designed “mirror image” rooms – back to back patient rooms with beds and toilet rooms on alternate sides of the wall in every other room. This allowed for grouping plumbing fixtures and “nesting” some spaces – creating a fairly tight space-efficient layout.
   ii. Recent outcomes research has found that “mirror image” layouts tend to increase medical errors. With medical gases and equipment hook-ups, for example, on alternate sides of the bed, nursing and medical staff may inadvertently reach for the wrong side in an emergency, leading to delays, confusion or occasional medical errors.
   iii. Current best practice is to design rooms (within a type – medical/surgical beds, critical care beds, etc.) to be identical, “same handed.” No mirror images. Though this may take slightly more space, increasing numbers of hospitals, especially those with very high acuity patients like Stanford, are doing this.

g. Academic medical centers require larger patient rooms:
   i. Interns, residents, other trainees and attending faculty must often all be in the room with the patient at the same time – in addition to medical equipment.
   ii. Academic medical centers have the highest acuity patients with complex medical conditions, requiring the most extensive array of equipment and technology. This occupies more space in a patient bedroom than in a community hospital.
2. **Private Room Area Comparisons**

Net Square Feet – including toilet rooms

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<td></td>
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<td>LPCH</td>
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<td>UCSF</td>
<td>Firm #1</td>
<td>Firm #2</td>
<td>Firm #3</td>
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</table>

Notes by Column Number:

**Note 1:** SHC private rooms typically programmed at 300 nsf. Larger areas are for Isolation and Bariatric Rooms, but do not include isolation alcoves/ anterooms.

**Note 2:** LPCH private rooms programmed at 278 – 298 nsf, depending on room type, plus an additional 40 (50 for ADA accessible) nsf for the toilet room.

**Note 3:** The Health Care Advisory Board 2007 report suggests an “optimum” range of 240 – 290 nsf including toilet room. They include both academic and community hospitals in their data base. They did not distinguish between adult and pediatrics.

**Note 4:** The Kaiser Study, completed in 2005, combines data obtained from 13 national health care planning and architecture firms, based on the bed areas programmed for recent hospital developments in their practices. (Names upon request) The areas presented did not include toilet rooms – so an area of 50 nsf has been added to the Kaiser study numbers to make a more valid comparison. The hospitals data includes both academic and non-academic institutions. The data was presented in ranges of high and low, most common, and mean and medians. The higher numbers in the ranges shown above are for private pediatric rooms vs. adult rooms. The “high” number, 300 nsf without toilet, just happened to be the same for both.

**Note 5:** Ronald Reagan UCLA Medical Center – just finished construction. 510 beds in single rooms, 14 in double rooms (only for pediatrics and psychiatry). Typical Med/Surg room is 220 nsf + 40 nsf toilet. May not include circulation area within the room for access to toilet room. ICU rooms are larger, 280 nsf.

**Note 6:** UCSF Mission Bay – planned for 260 nsf rooms + 45-50 nsf for toilets. Planned to make all toilet rooms handicapped accessible – a common practice these days.

**Note 7:** A national planning firm, with numbers entirely based on academic medical centers.

**Note 8:** A national architecture firm, with numbers representing both academic and community hospitals.

**Note 9:** Another national architecture firm, with numbers representing both academic and community hospitals.
Respondents did not distinguish between adult and pediatric patient rooms. Most data is understood to be for adult med/surg rooms – which was what was requested.

3. Observations and Conclusions:
   a. SHC: The space programmed for single patient rooms falls within, but nearer the high end of, the norms for other hospitals.
   b. LPCH: The space programmed falls more towards the high end of comparable recent hospital developments, but not outside the range.
      i. Approximately 200 of the total proposed 361 LPCH beds are being converted from existing doubles to new singles.
      ii. The space for each of these rooms may be somewhat larger than ideally necessary, dictated by existing construction and layouts that cannot reasonably be changed.
   c. Considering the impact of the size of the private patient rooms on the projects as a whole:
      i. Even if each patient room were reduced by perhaps 10% (approx. 30 nsf) – the overall impact on the total project size would only be about 2.5%.
      ii. This will not alter the order of magnitude of the projects or significantly reduce building configuration or impact on the campus and the City of Palo Alto.
   d. As the projects are developed in detail, the architects will be striving to “tighten” the layout as much as possible, while still meeting the functional goals.
      i. Stanford has an incentive to keep the rooms from expanding beyond their necessary functional sizes because additional space increases construction cost.
   e. From a Peer Review perspective, the spaces programmed for the patient rooms for both the SHC and the LPCH projects seem reasonable relative to current-day planning norms.
      i. At this early stage of planning – when no design has yet been developed – the numbers proposed are reasonable targets, though the LPCH private rooms might be “tightened” slightly.
      ii. The key space impact factor is the decision to plan for nearly 100% private rooms, not the size of the rooms.

D. Operating Rooms (ORs)
Another key element influencing the size of hospitals today is the “Interventional Platform,” the combination of services including Operating Rooms (and all surgical support services), Cardiac Catheterization, Interventional Radiology, Pre- and Post Admission Services, and all Anesthesia and Recovery services.

1. Growth in Size of Operating Room Suites – “Interventional Platforms”
The size of operating rooms and associated support space has dramatically increased industry-wide, and nation-wide, over the last decade. The OR is no longer viewed as a single room, but rather as the hub of a complex array of interventional diagnostic and treatment services. However, it is useful to compare the relative sizes of the ORs themselves – which the following table will do.

