ericB's ARE Multiple-Choice Exam Round-up

Below is a collection of the "synopses" I posted to the ARE Forum (areforum.org) following my exams. Please note that CD and MM are incomplete, as I took these exams prior to version 3.0, and frankly did not record my thoughts following the exam. If the comments in these synopses seem kind of strange (or make timely references), keep in mind that are pretty much just pulled from the original posts.

Why am I bothering to distribute this information?
The purpose of my "synopses" were always twofold: first, to serve as a record of my exam in the case that I failed and would have to take it again. Second, to help others focus their studies. Since I have passed the MC portions, I suppose only the latter point remains.

Why do I care if others pass? Doesn't this just create more competition?
I believe our profession is at a critical juncture. In an ever-changing building industry (and world, for that matter), we can take charge and become leaders, or we can let our significance dwindle as it has in many areas. I prefer the former option. To do this, we must work collectively. To work collectively, we must foster a spirit of camaraderie. It starts with those who will become tomorrow's leaders. It starts with us.

This is one of my humble contributions to that effort. I hope that sharing my experience will allow others to concentrate on the subject areas that our profession has deemed important to establish minimal competency. Our time is better spent practicing architecture than worrying about and taking these exams. I would also hope that an understanding of these areas will also establish a more competent workforce, and architects that I would like to consider colleagues.

Perhaps this is overly idealistic. I know full well that many will take this summary for their own purposes. However, I would ask that, if you find this information beneficial, continue the favor by helping out a fellow ARE candidate or contributing your time to the advancement of our profession. Get involved with your AIA chapter by attending events or serving on your chapter's board of directors – the AIA continues to demonstrate great interest in Associates and young architects and your voice can make a difference. Offer an architect's perspective on a community board or organization. Share your expertise. **Your community needs you.** Help us out – that's all I ask.

Disclaimers:

Recognizing the importance of maintaining the confidentiality of the ARE, I have made every attempt to generalize the subject areas presented. Nothing written here should be construed to represent actual content as defined by NCARB, nor reflect any specific question one may encounter on the exam. Below is the "Reminder from NCARB" posted to the ARE Forum, which I have repeated here in its entirety:

> *Each time a candidate takes each division of the ARE, he or she agrees to the following Confidentiality Agreement:*
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> *"I understand that the content of this examination is confidential. I agree that I will not divulge any questions on this examination to any individual or entity. I understand that the unauthorized possession, reproduction, or disclosure of any examination materials, including the nature or content of examination questions, before during or after the examination is in violation of law. A violation of this type can result in a civil liability and/or disciplinary action by my Board of Architecture."*
>
> *If an examinee cannot abide by this agreement, they should not take the exam. A violation of this Confidentiality Agreement, as it expressly states, can lead to civil liability and disciplinary action, as well as the temporary or permanent suspension of test taking privileges. Furthermore, disclosure*

of the content of examination questions at any time is unethical, unprofessional and a violation of the professional standards that NCARB, its member boards, certificate holders and your fellow candidates seek to foster and protect. In addition, disclosing the content of examination questions or using such information gives some candidates an unfair advantage and is extremely unfair to fellow candidates who rightfully choose not use such improper help.

NCARB believes candidates are and should be free to share their general experiences with the ARE, and to help fellow candidates with their test taking skills and the examination process. Such communications are part of the normal examination process. Disclosing the content of examination questions, however, either by direct quotation or paraphrasing, crosses the line separating general help from improper conduct. Simply put, it is cheating.

The integrity of examination process, which is part of the larger certification process, is integral both to NCARB's mission and the profession's obligation to protect the public's health, safety and welfare. If certain examinee's receive improper help, this threatens to diminish the ability of NCARB and state boards to protect the public's health and safety. Accordingly, NCARB will take all steps open to it, including civil and disciplinary action, to protect the examination process and to discipline those individuals who violate the Confidentiality Agreement, those who seek to share, use or disseminate exam questions, and all those who seek to give or obtain an unfair advantage over fellow candidates.

It is not my intention to promote "improper conduct" in any way. The subject areas below are those in which a thorough familiarity will hopefully prepare one to answer the questions one may encounter on the exams. I advise anyone who uses this information that reading this material alone will not prepare one for the exam; it will only provide direction to further study. In that way, it should be interpreted no differently than the published resources produced by Kaplan or PPI.

Overview of Material

I have organized the exams in the order that I took them:

1. Construction Documents (CD)
2. Building Design/Materials and Methods (MM)
3. Mechanical and Electrical Systems (ME)
4. Pre-Design (PD)
5. General Structures (GS)
6. Lateral Forces (LF)

In terms of sequence, I don't recommend any particular order, though I may suggest starting off with an exam you are more comfortable with (to get your feet wet) then moving to the hardest ones, just in case you have to take them over again.

For study materials, I would recommend treating each exam as it's own entity to determine the best possible resources, but there are a few that will be helpful for multiple exams. The text below is from a post that I wrote discussing general resources:

There really is no single list of study materials per se, as each exam has materials that are specific to the subject matter. There are, however, some basic sources. Check out this link as a starting point: **http://www.archvoices.org/index.cfm?pg=Licensure&s=ExamSG**

ALS stands for Architectural Licensing Seminars which is now owned by Kaplan. They publish study materials for all exams and are generally regarded as decent starting points for exam study. You can find them here: **http://www.dearborn.com/als/home.asp**

"Ballast" refers to the books by David Kent Ballast. There are two volumes: *Structural Topics* and *Non-structural Topics*. They are published by PPI. You can purchase these from Amazon and other sources. Some swear by them, others question their accuracy and usefulness. For more information, look here:
http://ppi2pass.com/catalog/servlet/MyPpi_pg_archid.html

Archiflash cards are also very useful. Check them out here:
http://www.archiflash.com/afinfo.html

And of course, NCARB itself publishes study guides. Find them here:
http://www.ncarb.org/Publications/arestudyguides.html

If you are interested in the above sources I would first recommend you attempt to either borrow them or purchase them used, since as new they can be quite pricey. Generally speaking, older versions from the past few years are generally adequate.

One source that you can use for most exams is *Architectural Graphic Standards* (or AGS). You can purchase it from many places, Amazon included. I would highly recommend you obtain a copy as it is also an excellent reference for daily practice.

If you're just getting into the material, I would recommend *Building Construction Illustrated* and A *Visual Dictionary of Architecture* by Francis D.K. Ching. Informative, well illustrated, and easy to read, I have used them to study for all multiple choice exams.

Oh, and for the graphic portions, you must obtain a copy of *ARE Solutions* by Professor Dorf. You can find it here: **http://www.are-solutions.com/**

One of the best sources for info is this forum itself. Also, be sure to check out the "Uploads" section of the site. TONS of great info here: **ftp://aretest:upload@webbcomm.biz/**

My General Recommendations

1. Use multiple sources for content.
2. Draw from your professional experience.
3. Do not underestimate any exam.
4. Do not overestimate any exam.
5. Get a good night's sleep before the exam.
6. Relax.

Construction Documents (CD)

(Taken pre-3.0)

(These are just a few of my postings. Sorry, no synopsis for this one.)

Link to AIA Documents commentary for free:
http://www.aia.org/docs_free_paperdocuments&grandCh=yes#commentaries

You will want to study, at minimum, A101 (not on website), A201, and B141. Copies of the AIA documents can be purchased from the AIA. The AIA website has a listing of all the documents with names. If you can get a copy of the Architect's Handbook of Professional Practice, it comes with a CD with all of the documents available for preview.

