Implementation Cases

Richard de Neufville
Professor of Engineering Systems and of
Civil and Environmental Engineering
MIT

Outline

Four Cases

- **HCSC – Vertical Expansion of Chicago building**
- **Houston Metro – Failed use of vertical phasing**
- **Dartmouth Hospital – Game plan for expansion of multiple specialties**
- **Newcastle Hospital – Inability to use flexibility**

How they did (did not) facilitate implementation

- **Initial Preventive Actions**
- **Ongoing Operational Actions**

- **Take-aways**

HCSC Building - Chicago

Situation:

- **HCSC – Health Care Services Corporation, formerly the local Blue Cross medical insurer**
- **Long-term activity centered in Chicago**
- **Large clerical workforce, commuting into city**
- **Need to be on regional transport**
- **Staff need to be ‘close together’**
- **Expanding geographically and demographically**

- **Early 1990’s: What to do? Staff had outgrown primary headquarters, in several buildings**

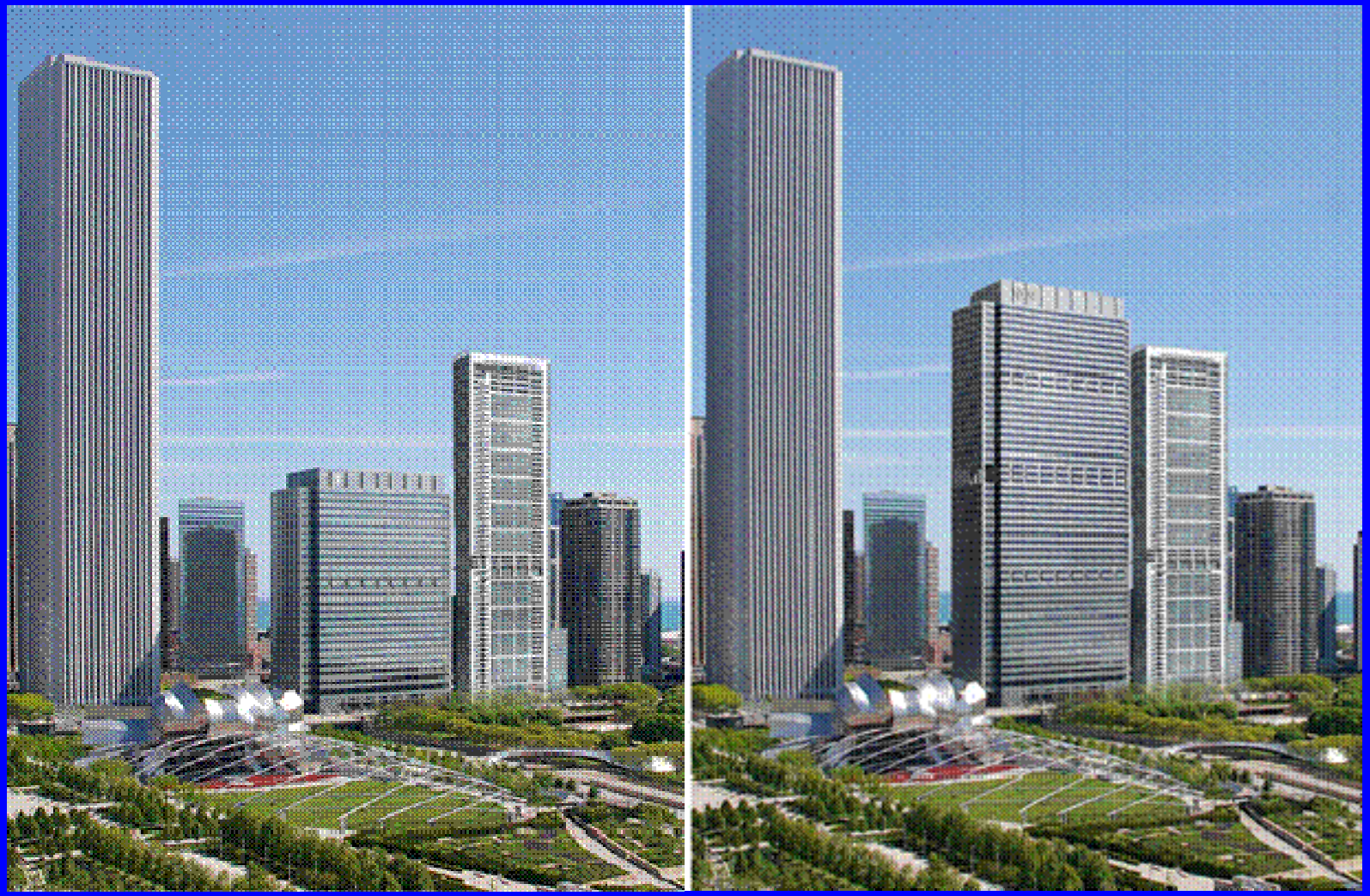
HCSC Building - Design

Flexibility Built in:

- **Located on top of regional rail station**
- **A 30 story building that can double height**
- **This required:**
  - **Extra Steel in Columns**
  - **Extra elevator space (immediate loss in area/floor)**
  - **Larger basement for HVAC (heat, vent, air con)**
  - **Permits from city**

- **What they did not do: plan on 2 buildings**
  - **Not convenient for staff**
  - **Need to 'dewater' 2 sites, associated difficulties**

HCSC in middle: before and after



Source: Goettsch Partners: Pearson and Wittels

HCSC Building – Use of Flexibility

- Flexibility used – 27 more stories added 10 years later (to open in 2010)

- Impressive, but not unique
  - Bentall Five Building in Vancouver
  - Tufts Dental School in Boston
  - Citicorp Campus in New York City (Queens)

- Guma, A., Pearson, J., Wittels, K., de Neufville, R., Geltner, D. (2009) "Vertical Phasing as a corporate real estate strategy and development option," J. of Corporate Real Estate, 11(3), pp.144-157

How HCSC facilitated implementation

- **Initial preventive actions**
  - Integrated Project Delivery? Not formally, but close cooperation between owner, architect, city