The increased size of the basic unit (the OR) is largely driven by the following factors:
   a. Explosive growth in new medical technologies, including intra-operative imaging, intra-operative MRI, robotics, and many very new medical technologies with substantial space and infrastructure requirements.
b. Requirements for separate control & equipment rooms, observation areas, and many kinds of support space.

c. Increasing numbers of physicians, nurses and technicians who work in or adjacent to the surgical suite at the very same time – adding to both OR and support space.

d. Higher acuity patients with multi-system problems that must be addressed during surgeries.

e. Increased concern about infection transmittal, requiring rigorous separation of clean and soiled areas – as well as separation of staff, patient and material access points.

2. OR Size Comparisons
   Note: When SHC was designed in the mid-1980s, ORs were planned at approx. 400 nsf.

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>1</th>
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<td>Kaiser Research Study</td>
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<td>Ortho OR</td>
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<td>Future</td>
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</tbody>
</table>

- IP = Inpatient
- CV = Cardiovascular
- Ortho = Orthopedics
- Neuro = Neurosurgery

Notes:
All ORs are supplemented by significant amounts of support space, including
- Control rooms for computerized equipment
- Pump Rooms for Cardiovascular cases
- Scrub areas, sterile supply areas, induction areas (where anesthesia is started), and equipment storage
- Post Anesthesia Recovery Units (PACU) space
This comparison has looked at the actual space in the OR itself as a measure of comparability from one institution to another.
Both SHC and LPCH are within norms for standard OR sizes and for CV OR sizes.

The space programs for SHC and LPCH do not specify different sizes for specific types of other ORs with two exceptions:

i. LPCH specifies 700 nsf (plus support space) for special MRI and Robotic rooms.

ii. SHC specifies two OR spaces of 1,000 nsf each for future as-yet unknown technologies, which would include support space for those rooms.

Note that UCLA, the only hospital that shows ORs at less than 600 nsf, was actually planned over 5 years ago. Even in that short time, there have been significant advances in medical technology, robotics, and intra-operative imaging equipment.

3. Number of ORs

a. Stanford’s proposed OR numbers

i. SHC will increase from 30 ORs to 40, including 3 additional standard ORs, 2 additional image-guided ORs, and 5 large ORs to accommodate future technologies.

ii. LPCH will increase from 7 to 12, including only 1 additional standard OR, 1 new robotic OR, and 3 ORs equipped with MRI.

b. This research has not identified relevant rules of thumb for the number of ORs relative to the number of patients in the hospital.

i. The number of ORs is related to a particular hospital’s type of patients and “centers of excellence” — which may be more or less surgically related.

ii. Academic teaching hospitals are likely to perform more surgeries and more complex surgeries than a community hospital.

iii. Academic teaching hospitals are referral hospitals for the most challenging regional medical/surgical cases — often requiring more extensive procedures, longer times, and therefore, slower through-put in ORs.

The number of ORs needed for a given hospital is defined by analysis of patient volumes and utilization patterns, including length of time and types and complexity of cases, hours of operation, and OR turn-around time.

i. Stanford has done these analyses (see Item A above) as part of their projections for overall project size and scope — similar to the studies to determine numbers of patient beds.

ii. The resulting numbers form part of their confidential business plan, related to projected revenue flows and operational costs.

4. Observations and Conclusions:

a. No definitive comment can be made on the number of ORs being proposed.

i. Stanford’s consulting firms state that a larger number of ORs could have been justified by a standard utilization analysis, but that Stanford has become very efficient in utilization and has pared down the numbers of ORs to minimize space and cost demands.

b. Both SHC and LPCH have proposed space sizes for the most advanced high-tech kinds of Operating Rooms that appear to be within the norms of other recent hospital developments.

i. The space allocated for “future technology” ORs for SHC, at 1,000 nsf per OR, is slightly larger than the norm — but it is hard to say whether or not there will be need in those spaces for additional control rooms, computer or medical equipment, or new robotics of some sort.
ii. The additional size increment of about 200 nsf for these 5 ORs (a total of 1,000 nsf) is not significant in the overall project – and may be very sound planning for unknown future needs. Some specialized ORs in other hospitals are already consuming 800-900 nsf.

E. Emergency Department (ED) Issues
Note: The Emergency Department at Stanford Medical Center is shared by LPCH and SHC.

The Stanford ED is a Level I Regional Trauma Center, designated to provide the highest level of care for serious emergencies, traumas and extreme/mass disasters. Stanford’s Level I Trauma designation covers a multi-county region, including the counties of Santa Clara, San Mateo (southern portion), Monterey, Santa Cruz and San Benito.

1. Key issues
   a. As noted by Stanford:
      i. Insufficient numbers and sizes of treatment bays
      ii. Extreme lack of support space
      iii. Inefficient operations, slow through-put, long delays and waiting times, caused by lack of space and support areas
   b. National trends
      i. Higher acuity patients – aging population, multiple medical problems
      ii. Incorporation into ED of imaging modalities (CT scan, MRI access)
      iii. Inclusion of satellite pharmacies
      iv. Immediate proximity to Interventional services – ORs, etc. – not just for convenience, but for patient safety. It’s a life and death matter.
      v. Provision of family space – especially for pediatrics
      vi. Dedicated triage areas – for separating levels of emergency
      vii. More provision for decontamination – potential chemical threats
      viii. Privacy concerns – HIPPA regulations – “hard-sided” cubicles or exam rooms instead of curtained separations – leads to more space
      ix. Modular rooms – for flexibility to treat different medical problems
      x. Surge capacity – for mass disasters
      xi. Point of contact ED registration, paperwork – space implications within ED

2. Number of Treatment Rooms
   Stanford is proposing an increase in ED treatment rooms from 43 to 57, approximately a 33% increase – comparable to the increase in patient beds.