Link to ADAAG material:
http://www.access-board.gov/indexes/accessindex.htm

You DEFINITELY want to know ADAAG for all exams. With the exception of GS, I've had ADA questions on all of the multiple choice portions.

Link to A101-1997:
http://www.ecis.org/consult/FacDevHandbook/appendix_b.pdf

Know your contracts up, down, and sideways. Read and re-read. I took the exam pre-3.0, but on my exam, the bulk of the questions related to the relationships between Owner, Contractor, and Architect.

Also recommended: *The Architect's Handbook of Professional Practice, 13th ed.,* AIA

Building Design/Materials & Methods (MM)

(Taken Pre-3.0)

Part I: Intro and Preparation

Some disclaimers: I took this test in February of 2003 (pre 3.0). Unfortunately, the full experience is not very fresh in my mind, but I did take notes immediately after completion. What follows is my best attempt to reconstruct that experience.

Some background: At the time, I had a little less than 4 years professional experience, though considered myself pretty strong in the M&M subject material due to my direct involvement in several construction projects. After taking the test, I believe I may have overestimated my qualifications in this regard.

I spent about three weeks studying (not enough, IMHO). Here are the resources I used:

Compiled Summary of PPI forum comments:
I had put together some comments from that forum, but only had about a dozen or so specific items to go by. In the end, I do not believe many (if any) of the items I recorded were actually on my exam. With respect to helpful content, this new forum is far superior.

***Building Construction Illustrated,* Francis D.K. Ching:**
I used this in the same manner as that for the MEP exam: as an intro to the subject material. Well illustrated and easy to understand. In retrospect, I believe this to be one of the most helpful resources - not so much for pure content per se, but familiarity with the material. (On a side note, though my old college professors (and many fellow students) may shun me for saying so, I believe that two other Ching books - *A Visual Dictionary of Architecture*, and *Building Codes Illustrated*, are wonderful resources. Easy to read and non-pretentious - very helpful.)

***Materials and Methods* (ALS series).**
Well illustrated, fairly easy to understand. A good follow-up to the Ching reading. Lacked the specificity that I encountered on my exam, but I do not regret using it as a source.

Architectural Graphic Standards, 10th ed.
The definitive source for tedious information. Well illustrated, good for detail, not so good for concepts. EVERY architect's first resource. I'm quite certain that 95% of the questions on my exam could be answered by this source, but to have read and absorbed the entire thing would have been an impossibility. I liken AGS

to the MM exam as MEEB is to MEP - a good source to base your studies around, but almost too much to handle on its own. I think it's good to supplement it with other sources.

Part II: The Test

First, some general comments, from what I can remember:

1. The test was FAR more tedious than I had imagined. I was lead to believe by several people who had taken the test previously that it was "easy" and "basic." When I left, I thought - "Either those people took a different test than I, or I'm just stupid." While I would not rule out the latter, I wonder (and hope, for my regard) that it was more of the former. I felt the tedium of many questions to be excessive. Of course, these could have been the fabled "throw-away" questions that we hear about. Perhaps, but frustrating nevertheless.

2. The test was very broad in scope. Here is where potential test-takers must beware: do not concentrate on one subject area at the expense of others. This test always seems to be a mixed bag. What Joe or Sally or Bob (or Eric) may have on his/her exam may or may not be anything like you encounter on yours. This is true for all of the ARE exams I'm sure, but it's particularly pertinent to this one.

3. Superficial understanding is not enough; you must really understand the properties and applicable uses of the materials and methods in question - that is, how do they relate to the practice of architecture and the science of building. This makes sense, as architects SHOULD be able to apply this knowledge in practical ways.

4. My exam was not limited to M&M - I had several ADA questions, and a few obscure history questions. I know that we're not supposed to be specific with questions, but, I will share that one of my questions had to do with the Statue of Liberty. I swear that a person would have had to watch a PBS special or something to know the exact answer (to me, several seemed reasonable).

5. Estimating and cost analysis were also represented, though primarily in a "methods" context.

6. I recall having to identify many diagrams and even a few photographs.

7. I was able to answer many questions purely from previous experience. For example, I had a question regarding the number of ADA fixtures in a particular use and had luckily just completed a building that incorporated that information. I believe that actual experience is very helpful on this exam, due to the exam's broad scope and specificity. On the other hand, I know people with minimal experience working in architecture factories (large firms, very limited and focused range of activities) who passed the first time around. Let's face it, if you're smart enough, have the time, and study the right things, you'll get through.

Areas of Study

What follows are from the notes I took immediately after my exam (mostly things that I was unsure of or surprised by). I have not reviewed the many previous posts within this forum to know if these are duplications for not; I submit them for whatever use you may have. I apologize that they are not ordered by content:

1. Proctor tests.
2. ADA dimensional criteria, particularly maneuvering and egress.
3. Choice of floor finishes for particular activity based on economics.
4. Water temperature and its effect on human tissue.
5. Elevator drive mechanisms.
6. Hydraulic vs. electrical elevators.

7. Cold formed steel and its use in construction.
8. Mortar joints.
9. Brick patterns/layout.
10. Masonry designations.
11. Roof flashing.
12. Ambulatory stalls.
13. Dimensional stability of beams.
14. R values for roofing.
15. Soils for foundations.
16. Identification of exterior facade elements.
17. Grout types.
18. Cofferdams.
19. Brick quantity calculations.
20. Depreciation.
21. Estimation.
22. Suspended ceiling components.
23. Acid rain.
24. Environmental impact components.
25. Naturally insect-resistant building materials.
26. Metal pre-stressing components and conditions.
27. Finishes of plumbing fixtures.
28. Bond beams.
29. Methods of building area calculation.
30. Scale factors in building area calculations.
31. Material permeability.
32. Single-ply roofing
33. Maximum path of travel related to fire classifications.

Final Thoughts

When I left my CD exam, I felt like there were 3 or 4 questions that I was not sure of. When I left MM, I was far less confident (to say the least). My general feeling was that, even had I studied an extra few weeks, I still would not have been prepared for some of the material I encountered. That's why I immediately began to write down everything that I could remember, in fear that I would have to take the exam once more. Luckily, it was not necessary, since I passed.

My general advice would be: don't freak out over what you may encounter, but at the same time, do not underestimate this exam. I understand that it has a high pass rate - which, based on my experience, I find surprising - but that doesn't mean you will get the same exam that the passing +80% received.

Mechanical and Electrical Systems (ME)

Part I: Intro and Preparation

This was test #3 for me. I would say that I spent more time studying for this exam than the others, yet left with a more negative impression of my performance.

I spent about 4 weeks studying, which was VERY difficult with my schedule – I averaged about 5 hours/week the first two weeks, and about 2 hours/night for the last two (give or take). My resources, and opinions of

them:

Compiled Summary of ARE Forum comments:
Developed after scouring the forum posts and downloadable material. Helpful for specific potential questions, though in reality to a minimal degree.

Building Construction Illustrated, **Francis D.K. Ching:**
As someone else on this forum pointed out, a good "boot camp" read. Compact, fairly concise, and well illustrated. I began my study in a particular subject (HVAC systems, for example) from this book and then moved on to similar subjects in my other sources.

Architecture Exam Review, Volume II: Nonstructural Topics, 4th ed**, David Kent Ballast:**
This was my second source, which I read after the Ching book. Compact, has decent information, but (to me at least) was not easy to understand at times compared to the other sources.

Mechanical Plumbing/Elec Systems**, Marc Schiler (ALS series), 1999 ed.**
Well illustrated, fairly easy to understand. Good for concepts.

