

A RUBBER BAND POWERED TRACTOR CONTEST

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Abstract:

An activity providing "hands-on" involvement of high school students to heighten interest in engineering design and energy utilization is presented.

The student goal of the contest is to design and build a model tractor to achieve a maximum weight-distance pull when powered by specified rubber bands. Prizes are awarded to the best pulling tractors and to the best engineered tractors. Contest rules and results are included.

The objective of engineering publicity and a campus visit by students has been achieved.

Introduction:

From the editorial "Hard Times are Coming" from Fran Lavoie in the magazine Machine Design, June 25, 1981:

"The engineering job market is booming. Both experienced engineers and recent graduates are able to pick and choose, with certain disciplines virtually able to write their own tickets.

"With demand comfortably exceeding supply, and with the prospect of a strong job market over the near future, this might seem an odd time to talk about unemployment.

"But if the past is any indication, hard times will come again. The current supply/demand imbalance will be evened out by large numbers of new engineers that our schools, bulging with students, will graduate over the next few years.

"Does this mean that we are doomed to go through another 1970-style blood bath? Has industry learned nothing from the many boom/bust cycles that have caused so much turmoil in the engineering profession?"

If the pinch comes in education, or if enrollment continues to surge, what has your department done to avoid the valleys and peaks, and to make sure the right type of student knows of your program and prepares for entry early?

During a period of low engineering enrollment at North Dakota State University, the Dean urged department heads to come up with recruiting ideas. The civil engineers already had a student bridge building contest. What could the other departments do? What would interest agricultural engineers? For agricultural engineers, one obvious subject was tractors, and a tractor pull in real life is interesting and exciting.

Full-sized, modified tractors had been used nationwide for entertainment and education for some years. A national association has been formed to regulate and provide guidelines for these contests. Full-sized tractor pulls have become an expensive, professional sport.

A less expensive, but yet exciting, alternative competition has started, using scale model tractors powered by model airplane engines. Costs again rose as competition was sharpened in the American tradition. Contest changes were needed to reduce costs and also demonstrate energy conservation as energy supplies become expensive and critical.

A rubber band-powered tractor contest seemed to be the answer. Here was an inexpensive, equal source of energy for young designers to work with. In many ways rubber band power offers chances for more innovation than standardized model airplane engines.

The Contest:

This type of activity should be meaningful, but also fun and interesting for all concerned. The sponsoring department should be rewarded by the quantity and quality of potential students contacted. The actual planning and running of the contest can be delegated to undergraduate students in the department. The contestants should be enthused while designing, constructing, and competing with their peers.

Rules and regulations for the 1981 North Dakota State University Student Model Tractor Performance Contest, photos of typical tractors, and loading details are included

as part of this paper. The contest for high school students has been expanded to another division to include university graduates, students, and staff. A nationwide contest sponsored by the American Society of Agricultural Engineers is held at the annual winter meeting in Chicago. Student branches from the United States and Canada compete.

A number of local businesses have generously supplied prize money and trophies. Prizes and trophies are awarded for the best pulling tractors and the best designed tractors. A desirable addition, which we haven't done, would be to furnish each participant with a memento of the day-- at a minimum this could be a certificate of participation.

The contest can be scheduled separately or become part of another event which brings students to the campus. The latter is practiced at North Dakota State University where many students and parents are attracted to the campus in February of each year for the Agricultural Engineering Show, which is part of the Little International event.

Publicity consists of letters to area schools, plus television and news articles. A 16 mm color movie film was made by our students to be sent to interested groups. The education television station had a tractor entry and also video-taped the 1981 contest. It has since been replayed over a statewide network. An old quote, "All publicity is good publicity" may apply.

The contest is held at the publicized time in an auditorium-type classroom with the contest in full view of all the contestants and spectators. Tractors are checked for weight and size limitations during registration.

Contestants are allowed three separate pulls on the test track. Everyone pulls once in the order determined during registration. Before the second and third pulls there is time to make minor changes on the tractor or decide which weight is optimum for prevailing conditions. Results are recorded for everyone to see during the contest. An announcer gives details concerning the tractor, contestant, hometown, and results.

Prizes are awarded at the conclusion of the contest. Two judges rule on any procedural questions and pick the best designed tractors. The decision of the judges is final!

The student-made 16 mm movie and a recording of the 1981 contest on videotape will be shown as part of this

presentation.