However, as with the number of ORs, the number of ED treatment rooms cannot be evaluated without knowing confidential business plan information such as anticipated patient volumes, patient mix, types and acuities of medical problems anticipated, etc. As described under Item A (above), Stanford appears to have done “due diligence” on the determination of these numbers. Some additional background validation is currently being obtained from Stanford.

It stands to reason that SHC and LPCH have no incentive to create more treatment spaces than deemed necessary.

- The number of inpatient nursing beds available in each hospital limits the number of people who can be seen in the ED, since a significant proportion of
ED patients will end up being admitted to an inpatient bed. If beds are not available, it is unwise to admit a serious emergency patient to the ED. Rather, they will be diverted and sent elsewhere if possible. (This is currently happening due to lack of both ED treatment spaces and lack of available patient beds.)

- The hospitals are also limited by the number of ORs available for emergency surgeries – as well as all other modalities, CT Scanners, etc.
- These services are interdependent – and relate to Stanford's patient volume, patient mix and medical problem projections, all key elements of their business plan.

3. **Treatment Room Space Comparisons**
   All of the rooms proposed for the new hospital development are private exam rooms, not open curtained multi-patient treatment bays.

<table>
<thead>
<tr>
<th>Room Description</th>
<th>SHC</th>
<th>HC Advisory Board</th>
<th>Kaiser Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Most common</td>
<td>Mean / Median</td>
</tr>
<tr>
<td>General Treatment Room</td>
<td>140</td>
<td>130-150</td>
<td>137</td>
</tr>
<tr>
<td>Trauma Room</td>
<td>400</td>
<td>250</td>
<td>368</td>
</tr>
</tbody>
</table>

4. **Observations and Conclusions**
   a. The General Treatment Room size is within the norms for other comparable hospitals.
   b. The Trauma Rooms are larger than some comparable institutions.
      i. Each Trauma Room at Stanford is designed to be able to serve 2 patients in the event of multiple emergencies or a disaster – making the size very reasonable.

F. **Imaging Department Growth and Change**
   There are huge variations in the types of spaces (rooms for CT vs. MRI vs. PET vs Rad. Therapy vs. Computer Equipment, etc. etc.) that comprise a current-day Imaging Department. My investigations show that Stanford's spaces (room by room) are comparable to others, when there are some directly comparable data. A detailed room-by-room chart would not reveal any variations from common hospital norms. Therefore, the following comments have focused on the qualitative issues.

1. **Technology explosion**
   Of all the departments in a hospital, the Imaging Dept. has experienced the most extreme growth and change in equipment, technologies, new approaches and methodologies.
   a. Interventional radiology – This is something that barely existed 10 years ago, and was often subsumed within other departments. It has now become a major space occupier on its own, both as part of a vastly expanded Imaging Dept. and as an adjunct to Surgery, Oncology, Cardiology and other subspecialties.
i. New, often heavy, equipment requires special mounting, often requiring more infrastructure and space than older buildings provide.

ii. Such equipment also requires separate computer rooms and other support spaces.

iii. Examples are advanced Cardiac Catheterization and Peripheral Angiography rooms which are larger and more sophisticated than earlier versions.

b. Diagnostic imaging – especially for cancer screening and treatment – is another area experiencing massive growth in terms of new technologies and applications.

i. New computer-aided detection tools.

ii. Radiation therapy and simulation.

iii. Special interventional procedures – gamma knives, stereotactic radiosurgery, etc.

c. Molecular imaging with special equipment is used in increasingly frequent genetic screening and analyses.

d. Myriad other new or improved technologies are now used much more frequently and overlap in their service from one dept. to another – sometimes requiring duplicate pieces of equipment to provide access for patients where needed. (CT Scan, MRI, PET Scan, EP (Electrophoresis), etc.)

i. In a large hospital like Stanford, everything simply cannot physically be near everything else, so some duplication is mandatory.

ii. Patient safety and operational efficiency may depend on appropriately accessible equipment.

iii. It often costs less in the long run to duplicate some equipment in widely separated departments – which leads to more space and more equipment costs, but is balanced by better patient care, fewer negative medical incidents, and increased operational efficiency for staff (less travel, less transport, etc.)

e. Digital imaging record keeping, transmittal and sharing across disciplines (and between inpatient and outpatient settings) is adding a new dimension to space and technician needs in Imaging areas.

i. Computerized PACS systems for recording, transmitting and archiving images.

ii. Need for technician work areas – vastly different from the old “film” days.

2. Blurred boundaries between Imaging, Surgery, Oncology, Genetic Testing, etc.

a. Newer techniques, equipment and medical advances have so blurred the distinction between Imaging and other specialties that it is no longer possible to do an “apples to apples” comparison at a department level.

i. A great deal of new imaging equipment is used in the OR setting.

ii. Other imaging equipment is used at the patient bed-side (mobile units which minimization is making ever more possible) – but adds to space needs on nursing units.

iii. Still other equipment is located within special departments – Oncology, Emergency, Women’s Centers, etc.