Architectural Graphic Standards, 10th ed.
The definitive sources for specifics on equipment. Well illustrated, good for detail, not so good for concepts. EVERY architect should have a copy within arms reach for actual practice, but most of you are probably aware of that.

Mechanical and Electrical Equipment for Buildings (MEEB), 9th ed.**, Stein & Reynolds:**
As many have pointed out, if you can only have one source, this is it. If you have the stamina to read AND absorb the entire thing, not only will it address 95% of the questions you will encounter on the test, but you are a remarkable specimen of human intellect, and should perhaps consider a more high-paying career. But seriously, this should become a desk reference for every architect. It's 1800 pages of good info. Very thorough, very detailed (sometimes too detailed at times), and pretty easy to read. Problem: there is just SO MUCH of it. The problem I found is that, after taking the test and reviewing the information I was able to find most of the answers within this book, though it was not always information that would be obvious to a casual reader. You really had to delve deep into the subject matter for some things. While studying, I read this after the other sources – i.e., I came prepared.

The Architect's Studio Companion: Rules of Thumb for Preliminary Design, 3rd Edition, **Edward Allen, Joseph Iano:**
I had this book all along and did not look at it until 2 days before the exam. Well, as far as a good source comparing various HVAC systems to each other, their applications, and their pros/cons, this is it. I highly recommend it. It, too, should become a resource to keep within arms length.

Archiflash Cards:
Good as a "refresher" for concepts and definitions. I used these last.

Part II: The Test

I feel like I put a great deal of effort into preparing for this exam, yet, after taking it, don't believe that it was quite enough. Why? Because, the relevant subject material is so vast, I was not able to get into the detail (or rather, REMEMBER the detail) necessary to answer many questions. Here are some other general thoughts/comments/tips:

1. Some have stated that the exam is primarily about general concepts. For me, this was somewhat the case, but I would submit that a candidate knowing only general concepts would NOT pass the exam I took. MANY

questions that I had were very specific in nature. There was one answer that I could not find without looking it up in the electrical code after the exam (it was not even in MEEB). And frankly, had I reviewed the electrical code prior, I still would have never thought to remember that particular section.

2. You have to know more than “general” concepts; you have to know how these “general” concepts are applied to real situations, with real equipment.

3. Reviewing the diagrams from MEEB is a good idea (there were several), but you can’t just skim them, you have to know what they are about. Example: I had a diagram from MEEB on the exam, but the question that was asked had nothing to do with the context in which the diagram was discussed in that particular section of MEEB.

4. The subject material of my exam was very diverse. It seems I had an equal sampling of thermal concepts, HVAC equipment, lighting, electrical, fire protection, and conveying systems. Do not concentrate in one area and disregard the others; all were represented on my exam.

5. I had two “history” questions, but they were application-based questions (i.e., you had to interpret the historical context and apply contemporary understanding).

6. I was bothered by the specificity of some of the questions. For example, I consider myself fairly well versed in accessibility issues, but was hit with a question that, IMHO, was far too specific.

7. Calculations: As said many times prior, they were all pretty easy. However, there was one specific “chart” question that was either a trick question or did not provide the most precise answer as an option. I fear it was the former. I wasted a good 5 minutes on this question alone, calculating and recalculating what I believed to be the correct solution.

8. If you are a quick study, can absorb information the first time around, and have the time and patience, you can probably pass the exam with one source: MEEB. However, proceed with caution. Most architects or pre-architects that I know (myself included) do not learn in this manner and benefit from multiple sources and perspectives. Of the sources I used, I feel all were beneficial in some way. I would focus a study around MEEB and use the others as intro or reference.

Ok, now to the “meat” of my advice. Based on my experience, I would recommend understanding of the following subject material in addition to the "standard fare" (i.e., your basic understanding of materials and concepts).

HVAC
1. The process of heat transfer.
2. Degree days.
3. Duct insulation.
4. Window ventilation.
5. Thermal storage capacity of materials.

SOLAR
1. Sun chart.
2. Roof configuration for photovoltaics.

PLUMBING
1. The sanitary system.
2. The storm water system.
3. Alternative methods to water supply.
4. Piping materials.
5. Piping designations.

6. Density of gasses.
7. ADA fixture requirements.
8. Dissimilar materials.

FIRE PROTECTION
1. Stages of fire.
2. Detectors and applicability.
3. Choice of sprinkler systems for specific building types.
4. System descriptions.
5. Loss of life.

ELECTRICAL
1. Service entrances.
2. Transformer lines/voltages.
3. Load reduction.
4. Clearance issues.
5. Load calculations.
6. Assumed continuous loads.
7. Outlet types.
8. Disconnects.
9. Power factors.
10. Underfloor raceways.

SIGNAL EQUIPMENT
1. Detector types.

LIGHTING
1. Visual discomfort.
2. Lamp types.
3. Fixture types (i.e., lighting distribution).
4. Color.
5. Duplicating lighting of historical space types.
6. Alternative lighting systems.
7. Color rendering of lamps.
8. Illumination levels for specific occupancies.
9. Ballasts.
10. Factors of zonal cavity method.

ACOUSTICS
1. Absorption in spaces.
2. Sound diffusion.
3. Methods of noise reduction.
4. Impact of openings in sound barrier.

CONVEYING SYSTEMS
1. Elevator types and advantages/disadvantages to each.
2. Escalators.
3. Elevator safety equipment.

GENERAL/OTHER
1. Site drainage.
2. Effects of wind pressure.
3. Life cycle cost analysis.

Closing Comments

I left the exam feeling very discouraged. I finished with 5 (yes five) seconds left. There was a very large portion of questions that I had marked for review, and I ended up changing a few of those answers. I found 98% of the material to be familiar, but many questions were either phrased in a way that was surprising to me, or they were of a level of specificity that I simply did not know. My exam required much more than a general understanding. In a sense, it was fairly "straightforward," but perhaps a little too detailed than what I believe an architect should have to know without having the opportunity to consult relevant reference material. I was hoping for more "HVAC application" questions – i.e., what system to use where – but was disappointed in that regard. There are still questions that I have yet to find a definitive answer to.

Pre-Design (PD)

Part I: Intro and Preparation

Taken 30 July 2004. This was test #4 for me.

I spent about 2.5 weeks studying, picking up shortly after completing MEP. Here are the resources I used and opinions of them. Where followed by (REQUIRED), this is a source I consider necessary in my study:

Compiled Summary of ARE Forum comments:
Developed after scouring the forum posts and downloadable material. Incredibly helpful, much more so than for MEP. (REQUIRED)

***Architecture Exam Review, Volume II: Nonstructural Topics, 4th ed*, David Kent Ballast:**
I read through the first chapter and then moved on to other materials. While the information is certainly helpful, there is just something about the delivery of the material in this book that discourages me from considering it a primary source of study. I felt similarly with regards to the MEP portions. I would not discount it; I just found other sources more useful.