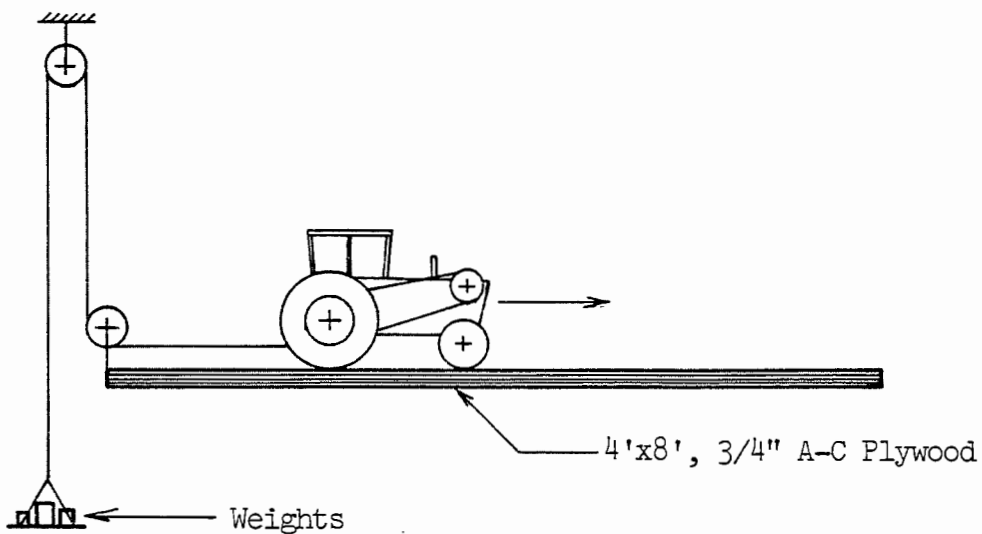
Summary:

Is it possible to eliminate the peaks and valleys in engineering enrollment? Perhaps not, but a recruiting device for your department similar to the "rubber band tractor contest" may reduce the variation, but more important, may interest the right students early so they can prepare for an engineering career.

Elements of a successful event:

1. Simple, inexpensive, yet challenging.
2. Involvement of present students and staff, in addition to the prospective students.
3. Competitive, but fair.
4. Enthusiasm plus participation = fun and results!

Tractor Loading Detail - Side View



1981 MODEL TRACTOR PERFORMANCE CONTEST (Student)

The Agricultural Engineering Department of the North Dakota State University is sponsoring a Model Tractor Performance Contest Saturday, February 14, 1981 during the Annual Agricultural Engineering Show. Prizes will be awarded to the top three pulling models and to the two judged best in workmanship, appearance, and overall function.

Eligibility

Any junior or senior high school student (grades 7 thru 12) may enter. Any number of students may work on a single entry.

The Problem

The object of the contest is to construct a model tractor or modify a commercially available model tractor. The tractor is to be propelled by two rubber bands furnished by the Agricultural Engineering Department. The model tractor will be judged in two ways:

1. Drawbar performance. The model will be tested for drawbar pull on an eight foot long horizontal plywood track. The test surface will be Douglas Fir, Grade A sanded. The pull will be horizontal and the load will consist of a variable amount of weights. Weights will be 50, 100, 200, 400, 800, and 1600 grams. The contestant may make three runs. The contestant will pick the weights he wishes to pull. The minimum weight is 50 grams. The distance the weights are pulled will be recorded. The run producing the highest product of the weight pulled times the distance will be the tractor's score.
2. Workmanship, appearance, and overall function. This score will be used to award the "Best Engineered" prizes, and break any possible pulling ties.

Date of Contest

All models will be tested for drawbar pull starting at 10:00 a.m. Saturday, February 14, 1981 at the Agricultural Engineering Building, North Dakota State University. Testing will continue until all received models are tested. Entries may be mailed in prior to that date, but delivery and operation by the contestant is encouraged. Any entry

received prior to the contest closing will be tested.

Cost

There is a \$1.00 entry fee.

Rubber bands to be used in testing the model before the contest may be obtained by writing and enclosing the \$1.00 entry fee to:

Model Tractor Performance Contest
Agricultural Engineering Department
North Dakota State University
Fargo, ND 58105

Each contestant will be furnished a new set of rubber bands for the day of the contest.

Entry Rules

1. All contestants must use only the two official rubber bands for propelling the tractor. The two rubber bands may be used simultaneously. Approximate size of the rubber bands is 6 mm wide, 1 mm thick, and 170 mm overall length, if cut.
2. The cost of the tractor and its modifications are to be paid for by the contestant(s). All tractors will be returned to the contestants. The winning tractors will be kept for display until the next year's contest, upon contestant's approval.
3. Any type of tractor model is acceptable with the following conditions:
 - a. Weight - total weight of the model ready for testing shall be less than 2.270 kilograms. The weight of the tractor may not be changed after weigh-in.
 - b. Size - maximum size limitation: 360 mm long, 200 mm wide, 230 mm high.
 - c. Drawbar - a rigid drawbar should be attached which would allow a pin attachment of the load. The drawbar shall be between 13 mm and 38 mm from the test surface. A horizontal line of pull will be used.
 - d. Provisions to keep the tractor headed straight

on the test track should be made.

4. The model must be completely assembled less rubber bands when submitted for testing. If an operator will not be present, complete instructions to install rubber bands and operate the model must be included.
5. All modifications must be completed before the tractor is weighed in.
6. Any individual may enter as many models as he desires. Only one prize will be awarded to any individual. The highest placement from multiple entries will determine the prize awarded.
7. Mail entries to the address given on the previous page. All entries delivered personally shall be brought to the Agricultural Engineering Building, North Dakota State University campus, Fargo, North Dakota before 10:00 February 14, 1981.
8. The final decisions on all questions will be left to the judges.

- Sponsored and run by the Agricultural Engineering and Agricultural Mechanization students

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Typical Rubber Band Powered Tractors

Top - Modified Commercial Tractor
Bottom - Home-Made Tractor