  - Game Plan? Organized by facilities manager for HCSC who had good support upwards and outwards
  - Anticipating Developments? Continuous relations with city zoning, monitoring market conditions

- **Ongoing Operational Actions**
  - Maintaining right? Careful attention to city planners
  - Maintaining knowledge? Same Manager for about 20 years, close to local architect, same suppliers
  - Monitoring environment? Yes, focused on manager

Metro Station - Houston

Situation:

- Houston has been an “automobile” city
- Creates difficulties for low-wage workers, older persons, children
- Congestion, smog, etc.
- National Program to support public mass transit provides money

- In 1990’s: Decision to implement a light-rail transit system in metropolitan area

Future Houston Metro Trains

- Source: Houston Metro/ CAF USA

Metro Station - Design

Flexibility Built in:

- **Designed Station near Texas Medical Center so that it would be easy to create parking, office blocks on top of station, over tracks, etc.**
- **Coordinated design with City, Federal Mass Transit Administration**

- **What they did not do:**
  - **Coordinate with Neighbors, particularly not the Texas Medical Center (a collection of hospitals)**

Metro Station – Use of Flexibility

- Flexibility not used
- Developers tried, but failed
- What went wrong?

Metro Station -- Issues

- What happened? Conflict with interests, revenues sources of hospitals. They claimed reduced revenues would hurt public services…
- McConnell (2007) "A Life-Cycle Flexibility Framework for Designing, Evaluating and Managing "Complex" Real Options: Case Studies in Urban Transportation and Aircraft Systems," Engineering Systems Division, doctoral dissertation

http://ardent.mit.edu/real_options/Real_options_papers/mcconnell-thesis-2007-05-30.pdf

Metro Station
what they did and didn't do

- **Initial preventive actions**
  - Integrated Project Delivery? Close cooperation in design – failed to consider system
  - Game Plan? Not really. Did not account for planning process and its politics
  - Anticipating Developments? So, they were 'blind-sided' by opposition from Medical Center interests
- **Ongoing Operational Actions**
  - Not the issue; poor design from systems perspective

Dartmouth-Hitchcock Medical Center

Situation:

