# Engineering and Surveying Techniques and Equipment:

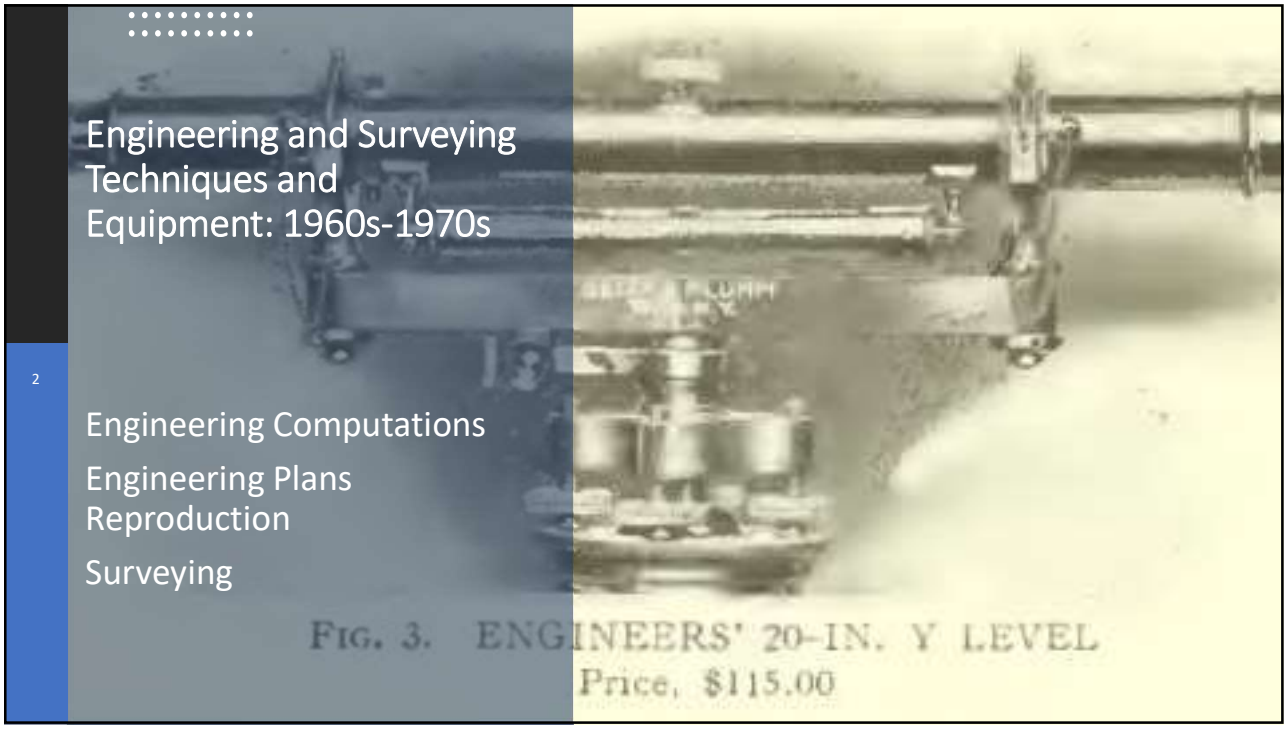
## 1960s-1970s

2020 Spring Conference

**HISTORY COMMITTEE**
Pat Brodin | John Carpita | Ken Hash | Bob Moorhead | John Ostrowski

AMERICAN PUBLIC WORKS ASSOCIATION APWA Washington State Chapter

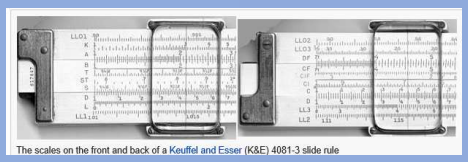
1

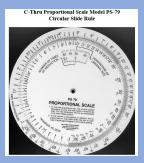



2

# Engineering Computations

- Slide Rules (sljpsticks)
  - A slide rule uses two logarithmic scales to allow rapid multiplication and division of numbers.
  - Calculations performed by aligning a mark on the sliding central strip with a mark on one of the fixed strips, and then observing the relative positions of other marks on the strips.
  - Numbers aligned with the marks give the approximate value of the product, quotient, or other calculated result.


