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# Henderson Construction Company

## Case Project, Part 1

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### Case Background

#### People involved

Patrick Henderson, Partner  
Bob Henderson, Partner  
Frank Borman, Job Site Supervisor  
Mary Henderson, Office Manager  
Melissa Brown, consultant

#### Company Information

Henderson Construction Company is a State Qualified Highway Contractor in Indiana. The company got its start about 10 years ago when Patrick and Bob Henderson decided to go into business together rather than work for other companies. Both Patrick and Bob were veterans in the highway construction business, having worked for larger firms for several years prior to setting out on their own. Henderson will take on any road construction job within their capacity; however, they specialize in small bridge projects. They will also do related construction jobs for local governments or private concerns, such as setting beams, pouring concrete foundations, or large-scale landscaping.

In its early days, the firm benefited from two major advantages: Patrick and Bob's experience in the field, and extremely low overhead. In fact, the brothers did much of the work on the early projects themselves, with the assistance of Bob's friend Frank Borman (who he met while in military service), and a few hired laborers. Many of the laborers who worked on those early projects (and/or their children) are still with the firm today. Patrick's wife Mary served as bookkeeper in the early days, and took over the office management duties a few years ago.

While there are others, Henderson's major client is the State of Indiana, Highway Division, which accounts for approximately 90% of Henderson's business (the rest is divided between private work and city, township and county government work). Projects are allocated by the state using a competitive bidding process: Henderson and other companies bid on various projects let by the state. The company with the low bid receives the project. They are then paid by the state at the completion of various stages of the project, such as foundation, structure, deck, roadway, drainage, and final completion. State construction inspectors who are assigned to every state highway job assess the completion.

In a good year, the company will win about 4-5 road building projects, worth roughly 1 million dollars each. The company can expect between 3.5 and 5 million dollars in gross revenue

in a given year. Net revenue, after salaries, other expenses, and taxes, can be expected to be between 5-10 percent of gross revenue.

While the core business hasn't changed much since Patrick and Bob bought their first backhoe 10 years ago, the legal and regulatory environment has changed significantly, leading to a marked increase in the amount of paperwork. Mary has noticed that she spends a lot more time in the office than she used to, just to keep up. In particular, payroll, which Mary has traditionally done by hand, has become an extremely complex undertaking. The company would like to expand its operations, but the sheer complexity of complying with various State and Federal wage scales and regulations (see "The work and the environment", below) makes this quite difficult given the present system of information management. At present, Henderson employs about 50 workers.

## **Organization**

Henderson has a fairly organic structure, in that there are very few official titles, and the titles do not really mean anything. While Patrick and Bob make the strategic decisions and manage the job sites (along with Frank), Mary handles the day-to-day operation of the office. She is the sole employee in the office, and nearly all of the information in the firm at one point or another will pass through Mary's hands. Mary handles anything not directly related to administration of a specific job site. Consequently, she is charged with a great deal of responsibility in the company.

## **The work and the environment**

Most projects proceed in the following manner. Every month, the State publishes "the book," which highlights the projects to be let that month. The company requests plans for jobs for which they may bid. Patrick, Bob and Frank review the plans and at least one of them makes a site visit. The bids are then completed and submitted to the state. During the bid writing process, suppliers for various line items (concrete, steel, paving material, paint, etc.) are contacted for their prices. Since the suppliers are qualified by the state as well, this is a simple matter of calling up and asking for the unit price for the material. In fact, since the suppliers are privy to the same information as the contractors (as well as who has requested plans), they will often call up Henderson, with the total cost (unit cost and amount already calculated) for a line item on a particular job.

If Henderson is "low-bid" on a project, they assign a supervisor, who is responsible for the site administration. The supervisor (Patrick, Bob, or Frank) takes a crew to a job site, and accomplishes the various tasks needed to complete the job over the few months that the project will run. The job site supervisor is the final authority on the administration of his particular job. The client will also assign an inspector (usually an administrator and/or an engineer) to the job site as well. Equipment and trucks are owned by the company, which can be moved to the various job sites by tractor and trailer. In some cases the job site supervisor needs a piece of equipment that is too specialized for the company to need on every job, hence equipment is sometimes rented.