***ALS Pre-Design 1 and Pre-Design 2*, Spreiregen, 2004 editions:**
First off, the information between these two publications should be consolidated into one single book. There is an incredible amount of redundancy between the two volumes, between chapters, and even within the same chapter. If you're an efficiency nut this may be frustrating. However, redundancy is not necessarily a bad thing from a study point of view, and I would therefore submit that such a format may actually be beneficial to some people. Perhaps I'm just a little sore that I shelled out 40 or 50 bucks for EACH of these things, though I did by them as a "set" and saved a few dollars. All of that said, I found these to be beneficial in my study and would recommend them as a source. (REQUIRED)

Architectural Graphic Standards, 10th ed.
Specifically, Chapters 1 (General Planning and Design Data), 2 (Sitework), 18 (Energy and Environmental Design), 19 (Historic Preservation), 20 (Building Types and Space Planning), 21 (Accessibility), and Appendix A (particularly portions on Area and Volume Calculation, page 1007 and Classical Architecture, pages 1011 – 1016). What can I say? AGS should be a study source for EVERY exam IMHO. The wealth of information is invaluable. If you don't have a personal copy as a reference in your daily practice, get one. It's worth every penny you'll spend on it. (REQUIRED)

***The Architect's Handbook of Professional Practice, 13th ed.*, AIA**
What AGS is to the technical aspect of the profession, the Handbook is to the practice aspect of the profession. If you are currently, or ever plan to engage in the operations of your firm, this should be your first

source of reference. It's loaded with great information about everything from owner, contractor, and consultant relationships to project delivery methods, professional services, contracts, firm structure and profitability, and so forth. Easy to read, well organized, and thorough, it's great for presenting the "business" aspect of architecture to those of use who received a primarily "design focused" education. And as far as the PD exam, I believe it is an excellent resource. It not only addresses several of the specific questions that I encountered, it conveys the kind of knowledge and approach that it necessary for taking the PD exam. (REQUIRED)

Site Planning, 3rd Edition, **Kevin Lunch & Gary Hack**
This was the textbook for my Site Planning course in college and is an excellent introduction to the varied aspects of site design and development. It's a good read. You can definitely pass PD without it, but you'll learn quite a bit if you read it.

A History of Architecture: Settings and Rituals, **Spiro Kostoff**
Another college textbook. Well documented and illustrated, it is an excellent source for historical information up until the early '90s. However, you'll have to look elsewhere for more contemporary information.

Modern Architecture: A Critical History, **Kenneth Frampton**
As the name suggests, it is presented in a "critical" format – that is, certainly not a historical text per se, but a good resource for a study of the modern movement. There is a good article on Sullivan's Chicago Auditorium.

A Visual Dictionary of Architecture, **Francis Ching**
Like all of Ching's books, it's a straightforward, easy to read and understand, unpretentious introduction to architectural concepts and terminology.

Archiflash Cards:
Good as a "refresher" for concepts and definitions. I used these both first and last. There is a lot of good information and I would definitely recommend them. (REQUIRED)

Part II: The Test

Unlike MEP and MM where I felt the subject material was excessively vast and tedious, I felt that PD was broad yet fairly general. Here are some other thoughts/comments/tips:

1. Last week "k" posted on the message board the following: "… the material was all over the place. But, a lot of the questions had key words that pointed to a correct answer. I think this exam is testing your ability to reason and think through a problem on the spot." After taking the exam, I completely agree on both points. Number one word of advice: READ THE QUESTION CAREFULLY. A difference in one or two words can alter the most appropriate answer.

2. Number 2 word of advice: read the "Content Areas" portion of NCARB's ARE Guidelines Version 3.0. Carefully consider all of the words they use. It lays the framework for the kind of questions you will encounter. I cannot stress this enough.

3. A broad range of practical experience, particularly in dealing with the "business" or contractual aspects of the profession, is invaluable for this exam. Those with experience in project management will do well on a significant amount of questions. In fact, such candidates may find some of the questions incredibly obvious and basic. Common sense and reasoning will serve you well.

4. Now, that said, there are some portions that are likely not based on direct experience, such as the

history/precedent questions. It's interesting that at least half of these questions were very contemporary – that is, a staple knowledge of Corbusier and FLW is not enough. I would recommend considering the recent move to sustainability and the influence of the "New Urbanism" movement when thinking about precedent.

5. The subject material of my exam was very fairly diverse, yet most of it could be considered relevant to the exam namesake: Pre-Design. It's all things that competent architects should know or be familiar with in developing a project from the early stages. Now, be warned that many of the questions involved other periods of the project delivery sequence, such as schematic design and design development. The amount of material focused on the construction or even construction document development phases was minimal.

6. As stated by others on this forum, knowledge of the importance of historical precedent is more valuable than the names per se, but be advised that names ARE important, at least from a familiarity point of view. Think about it: if you are asked a question where 4 architects or buildings or sites are mentioned, you must at least be able to identify and visualize those things before answering. Don't focus on overly advanced or complex theoretical implications – stick with the basics.

7. Again, a broad range of experience will go far on this exam. If you've taken the other exams, you probably don't need a great deal of time to study in preparation. If you have lots of professional experience and are just starting your exam sequence, you'll probably do ok, but I would highly recommend taking CD first. In that latter case, you may consider my approach: "blitz" it early – if worse comes to worse, you take it again in 6 months, which will probably be about the time you finish the others in the sequence. And if you pass – well, one more down!

If you've looked at the other posts and information on this forum, many of these things will be very familiar. Note that the format follows that established by the ARE Guidelines.

Programming and Analysis
- Relationship diagrams and proper arrangement of spaces
- Architect's cost estimate – inclusions and exclusions
- Adaptive Reuse considerations
- Schedule types in programming phase
- Relationship matrices
- Cost method based on historical factors
- Organizational devices
- Gross/net ratios with respect to specific building types
- Room data sheet
- Return on investment
- Visual inspection of building with respect to asbestos
- Visual inspection of building to determine probably cause for deficiencies
- "Hard costs"
- Efficiency comparisons interpreted from relationship diagrams
- Task/Data flow diagrams

Environmental, Social, & Economic Issues
- Art Nuevo architecture and use of empirical methods
- Historical precedent as expression of spatial or massing concept
- FLW's Broadacre plan
- Unit of measurements in Greco-roman orders
- Asbestos – establishment as hazardous material
- Architectural treatises and impact on specific architect's work in later period
- Purpose of historic residential district
- Projects exemplifying shift from "modern" design to environmentally friendly design
- Projects sensitive to existing urban fabric
- Design and crime deterrence

Codes & Regulations
· Acceptable area of refuge
· Characteristics of floor plan with respect to building code in reuse project
· Riparian rights
· Factors or methods used to limit development
· Source for parking requirements

Project & Practice Management
· Project delivery methods
· Initiating "partnering" relationship
· Identifying"milestones"
· Method for resolving disputes
· AIA Document A101- Owner/Contractor assignment of contract
· Responsibilities of Project Manager
· Salient characteristic of design build vs. design-bid-build
· Recognizing project delivery method from chart
· Payment methods for fast-track project
· Establishing contractual details with consultants
· Consultants and their recommendations concerning building components
· Advantages/disadvantages of "partnering"
· Need for consultants

Site Planning & Design
· Selecting appropriate site for given use
· Floodplain measures
· Factors affecting basement design
· Methods for sound reduction
· Silt fence
· Factors affecting microclimate of site
· Utilities affected by contours of existing site
· Extension of mass transit to suburbs

Closing Comments

I finished the exam in about an hour and ten minutes. I consider the majority of the questions to be rooted in common sense and proper practice, and well suited to the subject of the exam. I am a little surprised that the passing rates on this exam are lower than the other multiple choice portions. Perhaps it is easier than pre-3.0?

General Structures (GS)

Part I: Intro and Preparation

Taken 27 August 2004. This was test #5 for me.

Experience in structural topics: Over the last five years, limited to only a few construction types, such as wood & metal light framing and post-tension concrete construction. Very little structural steel. Nothing over 5 stories. I've not calculated one beam since taking structures during my first and second years of school. Bottom line: going into the exam, my grasp of the material was shaky at best.