- DHMC is a 'hospital' for a large isolated area
- DHMC involves 3 'independent' organizations
  - Clinic for Dartmouth colleges students and staff
  - Research associated with Medical School
  - Regional hospital for general public, private doctors
- Funding comes from different sources
  - Alumni donations, tuition
  - National Institutes of Health (NIH)
  - Local insurers, clients, businesses

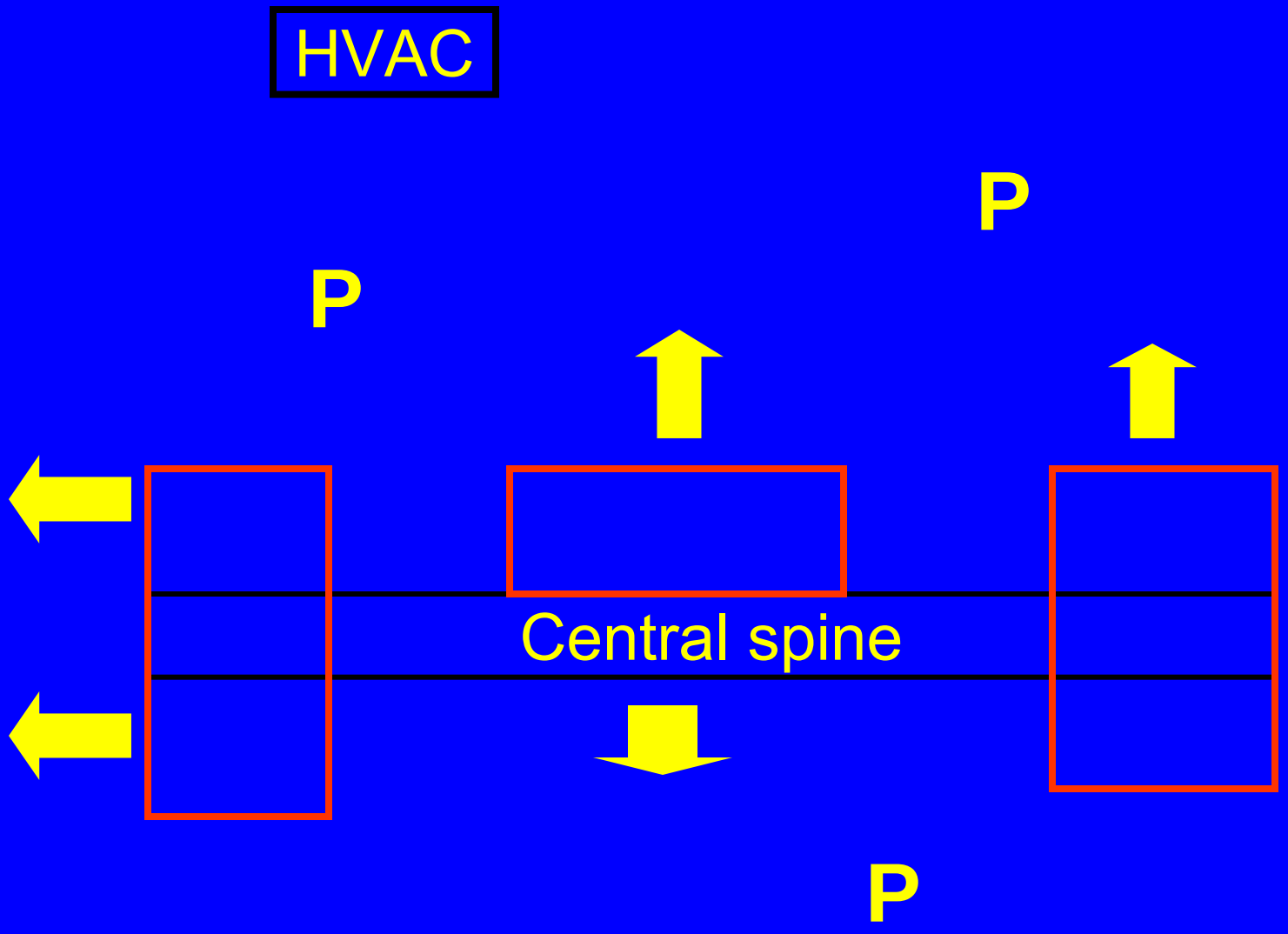
- Around 1990: Existing facilities next to college no longer enough for 3 types of users