The scales on the front and back of a Keuffel and Esser (K&E) 4081-3 slide rule

3

3

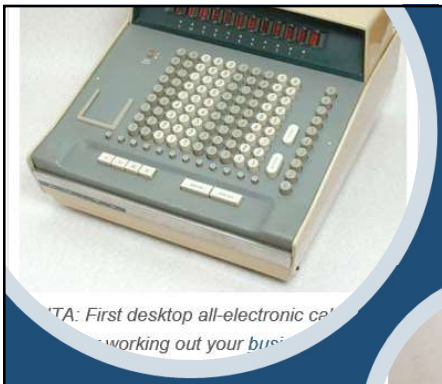
# Engineering Computations

- Curta
  - Small mechanical calculator conceived by Curt Herzstark in pre-WW2 Germany.
  - The Curta was perfected and manufactured in post-WW2 Austria.
  - Curtas were considered the best portable calculators available until they were displaced by electronic calculators in the 1970s.
  - Cost $125-$175 then, $1000 as collectibles now.


disassembled Curta calculator, showing the digit
epped drum behind them

4

4



*TA: First desktop all-electronic ca*
*working out your busi*

*Texas Instruments 'Cal Tech': shape of thing to come. Photo credit: Texas Instruments*

# Engineering Computations

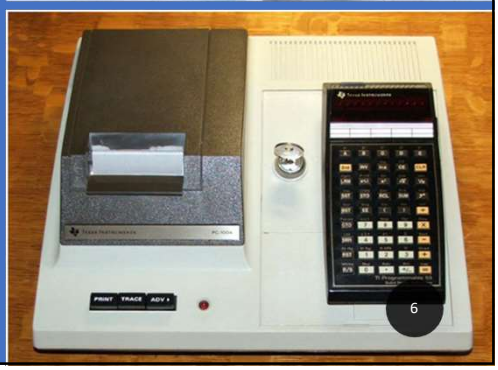
5

- Calculators
  - First electronic desktop calculator was the ANITA, developed in Britain by Control Systems Ltd. In 1961.
  - In 1967, Texas Instruments released its "Cal Tech" calculator that could add, multiply, subtract, and divide, and print results to a paper tape while compact enough to be handheld.
  - Hewlett Packard (HP) launched the first 'scientific' calculator in early 1972.
  - The $395 HP-35 was an almost pocket-sized calculator with trigonometric and algebraic functions.
  - The HP-45 was the second scientific pocket calculator by Hewlett-Packard, in 1973.

5

# Engineering Computations

- Texas Instruments TI-59 (1977}
  - Dark brown plastic with a red ten-digit LED display
  - Powerful and flexible programmable calculator, with more memory than its main HP competitor.
  - Built-in card reader, which accepted slim, flexible cards with a magnetic stripe on the back, to store and retrieve programs or share them with others.
  - Programs could be assigned to one of the alpha keys, so entering a number and pressing one would give you your result.
  - Mounted on a printer with 2-inch paper tape.

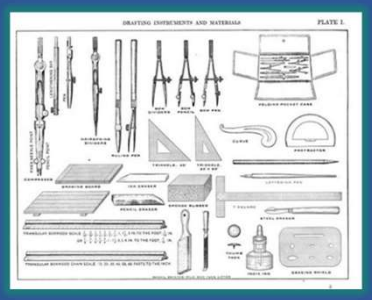


6

6

# Engineering Plans & Reproduction

- Architects and engineers in the 60s and 70s relied on skilled draftsmen/designers to prepare drawings for distribution.
- Myriad specialized instruments used for copying lines, curves, and arcs, from the French curve to the set square and the bow compass, were the tools of the draftsman's trade.



7

7

(WHITEPRINTER)


# Engineering Plans & Reproduction

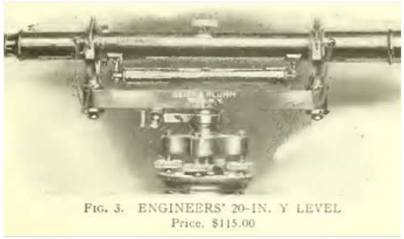
- Drawings in ink on vellum or Mylar.
- Reproduction with various brands and types of large format printers.
- Original mylar drawings stored in bulky cabinets.
- Plan sets rolled and stored in bins,

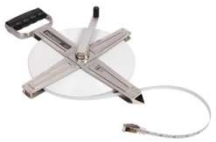
8

8

# Surveying Equipment

- Standard surveying gear in 60s and early 70s:
  - Transit
  - Plumb bobs
  - Steel tape
  - Tension spring handle
  - Level
- Four-person crew



9

9

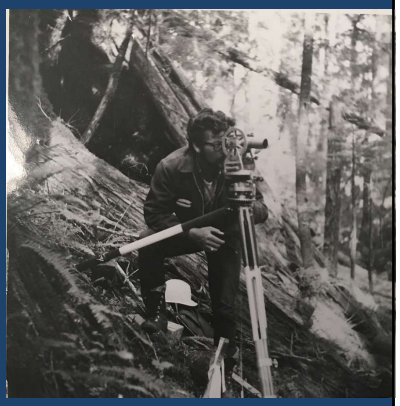
# Surveying Equipment

- First electronic distance meters (EDMS) became available in the mid-1970s.
  - EDM
  - Prisms
- 1 or 2-person crew

10

10


- TVW
- HistoryLink.org
- Wikpedia



# Credits

AMERICAN PUBLIC WORKS ASSOCIATION
APWA
Washington State Chapter

11

11