I spent about 2 weeks studying, picking up about a week after completing PD. I had to reschedule once since I

simply could not force any study time into the two weeks following PD.

Here are the resources I used and opinions of them. As you can see, "overkill" is not in my vocabulary when dealing with something as important as my livelihood. Please note that I did not read all of these books, and I certainly wouldn't recommend that anyone do so; however, they are some of the sources I have in my personal library so I dusted them off and used all to at least some extent.

Where followed by (REQUIRED), this is a source I consider necessary in my study.

Compiled Summary of ARE Forum comments:
I went through all of the posts since the inception of this forum and compiled them into one big list of things. It was definitely useful. One thing that many people mentioned is "you should know your concepts," and "there aren't that many calculations on the exam." Those are both true statements. (REQUIRED)

Structural Guide from David Thaddeus
If you haven't dowloaded this yet, do so now. Very helpful. David is a real swell guy for giving this out, and I thank him. (REQUIRED)

GS Notes from CD
Like the Structural Guide, a "must download." Thanks CD. (REQUIRED)

***Architecture Exam Review, Volume I: Structural Topics, 4th ed*, David Kent Ballast:**
As with previous subjects, I read through the first chapter and then moved on to other materials. While the information is certainly helpful, there is just something about the delivery of the material in this book that discourages me from considering it a primary source of study. I felt similarly with regards to the MEP and PD portions. I found it more useful after reading ALS. It seems to me that the presentation of material assumes you know about the subject (kind of like when someone who really knows a subject tries to explain it to someone who knows nothing about the subject – the person explaining often omits some basic but key things). One thing that I find particularly bothersome is the separation of the coefficients and abbreviations from the equations. There is nothing more frustrating than having to constantly look back at a master list of symbols to figure out what Fv really stands for. I should point out, though, that the book does have information the others do not; however, I would still consider this book supplementary and secondary to others.

ALS Structural Technology 1 &2, Berg and Marks:
Overall, I consider these very useful. If you're math shy, however, the first chapter can be very frustrating. After having been out-of-practice with general structures, forces, moments, et.al., I became very flustered and resorted to more "basic" sources for a general overview of structural behavior, such as those listed below. Like most ALS books they do a decent job of presenting things in an easy-to-understand manner, for the most part. The biggest problem: lack of breadth in subject material. For those familiar with other ALS sources, you may already be familiar with this issue; but we can't be too hard on them, it would be impossible to get EVERYTHING in there. IMHO, other sources (or decent experience) are necessary. (REQUIRED)

Architectural Graphic Standards, 10th ed.
I can never say enough good things about this book. It's great for the "nuts and bolts" (literally) of the material. This is particularly useful if you don't have a great deal of technical experience, but admittedly, can be a little too detailed at times. The section on building construction systems in the 10th edition is quite useful. (REQUIRED)

***The Architect's Studio Companion: Rules of Thumb for Preliminary Design, 3rd Edition,* Edward Allen, Joseph Iano:**
I would say the best outright comparison of structural systems around. It has charts, sizes, descriptions, and lots of diagrams. Highly useful, particularly if you are rusty with the various structural systems. On this test, you NEED to know your systems. This is a great book to gain such knowledge. (REQUIRED)

A Visual Dictionary of Architecture, **Francis Ching**
Like all of Ching's books, it's a straightforward, easy to read and understand, unpretentious introduction to structural concepts and terminology.

Building Construction Illustrated, **Francis Ching**
Excellent resource on the technological or physical aspects of structure and construction. For what it lacks in specificity in comparison to AGS it more than makes up for in brilliant illustration. It does a particularly fine job in representing the various construction systems. Browsing through after taking the exam, I even found some SPECIFIC material related to questions that I had on the exam that were NOT in most of the other sources I had. (REQUIRED)

Manual of Steel Construction: Allowable Stress Design, Ninth Edition, **AISC**
As most of the information you would need for the exam is already reproduced in ALS (and the reference section of the exam itself), it is not essential to have this book. However, it is a useful thing to have around. It may also impress your engineer colleagues if you can actually use it.

International Building Code, 2003, **ICC**
Particularly, Chapters 16 (Structural Design) and 18 (Soils and Foundations). Every architect working on actual buildings should keep this (or other relevant building code) within arms length at all times. In preparing for the exam, this is no exception. Several questions were pulled directly from IBC, and I mean directly. Study these sections well, you will not be sorry. (REQUIRED)

Structures, Second Edition, **Daniel L. Schodek**
This was a college textbook. I don't remember reading from it a great deal in college, and I realized why. This thing is chock FULL of information – tons of it – but perhaps too much. Trying to read it can become burdensome, and it switches from simple concepts to 7-level equations in no time flat. Information overload for an exam like the ARE. I would not discount it, however, since there are many useful diagrams and, as I said, a plethora of information. But be forewarned: this book is not inherently dumb-architect-friendly. Or at least, not to this dumb-architect-in-training.

Structures, Or Why Things Don't Fall Down**, J.E. Gordon:**
After completely freaking out that I had not retained any structural knowledge from my education, I felt the need to get "back to basics" in a big way. I saw this book on the shelf when looking for Salvadori, so I bought it. Overall, I would say it's "ok." It's decent to get your feet wet, and has some equations, but can get a little drawn out. The author's dry British humor can seem a little irksome at times (this coming from a fan of British humor in general), but helps keep things light. It does a good job at communicating the concepts of stress and strain. I read the whole thing, or most of it at least. In retrospect, I should have spent more time on other sources.

Why Buildings Stand Up**, Mario Salvadori**
If you REALLY need to get back to basics, this is the place to start. I can't say that I remember seeing a single equation in the book. However, it provides a good overview of structural behavior so if you're really feeling structural-knowledge inept, begin here.

Structure and Architectural Design**, Corkill**
If the Salvadori book has too many pages for you, or you want something even simpler, this is for you. The only thing more basic would be a childrens' book. I am a little embarrassed to admit that my studies began here. Yet, it does a great job of presenting most of the structural systems in a very quick and easy to read manner. Too basic for those with a firm grasp of the material, but a good starting point for those who feel they lack an overall grasp of the various systems, or are just frightened by the idea of structures altogether. This book shows you that it doesn't have to be that scary.

The Structural Basis of Architecture, **Sandaker and Eggen**:

This takes the form of a structural textbook written for architects. It tries to tie concepts of structures with buildings that we study elsewhere in the realm of architectural studies, such as the Pompidou Center and even Aalto's work. It's written by Norwegians, and definitely has a flair for Norwegian work (the authors were/are teachers at the school in Oslo where Sverre Fehn was dean). I think it may try a little too hard in its attempt to appeal to the architecturally minded reader, but I appreciate the effort. The one thing I find really frustrating is that it is primarily presented in SI Units, and not all of the equations have the English equivalents. Also, the nomenclature used in the equations are much different than those used in ALS and the ARE itself, so it can get confusing. This alone drove me to other sources.