3. Constant new developments dictate need for space to allow for expansion and change, and infrastructure to support it.

a. Imaging is one of the most expensive areas in a hospital – to build, renovate or move.

b. It is very difficult to add new equipment or replace existing because of demanding installation and infrastructure requirements.

i. Must be located where there is access for installing new and removing old equipment – which can be large, cumbersome and very costly.
ii. Mounting – equipment often mounted on ceiling booms, heavy, must meet seismic codes, demands special structures

iii. Special floors – wiring, shielding, cabling, special load-bearing capacities

iv. Special hook-ups -- power redundancies, cabling systems, wiring access

v. Special shielding – lead lined walls, concrete bunkers

vi. Additional ventilation requirements – heat, infection control

4. Observations and Conclusions:
   a. The explosion of technologies and applications of imaging equipment and capabilities is creating a whole new set of space and infrastructure needs for hospitals nation-wide that didn’t exist when SHC and LPCH were planned.
   b. The very uncertainly of new advances dictates that new hospital construction should be prepared to accommodate unexpected new developments.
   c. Especially in a research-based, academic medical teaching center like Stanford, being able to accommodate and test new developments in this field is critical to both top-notch patient care and to medical advancement nationally.
      i. The huge benefits of imaging technologies, which are often non-invasive, for both medical diagnoses and treatment cannot be understated.
      ii. In developing the space programs for SHC and LPCH, the planning firms worked closely with top medical professionals at Stanford to outline space appropriate for current and potential future equipment and procedures.
      iii. The new spaces being proposed are greater than in the existing hospitals – but cannot readily be compared as the newer technologies are distributed throughout the institutions, not grouped (as in the past) in one “Imaging Dept.” Many spaces are designed to accommodate equipment that didn’t exist 10-15 years ago.
      iv. On a room-by-room basis, specific rooms for specific pieces of equipment appear to be within typical norms for new hospital developments.

G. Overall Hospital Space Growth and Hospital Size: Additional Factors to Consider

In addition to the increase in space needs for specific rooms or services within hospitals today, there has been a general growth in support functions, corridors, and overall area.

1. Reasons for overall space growth:
   a. Infection control – and related patient safety
      i. Need to minimize cross-traffic – leads to more separate corridors
   b. Regulatory compliance – more paperwork, more workstations, more computers, more separation of clean and soiled work areas and disposal of trash and wastes
   c. ADA (Americans with Disability Act) requirements – add area to new developments
   d. Decentralization of care – more space in and around nursing units, computer records, charting, medications, supplies, etc.
   e. Patient care team approach – multi-disciplinary consultations and care planning require more support space, conference space, for physicians, staff and families
   f. Much more equipment throughout the hospital
      i. Nursing units -- much equipment now used at the bed-side – needs storage space
      ii. Interventional diagnostic and treatment areas – extremely equipment intensive
   g. Space for change – access and flexibility to replace or add equipment or renovate areas generates need for some “soft” space around highly intensive functional areas.
h. Amenities
   i. Patients – market competitive, want pleasant waiting spaces, private bedrooms, family areas – research shows this improves patient outcome, speeds healing and hastens discharge, an ultimate cost saving and care outcome benefit.
   ii. Staff – major nursing and technician shortage – need staff lounges, lockers, food service, support areas to maintain competitive position relative to attracting and keeping key nursing and technical staff.
   iii. Visitors – families – now recognized as an important part of the patient care and healing process – need to be accommodated in the hospital plan.

2. Academic Teaching Hospital – Special Requirements
   a. Quaternary care provided – highest care level available nationally
      i. Greater acuity and severity than “tertiary” care of most major hospitals
      ii. Academic teaching hospitals are “hospitals’ hospitals” – as UCLA noted
   b. Higher proportion of critical care rooms which take more space, more support and more equipment
      i. ICUs (CV ICUs, Medical ICUs, Pediatric ICUs, NICUs)
   c. Teaching functions – interns, residents, fellows – all see patients simultaneously during “grand rounds” and at other important times in patient care
      i. Require space for their paperwork, study, etc. in addition to the space they take within treatment areas.
   d. Greater amounts of newest equipment and technologies – for highest acuity patients
      i. Academic medical centers are the inventors and testers of new clinical and medical equipment and procedures
   e. SmithGroup estimates a space premium of 10% - 15% for an academic teaching hospital vs. a community hospital.

3. Multipliers: Net square feet (NSF) converted to departmental gross square feet (DGSF) converted to building gross square feet (BGSF)
   A space program defines space requirements in terms of NSF – the actual space needed for each room throughout the hospital. However, buildings include many more spaces - corridors, public areas, mechanical rooms, etc. For architectural planning, space is defined in three categories, and multipliers are used to estimate the increase in space from one category to the next.

   a. NSF = the actual space inside the walls of each individual room. Space programs are developed based on NSF.

   b. DGSF = Departmental Gross Square Feet = the block of space that defines the cluster of services that accommodate a given function, like a nursing unit. DGSF includes all internal department corridors, internal wall thicknesses, electrical closets, shaft spaces, etc. – everything that makes up that “block” of space.
      i. DGSF multipliers vary by type of service. Large storage areas require few internal corridors or dividing walls, whereas nursing units require many.
      ii. DGSF multipliers range from a low of 1.3 x NSF to as high as 1.65 x NSF.
c. BGSF = Building Gross Square Feet = the overall area of the entire building that must be built to accommodate all the NSF functions. BGSF includes all DGSF plus building service spaces like elevators and stairs, public toilet rooms, public circulation corridors and entries, all infrastructure space and all mechanical, electrical, boiler room and other support space that is not attributable to any one department, plus building structure and exterior wall thicknesses.
   i. BGSF multipliers are in the range of 1.35 to 1.4 x DGSF.

d. Multipliers are used to estimate the size of DGSF blocks of space, and the overall BGSF size of buildings prior to the building being actually designed. Multipliers are based on empirical evidence and data collected from the actual implementation of numerous project developments over many years.