Henderson Construction is an open shop; that is, employees may or may not belong to a craft or trade union. Patrick and Bob believe that the decision to join a union should be up to the employee. The bulk of Henderson's employees are not union, however, simply because there

usually is not enough specialized work within one trade to keep any worker busy all of the time. The State mandates that all workers be paid a union scale per hour rate based on the skill classification for the job that they are doing at any given time. Consequently, there is no financial advantage to joining a union. The varying pay scales make for a complex payroll calculation. For example, if a worker spends 2 hours as general labor (\$15 per hour), 3 hours as a carpenter (\$16 per hour), 1 hour in masonry work (\$17 per hour), and 2 hours as a heavy equipment operator (\$20 per hour) in a given day at a given job site, then their wage would be calculated by taking the amount they earned in each classification and summing those totals. In this example, the worker would gross \$135 dollars for that day. The scale for each job is supplied by the state with the construction plans. Employees working on non-state projects (or at the shop) receive \$15 per hour, regardless of job classification.

Henderson's workers are extremely flexible, and move from skill to skill and job site to job site on a daily, even hourly basis. The only constant at a given job is the job site supervisor. For example, last week when Frank's crew was getting ready for a big bridge deck pour, Patrick spared a few of his workers to help out, as his project was temporarily delayed (heavy rain had flooded a footer hole, which had to be pumped out before work could proceed). Consequently, a worker may have worked at multiple sites, in up to 5 skill classifications (general labor, carpentry, masonry, ironwork [also \$17 per hour], and equipment operation), in any given week. All of this has to be taken into account to generate a payroll statement. The job site supervisor is responsible for keeping track of most of the movement of employees from job to job and site to site; however, trusted employees who have been with Henderson for several years keep their own time cards. At any rate, all information relevant to payroll eventually gets turned into Mary.

Recently, employment equity legislation has also become an issue in the construction industry. Currently, legislation dictates that employers use certain percentages of visible minorities and women for each job skill classification on each job. A report stating how many hours (on each job, in each skill classification) were worked by women and visible minorities has to be sent to the Indiana Equal Employment Opportunity Commission (EEOC) every two weeks to demonstrate compliance. Currently, 10 per cent of all hours in each skill classification at each job have to be worked by a woman or visible minority to be in compliance with the regulation. Failure to comply could mean that Henderson would be stripped of its qualification, making it ineligible to bid on state contracts. In addition, as governments change, the legislation changes, and hence the reporting requirements change as well.

### **The planning meeting**

Once a week, on Saturday morning, Patrick, Bob, Frank and Mary have a planning meeting to discuss issues related to completing the various jobs, and to lay out general strategy. Mary mentioned the payroll and the EEOC compliance issues. The payroll issue was a knotty one; however, the EEOC compliance issue really got Bob and Patrick's attention. While Henderson has been putting both women and minorities to work, they had no convenient means of generating the compliance reports to prove it.

Frank brought up another issue, related to payroll. Some of the workers were asking questions about their paychecks, suggesting that they were perhaps being shorted hours. All four principals at Henderson knew this is nonsense (as did many of the workers). The problem was that the complexity of the calculations used to derive the checks made it difficult to see a direct correlation between hours and pay, what with taxes and all. A complete run-down of hours, jobs

and sites to attach to each worker's check each week would solve the problem, but it would fall to Mary to complete such a form for each worker each week, and she is already too busy.

Mary thought that part of the solution was to hire a new assistant to help with the office work. Obviously, some changes would be required in work hours reporting to prepare the biweekly EEOC compliance reports. She decided to ask her close friend, technology consultant Melissa Brown, to look over the situation and make some suggestions. Patrick, Bob and Frank agreed that this would be a good idea.

Once action on the payroll and EEOC compliance was decided, the discussion moved on to equipment, vehicles, tools and inventory. Henderson (like many contractors) has a significant amount of material, small tools, heavy equipment, and vehicles. Patrick, who handles the administration of Henderson's maintenance shop and grounds, has mentioned that simply keeping track of the maintenance of all of the vehicles and equipment is getting to be a difficulty. This can lead to a neglect of maintenance, with potentially disastrous consequences. Recently, one of Henderson's cranes was labeled a "menace to society" by an Occupational Safety and Health Administration (OSHA) inspector, who suspected structural weakness in the boom. This resulted in a \$2,000 dollar fine. In addition, small tools, parts, and other items thought to be missing appear (and then disappear) from time to time. Frank suspects that the items are simply moving from truck to truck (as needed on one job versus another), but clearly a means to track tools, equipment and inventory would be quite useful.

### **Mary's chat with Melissa**

When Mary put the idea to Melissa, she agreed to help. Mary and Melissa agreed that any new system would have to be simple and readily expandable, as the processing needs change. Mary discussed with Melissa the problems that had been discussed at the meeting with Patrick, Bob, and Frank. Hiring a technology team to implement a new custom system would be cheap, but the team had come to regard it as a "cost of doing business."