***The Design of Building Structures*, Wolfgang Schueller:**
This is a fascinating book. Profusely illustrated with great montages. The montages themselves, often taking up an entire page, are composed as pictures in and of themselves. It attempts to communicate a holistic understanding of structures with respect to form and architecture. It has a significant amount of information, and is a good overall resource. Unfortunately, I got into this book way too late in my studies, originally assuming it would be too broad. In retrospect, I believe I should have used it much more. I would take particular note on the section regarding soils and foundation walls. Some sources, such as the Schodek book, do a poor job in this area. Overall, GREAT illustrations, lots of information, and fairly easy to read (for an in-depth book on structures). Be forewarned, though, that it gets MUCH deeper into the subject material than is necessary for the exam, particularly with respect to equations. You simply don't need to know that much. Of the various "structures textbooks," this is my favorite. (REQUIRED)

Part II: The Test

It's hard for me to summarize my experience in a sentence or two, as I have been able to do for all of the other exams I have taken. I will say this: it's not a difficult test for those with a decent grasp of the theory and basic equations supplemented with a good range of practical experience OR broad exposure to structural issues. Going into the test, I wouldn't put myself into any of those categories, so needless to say, my experience was not good. A few comments:

1. Many have stated that the understanding of the concepts of the basic equations is essential for this exam. I would agree. But let me add a caveat: that, alone, is not enough. It does get specific in some areas, and you will have to know some definitions and common practices.

2. Understanding your various systems is key. This has also been reiterated many times on this forum, but I'll do it again. Make sure you cover them all, because you don't know where the questions will be coming from. My exam frequently touched on pre-fabricated systems and techniques, and there was more than one question on tilt-up construction.

3. Practical experience is helpful for this exam, but not necessary, IMHO. There were several questions that relied upon my first-hand experience with things, but I would say the majority of material can be extracted from the various study materials. So yes – this test is definitely driven by theory.

4. Think economy and remember cost. This should be a blanket statement for most of the multiple choice exams, at least – remember, it's not your money that you're spending on those buildings.

5. Soils are very important. If you've been reading the recent posts here lately, you'll already be familiar with this warning. A decent chunk of my questions related to soils or foundations in some form or another.

6. There were only about 12 or so calculation problems. Many were incredibly basic, such as finding reactions. But there were at least two equations that did NOT have the formulas in the reference materials. I am positive about this, as I spent quite a bit of time searching. Perhaps I was misinterpreting the question, or was supposed to use a form of something else given, but I'm pretty certain that the formulas just were not on

there. And there were at least two calculations where I simply could not get my calculations to match those available; clearly, I must have been doing something wrong, though I checked several times and verified various unit conversions. The point I'm trying to make is that, though some calculation problems seemed straightforward, they apparently were not. But I will admit that these types of problems were few in number.

7. I encountered at least one question that was very, VERY poorly worded, undoubtedly the worst I've encountered on any of the multiple choice exams. I hope you don't get that question.

8. Read the building code sections on structural design and soils.

9. General concepts are important and pervade many questions. Certainly, be familiar with shear, bending, and deflection, what these mean, what they influence, and how they are affected (or affect) portions of equations. Yet don't assume that general knowledge alone will get you through (perhaps it will, depending on the cut score). Definitely prepare yourself with a knowledge and understanding of the practical aspects of the structural systems, connections, materials, and their relationship to the entire building. I will stress again that construction types and structural systems are very important to know. Ask yourself: what kind of things should an architect know about structures? If I'm designing a building, how do I select a structural system, or how can I tell if what my engineer is suggesting is appropriate? Or, what are the things that, if I don't know, can wreak havoc on my project down the line?

Below are subject areas that I would highly recommend studying, and are based on my own experience.

General Theory
- Modulus of Elasticity
- Trusses
- Inflection
- Overhanging and continuous beams
- Vectors and resultants
- Deflection
- Shear & Bending
- Relationship between load, support, and components of reactions
- Structural configurations producing horizontal reactions

Calculations
- Determining values for bridging components
- Sizing caissons
- Tributary areas
- Moments in cantilevers
- Reactions
- Steel beam selection
- Effective live load
- Resultants
- Cost/span chart

Structural Design & Cost Considerations
- Comparative live load values
- Relative cost of structure based on occupancy and building type
- Relative cost of on-site labor
- Flat roof considerations
- Roof selection and cost
- Minimizing costs in masonry construction

Soils & Foundations
- Water content and effect on structural behavior

- Support for basement walls
- Methods and components used in existing or adjacent conditions
- Encountering water
- Particle size
- Soil tests
- Acceptable footing materials
- Expansive soils
- Heaving
- Foundations & cost
- Soil grading
- Evaluating existing conditions for suitability to new use

Structural Materials & Methods
- Compressive strengths of various concrete materials
- Moisture content in wood
- Historical use of masonry in certain forms of construction
- Temporary support
- Strengthening existing components
- Thermal properties of structural materials
- Fire resistance of materials
- Forces in materials
- Solid masonry construction

Structural Components, Details, & Connections
- Camber in structural components
- Effect of temperature in members
- Beam end details
- Flat roof decks
- Ponding
- Connection types
- Bond beams
- Anchorage in concrete frame
- Control joints
- Controlling thermal movement in exterior walls
- Reinforcing in concrete slabs

Structural Systems
- Tilt-up construction
- Systems and floor-to-floor heights
- Pre-fabricated removable systems
- Pre-fabricated concrete systems
- Pre-cast concrete slabs
- Short, medium, long span options
- System substitution
- Staggered truss
- Barrel vaults
- Folded plate

Closing Comments

This is probably not a difficult exam for most people, and I can understand why some people say it's easy. I, on the other hand, am not most people, and had some difficulty. I employed the calculations-last method, then the least complex to more complex (etc. etc.), but was a little disconcerted by the number of questions that I

had skipped or marked the first time around (a good portion were not even calculation related). Then there were two or three calculation problems that threw me and I had to take a WAG. I also got hung-up on many non-calculation problems.

Lateral Forces (LF)

Part I: Intro and Preparation

Taken 7 January 2005. This was test #6 for me; I took GS in August.

I spent one week studying fairly intensively – basically took off time from work after the holidays.

Below are the resources I used and my opinions of them. If you have ever read any of my other synopses you will know that I try to use every possible source at my disposal. Certainly, all are not necessary; this time around, I even found some to be hindrances. I include them here in case you are considering their use.

Where followed by (REQUIRED), this is a source I consider necessary in my study.

Compiled Summary of ARE Forum comments:
As always, I went through all of the posts since the inception of this forum and compiled them into one big list of things. It was definitely useful; however, unlike the other MC exams, LF seems to have far less useful posts. (REQUIRED)

Structural Guide from David Thaddeus
Good for a refresher, but not necessary for LF, except for the basic stuff (trig, bending moments, forces).

***Simplified Building Design for Wind and Earthquake Forces, 3rd Edition*, Ambrose/Vergun**
I have mixed feelings about this resource. On the one hand, It serves as a great introduction to lateral force concepts, and does a good job of presenting the equations and coefficients. It has decent and easy-to-understand diagrams. On the other hand, the "design examples" get confusing rather quickly. Many steps during the calculation process seem to be taken without explanation. There is one example in particular that, unless I am completely missing something, there is inconsistency between the diagrams used for the calculations in the same problem. I have re-read through it and still cannot figure out how they arrived at some of the values given previously provided data. Overall, however, I found it useful. (REQUIRED)

***Architecture Exam Review, Volume II: Structural Topics, 4th ed*, David Kent Ballast:**
Despite my previously documented dissatisfaction with this source, I have to admit that I found it somewhat useful for the LF portions. Although incomplete in a total sense, it seems to have presented the information in a non-complex manner, unlike some of the other sources. I should note that I used this source after reading several others, so that certainly helped with the understanding of the content. BTW, get Chapter 14 here: **http://ppi2pass.com/catalog/servlet/MyPpi_fl_Errata-ARES5ch14.pdf** (REQUIRED)

***ALS Structural Technology 2*, Berg and Marks:**
Definitely incomplete in a total sense, yet I found this useful for basic concepts and simple presentation of the material, particularly the calculations. After using ALS for 5 other exams, I think the key is to always remember that 1) ALS does not cover everything and 2) ALS is a summary. It will touch on a lot of the subject areas, but often only in a brief manner. Don't neglect the small stuff. I actually came to ALS last in my studies. (REQUIRED)

Architectural Graphic Standards, 10th ed.
A favorite source for sure. It has a decent section on seismic design that can serve as either a good intro or

refresher. (REQUIRED)

***The Architect's Studio Companion: Rules of Thumb for Preliminary Design, 3rd Edition,* Edward Allen, Joseph Iano:**
This was much more useful for GS, although it does touch on lateral forces somewhat. It's good in its presentation of overall building systems.