e. Multipliers have gotten much larger in recent years due to:
   i. Increased infrastructure demands – information technology, communications closets, wiring / cabling access, etc.
   ii. Increased airflow and ventilation requirements, related to infection control and air quality management – bigger mechanical spaces, for example
   iii. Increased structural requirements in CA – more space for structure required
   iv. Increased need to limit cross-traffic for infection control purposes as well as patient privacy – leads to more separate corridors, more space, higher multipliers
   v. Increased space required for equipment incorporation and storage

f. Multipliers used to be considerably lower.
   i. NSF to DGSF multipliers always varied, depending on the department, but nursing units used to be more like 1.4, rather than 1.55 to 1.6 x NSF.
   ii. DGSF to BGSF multipliers used to range from about 1.2 – 1.25, rather than current higher numbers of 1.3 – 1.4.

g. Multipliers have an enormous impact on the total space estimates. Currently, they lead to building space more than double the size of the NSF areas planned.
   i. Multipliers are valid and applicable only as planning tools.
   ii. Actual design layouts are “the proof of the pudding,” the actual implementation of fitting the programmed NSF functions into a building envelope.
## Comparative Multipliers

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF to DGSF</td>
<td></td>
<td></td>
<td>Nat'I Planning Firm</td>
<td></td>
<td>UCLA</td>
<td>CPMC, UCSF, SCVMC</td>
</tr>
<tr>
<td>Nursing Units</td>
<td>1.60</td>
<td>1.55</td>
<td>1.5-1.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interventional/</td>
<td>1.65</td>
<td>1.60</td>
<td>1.6-1.7</td>
<td></td>
<td></td>
<td>1.6-1.65</td>
</tr>
<tr>
<td>Surgeries /</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imaging</td>
<td>1.65</td>
<td>1.55</td>
<td>1.5-1.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td>1.30</td>
<td>1.35</td>
<td>1.25-1.4</td>
<td></td>
<td></td>
<td>1.3-1.35</td>
</tr>
<tr>
<td>DGSF to BGSF</td>
<td>1.35</td>
<td>1.40</td>
<td>1.3-1.35</td>
<td>1.40</td>
<td></td>
<td>1.35-1.4</td>
</tr>
<tr>
<td>NSF to BGSF</td>
<td>2.16</td>
<td>2.17</td>
<td>Approx. 1.95-2.2</td>
<td>2.00</td>
<td></td>
<td>Approx. 1.9-2.3</td>
</tr>
</tbody>
</table>

The NSF to DGSF multipliers presented in columns 1 and 2 represent a sampling of multipliers used in the SHC and LPCH planning documents. The DGSF to BGSF multipliers are used across the board for SHC and LPCH, respectively.

While there is a small variance in the multipliers used by the two separate firms who did the programming for the two hospitals (KSA for SHC, SmithGroup for LPCH) – the end result is virtually identical:

- For both SHC and LPCH, more than 2 x the NSF area is required to accommodate the necessary functions.
- These numbers are within the range used by a national planning firm for 4 other recent academic medical center developments:
  - MUSC
  - Ohio State
  - University of Florida-Shands
  - University of Michigan
- These numbers are well within the range used by a major firm for planning for CPMC, UCSF and SCVMC (Santa Clara Valley Medical Center)
- Kaiser informally reports that an overall multiplier (NSF to BGSF) of approximately 2.0 is typical for hospitals these days.
  - Academic medical centers require more space than community hospitals – teaching staff, residents and interns, incorporation of research, more equipment, higher acuity patients, etc.
  - Kaiser does not provide academic medical centers, only community hospitals.
H. Building Height Comparisons – Floor-to-Floor Heights

A number of factors lead to the need for greater “floor to floor” heights in each floor of a hospital. (This is the distance between the structural floor plates, not the visible ceilings.)

1. Key Factors driving potential Building Floor-to-Floor Heights
   a. CA seismic / structural codes require heavier-duty building structures
      i. Deeper beams require more vertical space
   b. More (and more complex) medical equipment creates a need for more vertical space for equipment mounting and stabilization
      i. Functional requirements for equipment – imaging, etc. – needs both mounting area above the visible ceiling, and considerable vertical space in the patient-occupied zone
      ii. Mandatory requirements for stable mountings require structural bracing
   c. New kinds of equipment require ceiling-mounted booms to operate
      i. Patient “slings” for moving patients – driven by need to reduce patient falls and nurse injuries (both increasingly serious problems) as well as by bariatrics (obese patients)
      ii. Proliferating imaging equipment which is often ceiling-mounted.
   d. Complex equipment and infrastructure systems create a need for ceiling access (maintenance, equipment changes) without disrupting functions below ceiling space
      i. Maintenance personnel need to be able to get into ceiling space and work, without opening up the ceiling from below.
   e. Overall, in CA, new structural requirements, combined with medical and equipment demands, are adding approximately 2’ to older floor-to-floor heights.