Having talked with Mary many times over the years about work, Melissa had a pretty good grasp of the issues Mary faced in the office. Melissa knew that payroll had been a time consuming task when she did it, and now the work was going to be increased even more. The irony was that most of the work appeared to be merely processing and formatting of the same basic kinds of information.

Melissa suggested that she could do the work. Mary was quite enthusiastic, but Melissa cautioned her that things would have to be taken slowly, and that there would be a pretty steep learning curve. Further, some analysis would have to be done before a decision could be reached on what kind of information system would indeed handle Henderson's problems. Melissa agreed to take on the project, and promised to get back to her with some ideas after she consulted with a team of database experts (that's you!).

## Your team's assignment

The intent of this assignment is to give you a hands-on experience making a database design for this case. Your team will assist “Melissa” in this case. Assume that “Melissa” has decided to build a small-scale custom application for Henderson. For this course, you will focus only on the database aspect of the project (not on programming, interface design, etc.) In other words, if you were working with Melissa, how would you set up the database on the back-end, so that later on she or another team could design a front-end application to work with that database?

The format of your deliverable should take the form of a professional executive summary. There should be one submission per team. Overall, your team's executive summary should consider the business problem, address specific business requirements, and propose a database design. During this initial stage, you are given general information. At this point, you are welcome to make any reasonable assumptions you wish, but they should be stated clearly in your write-up. More detail about the company and scenario is coming in later parts of the project.

As with all assignments, the executive summary should be professionally done (e.g., well written, formatted neatly, page numbers, headings, subheadings, etc.).

As you are writing your executive summary, consider the following questions. (Do NOT list answers in a “question and answer” format. Rather, type up 2-3 pages of text/summary that addresses all the points, written in a format with the course instructor and your peer students as your audience.)

1. What do you believe to be the most pressing problem facing Henderson? Why? What other problems is Henderson facing?  
Note: Your data model should incorporate tables to address all issues, not just the most pressing one.
2. How would designing a system that stores information in a database help with their business needs? (Explain the benefits of relational databases for this case.)
3. What information should be stored in the database? How should this information optimally be stored (including properly normalized) to address these needs?

When creating your data model, you may include foreign keys if you wish, or you may choose to keep this as a purely conceptual diagram without foreign keys and intersection tables. Adding foreign keys gets you a step ahead for Part 2 of the project later in the semester, but omitting foreign keys for this deliverable allows you to get feedback before making FK decisions. It is up to your team.

*(instructions continued on next page)*

## **Your Project Part 1 deliverable should include:**

### **(1) An executive summary in PDF, including the following:**

1. Your answers to the questions above, written in text/paragraph format.
2. Your proposed database design in text summary format. In other words, list tables where table names are capitalized, attributes are listed within parentheses, and primary keys are underlined. If you include FKs at this stage, show them in *Italicized* font.

Example of parenthetical format: EMPLOYEE (EmployeeID, EmployeeName, *DeptID*).

### **(2) Your proposed conceptual data model as a Crow's Foot E-R diagram in PDF format**

### **(3) A short video (5-15 minutes) presenting your executive summary and database design.**

You can submit a video file or you can upload your video to a streaming service (e.g., YouTube) and submit the link. The format and length are flexible. For example, you could record yourselves presenting a PowerPoint presentation, or you could create a video where you “voice over” a set of slides or pictures of your database design. You can use Zoom, iMovie, QuickTime, Camtasia, or any of hundreds of other tools out there. **Be creative!** At a minimum, you should (1) summarize the key need for a database, and (2) show the conceptual diagram and explain it in layman's terms (imagine you are presenting the diagram to the other students in the course as if it were a presentation during class.)

You may work together or divide up the work as you see fit. For example, not everyone has to be in the video.

Please contact me if you have any questions.

Finally, please note that everything in this deliverable is the conceptual design. The final project deliverable will be the physical implementation in an actual DBMS.

## **Rubric for Project Part 1:**

- Completeness of content in executive summary (and video): 30 pts
  - Gain full points by clearly addressing the 3 questions on the previous page
- Correctness / completeness of E-R diagram data model: 50 pts
  - Set-up addresses all major issues of Henderson (30)
  - E-R diagram is error-free and normalized (20)
- Text listing of database tables (parenthetical format): 10 pts
- Ratings from other teams based on video presentation: 20 pts
  - Instructions for rating other teams will be given in the class following the due date
- General formatting and grammar: 10 pts
- **Total:** 120 pts

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