***A Visual Dictionary of Architecture,* Francis Ching**
Like all of Ching's books, it's a straightforward, easy to read and understand, unpretentious introduction to the concepts and terminology. There is a lot of overlap with *Building Construction Illustrated* which is why I don't list this as "required."

***Building Construction Illustrated,* Francis Ching**
Excellent resource on the technological or physical aspects of structure and construction. For what it lacks in specificity in comparison to AGS it more than makes up for in brilliant illustration. It's good for a nuts-and-bolts presentation of the material, and makes that connection from theory to building in an easy-to-understand manner. (REQUIRED)

***International Building Code, 2003*, ICC**
This was a great source for GS. However, I found it confusing for LF. Why? The regulations for both wind and seismic forces have many significant differences to the specific requirements that you will find in the majority of other sources (most based on 1997 UBC or NEHRP). Sure, there are similarities, but overall, I found this confusing. I would highly recommend using the 2000 IBC instead, or even just sticking to 97 UBC. I found that the specifics did not matter. HOWEVER: I was tested heavily on basic "model code" issues (see below). As such, I would strongly recommend familiarity with at least one of the relevant codes.

***Structures, Second Edition,* Daniel L. Schodek**
See my comments on this source in my GS synopsis. I found the diagrams particularly useful.

***The Structural Basis of Architecture,* Sandaker and Eggen:**
Again, many of my comments from my GS experience are relevant here as well. Bottom line: this book was not used very much.

***The Design of Building Structures,* Wolfgang Schueller:**
See my review of this in the GS synopsis. There is a pretty decent chapter on lateral forces which I found useful.

***ARE Study Guide: Multiple Choice* v. 3.0 (NCARB)**
I only used the questions themselves. Of all of the sources, this best represents the type of questions you are likely to encounter on the actual exam, which it should, given its author.

I found several great sources online this time:

ATC/SEAOC Briefing Papers: Built to Resist Earthquakes - The Path to Quality Seismic Design and Construction (ATC 48)
http://www.atcouncil.org/atc48bp.htm
If you download one source, this should be it. Great intro to the gamut of seismic design and construction. Easy to read, well illustrated, and straightforward, I cannot recommend this enough. (REQUIRED)

FEMA 154: Rapid Visual Screening of Buildings for Potential Seismic Hazards
http://www.fema.gov/hazards/earthquakes/nehrp/fema-154.shtm
This is particularly useful for its sections on analyzing existing building types, their inherent weakness resisting seismic forces, and potential rehabilitation techniques. Nice and detailed, easy to understand, and well illustrated. (REQUIRED)

FEMA 172-NEHRP Handbook of Techniques for the Seismic Rehabilitation of Existing Buildings
http://www.fema.gov/hazards/earthquakes/nehrp/fema-172.shtm
The name says it all.

FEMA 368: NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures
http://www.bssconline.org/pubs/downloads.html
A good source for the more technical aspects of the material, particularly with respect to code issues, but keep in mind that it is a set of guidelines. As such, it reads like a code. I would highly recommend that you use FEMA 369 concurrently. Also, be aware of the differences between it and UBC 1997.

FEMA 369: Commentary to FEMA 368 http://www.bssconline.org/pubs/downloads.html
This document helps to make sense of FEMA 368. It does an excellent job of providing the background and reasoning behind the provisions, even discussing the rationale behind the specific factors in the seismic equations. (REQUIRED)

The Seismic Retrofit of Historic Buildings: Keeping Preservation in the Forefront, National Parks Service
http://www2.cr.nps.gov/tps/briefs/brief41.htm
Another site on retrofits.

UVA Arch 721 page
http://www.arch.virginia.edu/~km6e/arch721/content/content.html
Great graphic/pictorial explanation of lateral force concepts. UVA seems adept in the integration of structural theory with architectural concepts.

MCEER FAQ page
http://mceer.buffalo.edu/infoService/faqs/default.asp
Easy to understand intro into basic concepts.

WBDG's Seismic Design Principles
http://www.wbdg.org/design/resource.php?cn=0&rp=35
Online presentation of seismic concepts.

Boston Architectural Center ARE Review: Lateral Forces
http://www.gregorianengineers.com/BAC/ARE_Lateral_Loads.PDF
A nice little PPT presentation in PDF form. Lots of good illustrations.

APA's Introduction to Lateral Design
http://www.apawood.org/pdfs/managed/X305.pdf
Obviously limited to wood structures, but well illustrated and easy to understand nevertheless.

US Army Corp of Engineers Materials
http://www.hnd.usace.army.mil/techinfo/ti.htm
Check out "Seismic Design for Buildings" and "Seismic Evaluation and Rehabilitation for Buildings." It's like having an entire BOOK to study from. Tons of great information, and surprisingly easy to read (the introductions, at least). Lots of actual DETAILS. Caveat: these guidelines are for Corp buildings, so they may not be relevant to every situation. However, you will find no greater source of free detailed information anywhere that I am aware of. Another big caveat: the files are huge – the Design document is 800+ pages alone.

TLC's Make-a-quake
http://tlc.discovery.com/convergence/quakes/interactives/makeaquake.html

This is just fun.

I also found some other random things, including data on seismic glazing and details, for which I printed out information but did not save the link. Do some digging, there is a ton of information available.

Part II: The Test

Much distress over this exam has been registered on this forum, with many indicating a surprising amount of previously unseen information or confusing calculations. My own experience was different. A few comments:

1. Many have stated that the understanding of the concepts of the basic equations is essential for this exam. I would agree. No question required memorization of a complex equation, though SEVERAL questions asked about the coefficients that can be found in those equations.

2. Practical experience – or at least, specific practical experience – was not necessary. My exam was heavily theory-based. It is somewhat helpful that I work in an area with high wind considerations, but most of the information I culled was from the readings.

3. Cost did not seem to be a big issue. Practicality, least-disruptive, and best practices were more prevalent in my questions.

4. There were only about 10 or so calculation problems. Some questions were disguised as calculation problems but were actually theory (tricky!). The math on all but one was so unbelievably simple that it worries me. The key was knowing how to solve the problem.

5. Like all MC exams it seems, wording is critical to understanding the question. I was tested heavily on definition-type information, subjects that, if you only possessed a passing knowledge of the term, you would be tripped up by the choice of answers. My suggestion: be very clear on the terminology.

6. Understanding the logic behind the "model codes" was a very frequent theme. I would estimate that at least a half-dozen questions related to issues involving code assumptions or theory, particularly with regards to the determination of wind and seismic forces used in the design methods. I strongly recommend developing an almost intuitive understanding of the rationale behind the code requirements, perhaps even more so than the specific requirements themselves.