2. Building Floor-to-Floor Height Comparisons
   a. The proposed building floor-to-floor heights for the Stanford hospitals only apply to new construction.
      i. At SHC, the bulk of the hospital replacement will be in a separate new building where these new floor heights will apply.
      ii. At LPCH, some floor heights will be compromised to match existing construction and to avoid ramps between building sections, as necessary – so they may not all be as high as the proposed numbers indicate. New floors without connections to existing structure will be as noted below.
   b. Building floor-to-floor heights proposed by Stanford are very preliminary, since the buildings have not yet been designed.
   c. Right now, the height estimates are towards the top of the range for current-day design – but may well be slightly reduced as detailed design and engineering systems are developed.
Building Floor-to-Floor Height Comparison Chart

<table>
<thead>
<tr>
<th>Function</th>
<th>SHC &amp; LPCH</th>
<th>Nat’l Planning Firm</th>
<th>Kaiser</th>
<th>Firm #1</th>
<th>Firm #2</th>
<th>UCLA</th>
<th>UCSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing Units</td>
<td>16'</td>
<td>14’-16’</td>
<td>15’-6”</td>
<td>14’ min.</td>
<td>16’ min.</td>
<td>15’-9”</td>
<td>16’</td>
</tr>
<tr>
<td>Diagnostic &amp; Treatment Areas</td>
<td>18’-20’</td>
<td>16’-18’</td>
<td>18’-19’</td>
<td>16’ min.</td>
<td>18’ min.</td>
<td>20’ - 21”</td>
<td>18’</td>
</tr>
</tbody>
</table>

3. Observations and Conclusions
   a. Design heights for floor-to-floor vertical space are within the norms relative to other planners and institutions.
   b. Final floor-to-floor heights will be determined as design and infrastructure/engineering systems are defined.
   c. Extra vertical building height on a per floor basis adds considerably to the cost of a building – so there is a strong dis-incentive to add additional vertical height per floor if it is not deemed really necessary to meet code, infrastructure and equipment needs.
   d. SHC is currently proposed to be 7 stories above grade, or a maximum of 130’ tall.
      i. Over that height, a reduction of approx. 1’ per floor would affect the overall building height by only about 7’. A floor height reduction of more than about 1’ is highly unlikely, given the ranges of contemporary construction noted above.
      ii. If the 7-story building configuration is maintained as currently proposed, reducing the floor-to-floor heights on a per floor basis will not significantly affect the visual impact of the hospital buildings on the site.
   e. LPCH is proposed to be 4 stories above grade, for a total height of approximately 70’.
      i. The same comment applies – per floor reduction of height will have almost no discernable visual impact.
   f. In both hospitals, not all of the structure will be the maximum number of stories tall.
      i. Both designs are proposed to step down to lower heights in various places.

I. Hospital Configuration – vertical vs. horizontal balance – relative to overall building height

Total building height will depend on the way in which the buildings are configured – how much is stacked up vertically and how much is spread out horizontally. Given that the floor-to-floor heights will not vary much from the numbers noted above, height differentials will be the result of how the overall buildings are configured., how many stories high they are – not the height of each story.
1. Major site area limitations
   a. Current design proposals for SHC and LPCH are over 3 stories and over 50’ in height
      i. As set forth in the Facilities Renewal and Replacement Project Application dated August 2007, Stanford currently proposes a design concept for SHC that would be 7 stories tall above grade (about 120’ – 130’) and for LPCH of 4 stories tall above grade (about 70’).
      ii. These preliminary design concepts are based on contemporary principles of good hospital planning and design, on the necessity (particularly for LPCH) of coordinating functionally with existing service locations, and on the critical importance for both institutions of keeping all existing medical services in operation during the phased construction of new space.
      iii. The design configurations are also dictated by the limited site area available.
   b. Even a 3-story hospital structure above grade (which the SHC HMP is now) can barely fit within the 50’ zoning height limit of the City of Palo Alto.
      i. Current-day floor-to-floor heights easily push a 3-story building over 50’.
      ii. The last SHC HMP building literally dug down a level below grade and scooped out the earth to create a below-grade floor with outside exposure, to meet codes and accommodate needed patient rooms. It was impossible at that time, without violating the 50’ City height limit, to fit in the needed number of beds any other way. Functional relationships and operational efficiency in the HPM project were compromised as a result.
   c. Hospitals are mandated by State code to provide operable windows for all patient rooms, and no patient window can be less than 40’ away from another window.
      i. This dictates a spread-out configuration – which takes more space than the same square footage assembled into a tight block.
   d. Thus, regardless of good planning goals – if the two hospitals were to construct the approximate magnitude of space they deem necessary, as set forth in their detailed space programs, and to maintain a design configuration profile of no more than 3 stories or less, they would occupy considerably more than double the amount of horizontal site area the plans currently show.
      i. Two stories of diagnostic-type space would require 36’ to 40’ of height, and one nursing floor on top would add 16’ more – totaling 52’ to 56’.
   e. The existing Stanford site simply does not have enough area available.
      i. Visual assessment of the site plan indicates that it would be impossible to fit the hospitals onto the site at all, while maintaining existing medical operations, if the buildings are configured horizontally and do not exceed 50’ in height – let alone that they could be configured in a functionally workable design.
      ii. There would be no space, or completely inadequate space, left for necessary parking, service drives and access, delivery zones, ambulance access, etc.
      iii. There would also be little or no open, green space left.
2. **Different Plan Configurations for SHC and LPCH**

The proposed plans for SHC and for LPCH differ from each other considerably.

a. SHC is basically a replacement hospital which is proposed to be a 7-story structure above grade, with 5 floors of nursing units stacked on top of a 2-story base of diagnostic and treatment floors.

b. The LPCH project is a 4-story tall above-grade addition, with blocks of new nursing units horizontally adjacent to the existing building, connected by corridors and support spaces.

c. In both cases, the plan configurations and overall building heights result from and are in response to existing circumstances and limitations:
   i. Limited site area available in the right locations to allow space needs to be met and to allow services to function and interrelate properly.
   ii. Necessity for construction to be phased so that patient care and operations can be maintained throughout the development process.
   iii. Necessity to relate to existing structures and site conditions – juxtaposition of services, access points, service and delivery pathways, and, in the case of LPCH, direct connection to existing building.