DHMC - Design

Flexibility Built in:

- **Large area widely cleared and leveled (behind screen of woods so space no visible from road)**
- **Building is 3 major elements off a spine corridor**
  - **Much space for horizontal and vertical expansion**
- **HVAC plant located far away, across parking lot**
- **No structured parking (at start)**
- **Why does this create flexibility?**

Sketch Plan of DHMC



DHMC – Use of Flexibility

- Flexibility used – many additions added over years, as each group received funding
  - "pods" added to intensive care units
  - Floors added to cancer research center
  - Central buildings extended into parking lots
  - Parking Garages have been built, now that hospital buildings have extended sufficiently far

- Lee, Yun Shin, doctoral dissertation in preparation, Judge Business School, Cambridge University

How DHMC facilitated implementation

- **Initial preventive actions**
  - **Integrated Project Delivery? Yes, indeed**
  - **Game Plan? Yes**
  1. **Set up Management Team for all organizations, to coordinate and meet collective needs**
  2. **Design to allow groups to expand independently**
  3. **Schedule for expansion of HVAC plant, for when it would be desirable to create structured parking**
  - **Anticipating Developments? Yes. Cleared large area, paved it over (for surface parking) to forestall future changes in rules about eliminating forest area**

How DHMC facilitated implementation

- **Ongoing Operational Actions**
  - Maintaining right? Management team carefully monitors ongoing financial, safely (NIH), accessibility (ADA) developments
  - Maintaining knowledge? Not only same long-term manager but a support team of professionals engaged in continued facility development. "Bench depth" so success does not depend on 1 person. Also, same architecture firm on long-term retainer (Shepley Bulfinch)
  - Monitoring environment? Yes, focused on manager

Royal Victoria Hospital - Newcastle

Situation:

- **1990s: UK Government policy to create social infrastructure with Public-Private-Partnerships**
- **Hospitals, etc. set up as "trusts" – these designed to be business-minded and consider long-term costs**
- **Financing through underwriters who create, and then sell bonds to range of passive investors**

- **Early 2000's: Newcastle Hospital needs to expand, hires designers, raises money**

Newcastle Building - Design

Flexibility Built in:

- **Design permits expansion vertically, also ‘shell space’ without partitions, etc, to permit variety of later uses (Mt. Auburn hospital, Cambridge did the same in 2009)**
- **Possible operating theaters, office space, etc.**
- **Coordinated between architects, builders (Laing O’Rourke) and owners (the ‘trust’)**

Newcastle – Use of Flexibility

- Flexibility not exploited
- Wanted to do this, but could not
- What went wrong?
- Lee, Y. S. (2007) "Flexible Design in Public Private Partnerships: a PFI Case Study in the National Health Service," Master's thesis, Judge Business School, Cambridge, UK
  http://ardent.mit.edu/real_options/Real_opts_papers/Yun's_Final_Dissertation.pdf

What happened at Newcastle?

- When it came time to expand according to plans…
- Owners of bonds – not original underwriters (fund raisers) objected…
- New addition would increase financial risk of hospital, decrease value of bonds, and were not permitted by terms of original loan
- Hospital could resolve issue by repaying bonds early, and raising new money
- But that would be too expensive
- So, flexibility was not used!

Newcastle
what did and did not occur

- **Initial preventive actions**
  - Integrated Project Delivery? Only for physical aspects concerned. Did not deal with financial side
  - Game Plan? Apparently, had assumed that when project justified, there would be no difficulty
  - Anticipating Developments? No. Had not realized effect of loans being sold to long-term investors not interested in changes to plan

- **Ongoing Operational Actions**
  - Maintaining right? Never had it as practical matter.
  - Maintaining knowledge? No special effort
  - Monitoring environment? Not particularly

Take-Aways

- Flexibility in physical design can be negated by failure to take a systems view of requirements
- Successful implementation requires both
- Initial Preventative Actions
  - Integrated Planning (HCSC, DHMC)
  - Game Plan (HCSC, DHMC)
  - Anticipating developments (DHMC)
- Ongoing Operational Actions
  - Maintaining right to develop (HCSC)
  - Maintaining, developing skills (DHMC)
  - Monitoring the environment (DHMC)