7. Rehabilitation and strengthening of existing structures was a consistent theme. Topics ranged from overall concepts to specific solutions. Know the properties of the various materials and lateral force systems. Also, become familiar with connection details.

Below are subject areas that I would recommend be included in your studies:

- Wind speed maps
- Geographical regions subject to wind or seismic events
- Modes of failure due to lateral forces
- Use of materials in seismic-prone areas
- Component action under lateral loading conditions
- Design approaches to buildings and their components
- Wind stagnation
- Importance factors: basis and impact on structural design
- Load combinations
- Force design assumptions in codes
- Seismic details

- Methods for increasing lateral resistance of existing structural systems
- Methods for increasing lateral resistance of structural components
- Methods for increasing lateral resistance of non-structural components
- Bracing configurations
- Use of non-structural materials to increase lateral resistance
- Effect of additions to existing structures in seismic areas
- Effect of torsion on structures
- Lateral deflection of non-structural components
- Seismic restraint of building components
- Damping
- Gradient
- Soft story
- Ductility
- Battering & pounding
- Stiffness
- Historic examples of failure due to lateral forces
- Ability of diaphragm materials to transfer shear
- Curtain wall details in seismic areas
- Wind tables
- Causes of earthquakes
- Earthquake terminology
- Reactions to frames based on wind loading conditions
- Base shear as a function of mass and building period
- Factors affecting lateral displacement under seismic load
- System redundancy
- Soil properties
- Cause of failure of building components under wind conditions
- Vertical irregularities
- Conditions that govern selection of appropriate lateral-force resisting systems
- Advantages/disadvantages of braced frames
- Wind pressure and its effects on building envelope
- Reading a chart
- Calculation of seismic separation
- Calculation of diagonal forces
- Calculation of shear
- Calculation of member sizes

Closing Comments

This test is not to be overestimated or feared. This test is not to be underestimated or taken lightly. My experience is not consistent with those who said that the exam was impossible nor with those who claim it was easy – it was definitely somewhere in-between.

I would recommend a study strategy focused on the development of a clear and specific understanding of lateral, wind, and seismic forces, primarily by understanding the rationale used by the model codes to develop provisions to improve the ability of structures to respond to those forces. Keep in mind that wind and seismic design is not an exact science due to the dynamic nature of loads. Also, keep in mind that best practices are continually changing. This is important because it affects existing buildings as well as new – hence, I believe, the ARE's noticeable inclusion of rehabilitation concepts and techniques. I would focus primarily on the UBC 1997 and NEHRP regulations and their differences, since this will call attention to some of the major issues (BTW, I downloaded a comparison between the UBC 1997 and NEHRP but do not recall the source).

Building Technology

Took it today (1 March 2005). This was exam number 9... can't say it's my last until I find out for sure...

Just as for Site Planning, I have very little to offer in terms of advice that has not already been mentioned many times before. To summarize:

1. Get *ARE Solutions* from Professor Dorf (obvious).
2. **NCARB's** *ARE Study Guide: Graphics Divisions* was helpful for its examples, though I find their solution to the stair problem to be terribly inefficient.
3. Just as with the other two graphic divisions, this test is really about one thing: **FOLLOWING DIRECTIONS.**
4. The number one thing you can do to prepare for this exam is **practice the software**. A close second would be to read *Solutions*.

Here's a quick synopsis of my actual experience:

Part 1

Building Section: Frighteningly similar to the practice problem. The only real differences were the dimensional parameters and some duct locations. There was one tricky portion, however: the size of the joists was very difficult to determine on the second floor... when establishing the duct/joist combination, it wasn't exactly clear what joists were in the corridor area... I decided to err on the side of caution and used the larger combination (which I believe to be correct anyway). Lesson: study the layout carefully before settling on your dimensions. I would strongly recommend you calculate these things BEFORE drawing the section, as the elements can obscure or confuse things.

Structural Layout: Trickier than the practice problem, but not difficult. I had an all-steel solution.

Accessibility-Ramp: Very tight space to work with. I know the general consensus is to provide no more than 2 landings, but I am thoroughly convinced that such a solution would be impossible given space I had to work with. The solution actually worked out quite nicely vis-a-vis the consistency of layout and definition of remaining space... hopefully the choice to use 5' wide ramps instead of the minimum to simplify the design will not be "downgraded" since it wasn't the tightest or smallest theoretically possible.

One thing concerns me a little, but only because of discussion on this board: there was a double door leading from the lobby to the exterior, but the lobby was fed by two exits - one existing (at the lobby level) and one new (i.e., the one we work from). Discussion on this board has suggested that if two doors are leading FROM the lobby, two doors would be required into the lobby from the new corridor. The width of the "new" corridor was 6' exactly; hence, two doors could not fit and maintain a wall. The existing corridor was 56" or so. The code states a minimum egress width of 44 inches - none greater. I could find no justification for the use of two doors - none - beyond the fact that two doors led FROM the lobby (and that's only because of what I've read here). However, one could

argue that the combination of old and new corridors could create the need for two doors at the lobby (or maybe two doors were desired for another reason). Accordingly, I only put ONE 36" wide door in the new corridor - anything more would seem awkward and excessive. While I realize "design logic" in the practical sense plays only a small part in these exams, I simply cannot help but apply it here. If this is a fatal error, I'll let you all know in 4-6 weeks. If I missed a requirement somewhere, shame on me.

Part 2

Mechanical & Electrical Plan: Different layout from the practice problem, but nothing too difficult. Although I'm a big fan of the single-rigid-duct solution, my sense was to use a dual-supply layout, and I stuck with it. All but one space (besides the space with incandescents) used 2x4 fixtures instead of 2x2s. The lighting in one space worked out best with a 4" portion of grid on one side only (the program tolerance seems to be 4"), so I bucked the "don't leave any slivers" guideline and kept it.

Stair Design: The second floor and landing entries into the space were stacked, which really only allowed 2 possible solutions... maybe only one really, since I didn't pursue the second to be sure it would work. Everything worked out quite nicely - the risers could all be exactly 7", and the switchback had two runs of equal risers. A little too convenient maybe...

However, I'm always leary about the space below the stairs. Although the actual stair and landing locations would allow for the required 80" headroom for the exit by passing a certain way below the stair, a portion would dip down below, which in reality could be awkward unless railing or wall was used to prevent someone from bonking their head on the underside of the stair. I guess as long as there is a compliant means out, that's all we have to worry about (I hope). One last thing: a cut stair was necessary (as it would be for any situation where the entries were stacked), so practice with this arrangement beforehand would be helpful.

Roof Plan: Amazingly similar to the practice problem. No real surprises.

Summary:

I finished each part with about an hour and 15 minutes to spare. I spent the rest of the time checking and rechecking and basically noodling around with the layouts a little... in reality, I don't know that I really appreciably changed anything. The code information (except for the building section) was identical to the practice software. Yet even so, I still can't shake this sinking feeling that I forgot SOMETHING.

It's been said before, and I'll say it again: the keys to all of the graphic portions are:
1. Practicing the software.
2. Reading *Solutions*.
3. Reading and following the directions exactly.

Once you've mastered the ability to work with the vignette tools to the point where it becomes second nature, you can spend the rest of the time during the actual exam to read the directions carefully, devise a scheme, fine-tune, and check your work. The

vignettes are simply graphical puzzles. That's it - really.

Final words of advice: don't fear this exam. Schedule it, practice, and take it. In retrospect I probably should have taken the graphic portions first instead of fearing their mystique and leaving them to the end, but hindsight is 20/20.

Good luck!