3. **Factors to consider relative to the “stacked” configuration of the SHC replacement hospital**

As noted, SHC will be almost totally a new 7-story replacement hospital. After the new hospital is built, the oldest portions of the existing hospital will be demolished, and the 3-story HMP section, built in the 1980s, will be renovated for use for a number of support and administrative services, for ambulatory clinic space, for faculty offices, and possibly for other support or outpatient types of uses. Note also that some of the existing HMP nursing units will be renovated to accommodate patient beds serving LPCH.

a. The SHC replacement hospital, totaling about 1.1 million building gross square feet, will have 7 occupied stories above grade, making it about 120’ tall, with an additional +/- 10’ in height for mechanical and roof equipment.
   i. Three options were explored – and all three using variations of this concept.
   ii. In all cases, the “base footprint” – the amount of horizontal site area used by the building – was essentially the same: approximately 170,000 BGSF.
   iii. That appears to be about as big a footprint as could be fitted on the site, while still allowing space for a new parking structure, ambulance access, and necessary circulation – as well as space to stage and implement the construction project.
   iv. In each option, different nursing unit configurations were created, but all needed to be stacked on top of the same “interventional platform” base to fit on the site. The number of stories did not vary.

b. This “stacked” configuration is common for most large hospitals of over 250-300 beds. There are a number of operational and patient care advantages.
   i. Greater speed, efficiency and safety in patient care using direct vertical transport – between Emergency, Surgery, Imaging and patient bedrooms, including ICUs and critical care.
   ii. Shorter travel times and distances – more staff satisfaction and greater patient safety during transport (minimizes falls, bumps, jostling of IVs, etc.)
   iii. Dedicated elevator banks minimize cross-traffic between patients, the public, service deliveries and housekeeping/waste disposal systems while taking up less space than separated horizontal corridors.
iv. Minimizes patient exposure to outside infection from any of these sources.

v. Places the heaviest traffic areas (comings and goings) on the lower floors where access is easiest, and puts less frequently accessed areas (nursing units) on upper floors. (More people access diagnostic / treatment areas on a regular basis than nursing units.)

vi. Enhances building security – fewer outside access points to manage and control, especially at night.

4. Factors to consider relative to the Horizontal Configuration of the LPCH addition

The proposed LPCH project is essentially an addition to the existing hospital, with some renovation of existing space and considerable relocation of patient beds from existing space to new construction.

a. The existing LPCH hospital is 3 stories tall and is within the City’s 50’ height limit. Existing patient nursing units are primarily on the 3rd and 2nd floors of this structure.

b. The LPCH plan is to convert many of these to specialized critical care units, and to build a 4-story block of new patient nursing units adjacent to the existing hospital.

c. Thus, the LPCH will be a largely horizontal expansion, rather than a vertical one – but it still requires a 4-story block of new space to accommodate the needed space.

i. Note that is was not possible to add additional stories on top of the existing LPCH. Seismic codes have become more stringent since the building was first built, in the 1990s. Also, building on top of the patient rooms on the existing 3rd floor would have been extremely disruptive, if it were even possible. This is almost always true in CA.

d. The horizontal addition has several advantages.

i. It allows the new building to be structured in the most efficient way to accommodate the new design for all-private patient rooms.

ii. Above the 1st floor, the floor-to-floor heights of the new addition can meet current-day standards, and will not be restricted by the slightly lower floor heights of the existing building.

iii. The new building can meet all applicable codes, with no need for renovating older areas.

iv. The new addition can incorporate space for a future additional wing adjacent to the new building.

v. A new ground level (basement) will be gained, providing space for new support services and some new diagnostic/treatment services.

e. There are also some unavoidable disadvantages to this kind of addition:

i. Separate elevator banks will have to be developed to serve the new patient towers – so direct travel between the 2nd and 3rd floors of the new area and the 2nd and 3rd floors of the existing building will not be possible. The only intersecting levels will be at the ground and 1st floors.

ii. Functions that serve all nursing beds, such as food service, cannot be duplicated under both sections of the hospital, so there will of necessity be a fair amount of horizontal travel and cross-traffic in delivering food to both the new nursing beds in the new addition, and the existing ones maintained in the older hospital area. The same will be true for all material deliveries, housekeeping, etc.
5. **Future Expansion and Change Concerns**

Any hospital construction needs to consider the potential for future expansion and/or change. On the Stanford site, there is very limited space for future growth, although some options have been suggested. Renovations to some degree are always possible.

a. The LPCH plan outlines space for one additional future nursing unit to be built and still supported by and connected to the other services in the hospital.

b. It is not clear how or if the main SHC could expand in the future – although there will be a little latitude after the new replacement hospital is completed and the oldest portion of the existing hospital is demolished.
   i. Most of that space will be used by the medical school and its research functions.
   ii. A major new initiative for academic medical centers nation-wide, advocated by the National Institute of Health (NIH), is “translational research” – a system of interconnecting medical research with clinical trial areas, to better promote the development and testing of new health care methodologies, treatments, and equipment.
   iii. The close physical relationship of the School of Medicine and its research components to both hospitals is a strong benefit for SHC and the LPCH.

c. For both LPCH and SHC, the existing Stanford site appears close to being “maxed out.” This creates a strong need to maximize the use of the site in the most space-conservative way possible.
   i. Major external building additions, with the exception of one more patient bed wing for LPCH, do not appear likely or possible.
   ii. Given the continual changes in seismic codes in CA, it is highly unlikely that any future vertical expansion could occur on top of the buildings now being proposed for either SHC or LPCH. This makes it all the more critical to build as much vertical structure as is reasonable at the outset and preserve as much horizontal area for future expansion or change as reasonably possible.
   iii. This also adds a strong incentive to plan the most flexible concepts and layouts to accommodate internal change and renovations.

