

# Tunnel Vision, Inc.

*"We Dig Your Business!"*



231 Cave Inn Drive  
Yorzin Mine, AL 35400

January 17, 2008

Independent Mathematical Contractors, Inc.  
104 Pinkerton  
Tacoma, WA 98402

Dear IMC:

Our company handles small tunnel-digging jobs here in Alabama. Dr. Nuller, our only staff mathematician, recently resigned, leaving us with only a page of sketchy notes about an important upcoming project. When we asked trusted colleagues on the best mathematical consulting company to engage, your name was continually mentioned.

As you can imagine, the cost of digging a tunnel depends on several factors, including length. However, even in digging a single tunnel, the cost per unit length is not constant: as the tunnel gets longer, the cost per unit length increases, because of the increasing expense of carrying tools and workers in and hauling dirt and rock out. This effect is documented in the following table of cost per foot vs. tunnel length:

Length (ft.)	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Cost per ft (\$ per ft.)	500	820	1,180	1,580	2,020	2,500	3,020	3,580	4,180	4,820

We would appreciate your help with the following questions: How much will it cost to complete the digging of a 1000-foot tunnel? How much money could we save if we start this 1000-foot tunnel from both ends and have the two halves meet in the middle? If the tunnels don't quite meet in the middle, what could we do to fix the problem, and how expensive would this be?

There is one more issue we need to resolve. Dr. Nuller's notes included (i.) remnants of a graph of the data from the table above (this graph was rendered unreadable due to spilled coffee), and (ii.) some scribble in the margin about the area beneath the graph. Since Dr. Nuller will no longer return our phone calls, we hope that you can help us figure out the point of those margin notes. Please reconstruct the graph for us, and try to determine the

significance of the "area beneath the graph." Any explanation you can offer would be comforting to me and my superiors.

To assure your success in the completion of this project, our department's scientific expert, Dr. Jennifer Quinn, will be available to answer any technical questions you might have in the course of your investigation—feel free to contact her (with all members of your consulting team) with any questions you might have. You should additionally plan to see her by **February 1<sup>st</sup>** with an indication of your group members and preliminary work on the project.

We look forward to receiving your report, which should be typewritten and 3–5 pages in length. Equations explaining your solution should be included in the report, and it is permissible to hand-write these in blank lines between your typewritten explanation if this greatly facilitates the production of the report. Please respond by midnight, **February 15**, so that we might submit our bid for this job in a timely fashion.

Sincerely,

Burroughs B. Kneath  
Executive Vice President