6. **Comparative hospital configurations**

Note that every single one of the following hospitals is configured with nursing units stacked on top of 1, 2 or 3 stories of diagnostic, treatment, administrative and/or outpatient functions.

a. **UCSF at Mission Bay** – being planned now (2007)
   i. 289 beds, currently planned for a 6 story building, 3 floors of nursing units stacked on top of 3 stories of diagnostic, treatment and support space.
   ii. They have to utilize a 3-story “base” since the ground conditions at Mission Bay prohibit building a deep basement. Many support functions (stores, food service, etc.) that are often located below grade cannot be so located at Mission Bay

b. **UCLA** – opening 2007-2008
   i. 589 beds and 1.1 million bgsf, 8 stories tall above grade – 2 below grade – for a total of 10 stories.
   ii. The lowest basement level is for parking.
   iii. The first basement level is for support space.
   iv. There are 3 levels above grade of diagnostic and treatment functions.
v. There are 5 stories of nursing units stacked on top of that 3-story above-grade base.

c. Johns Hopkins – opened 2006
   i. 320 beds in a Cardiovascular and Critical Care Tower, 12 stories
   ii. 205 beds in a Children’s Tower, 12 stories
   iii. Total of approx. 1.5 million square feet – plus outpatient clinical space

d. Massachusetts General Hospital – being planned now (2007)
   i. An addition of 150 beds plus much diagnostic and treatment space
   ii. 150 beds
   iii. 10 stories

e. Hoag Memorial Hospital, Heart Vascular Institute – Newport Beach, CA, 2007
   i. 96 bed addition
   ii. 375,000 gross square feet
   iii. 6-7 stories

f. El Camino Hospital, Mountain View, CA
   i. 426 beds – addition being planned now (2007)
   ii. 5 stories – 1 level partially below grade (4 ½ stories above grade)
   iii. 450,000 gross square feet
   iv. Lower 2 levels diagnostic, treatment and administrative functions
   v. Upper floors, nursing units

g. St. Joseph’s Hospital and Medical Center, Marrow Neurological Institute, Phoenix, AZ – 2006=2007?
   i. 475,000 gross square feet
   ii. 144 beds
   iii. 6 stories

J. Services located off-site
1. Stanford has already off-loaded all of their “non-essential” services. These include all services that are, by CA code, not deemed essential to the operation of a hospital in its main facility. That is, they can be located elsewhere. These include, but are not limited to:
   a. Many administrative and office functions
   b. Data processing, financial and business office functions
   c. Warehousing and bulk storage
2. None of those services are planned to be moved back to campus
3. There are no other services that Stanford can move off-campus – all remaining services included in the space programs are deemed “essential” by code as well as functional necessity.

K. Staffing
This report is not dealing directly with staffing of the proposed hospitals. The EIR application states the staffing / personnel projections which Stanford has developed. These numbers relate to both the numbers of inpatient beds and also to all of the other outpatient and support services that form the hospitals. The following comments are general observations only:

1. Additional staffing for additional patient beds
   a. An increase of 240 patient beds on site will necessarily lead to an increase in nursing staff, in ratios mandated by CA State code.
   b. There will also be a marginal increase in support staff related to the additional amount of area to be occupied by the additional beds:
i. Housecleaning
ii. Food Service
iii. Deliveries

2. A comparable increase in staff may not be required for the ED or OR areas
   a. Stanford is working in constrained circumstances now – with long delays and back-ups in the ED, for example.
      i. More space may simply spread out the staffing, and relieve patient waiting and back-up – not necessarily leading to more staff.

3. Service and Maintenance personnel
   a. Some additional staff will be required for maintenance, housekeeping and deliveries due to the greater physical area to be serviced.

4. Issues to consider relative to staffing:
   a. Peak shift times – which will most likely be at around 7 am and 3 pm, when the hospitals are most active and when nursing shifts change and there is a temporary overlap in personnel.
      i. This primarily impacts parking and traffic
   b. Total employee / staff increases:
      i. Distribution of types of employees – probably mostly at mid or lower levels of the professional and economic scale. Needs to be defined by Stanford.
   c. Impact on housing versus parking and traffic
      i. Housing impact related to both overall absolute numbers of additional employees and to their income distribution
      ii. Traffic and parking related to shift times and hours of operation of many services, especially nursing shifts and outpatient hours.

L. Summary
   1. Spaces as Proposed by Stanford
      a. The Peer Review overall assessment is that Stanford’s plans are not in any significant way outside standard norms for good planning and current-day medical practice, especially for a premier academic teaching hospital that is being designed to serve at least 25-30 years into the future.
      b. While perhaps 5 - 10% of space might be reduced without changing functions, this will not have a significant impact on the order of magnitude of the two projects. (This is about the maximum amount of “tightening” that can possibly occur during design, and even that is very difficult.)
      c. In the normal project development process, Stanford will be trying to “tighten” its spaces anyhow. They are already doing this with the LPCH space program.
      d. Stanford is keenly aware that more space costs more money. They have every incentive to tighten space layouts – while still preserving the functions they consider important.

   2. Impact of Proposed Increase in Numbers of Beds
      a. If Stanford’s patient bed projections are reasonably accurate and acceptable – then the rest of the space follows in a rational fashion and does not appear to be outside normal ranges.
      b. If the rationale for Stanford’s projected increase in new beds is not deemed supportable, then the space needs could change substantially.
      c. Stanford appears to have done solid “due diligence” in forecasting the number of additional patient care beds it needs for SHC and for LPCH.