

**U.S. DEPARTMENT OF ENERGY  
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**PRESENTATION TO  
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD**

**SUBJECT: UNDERGROUND  
TRANSPORTATION METHODS**

**PRESENTER: BILL KENNEDY**

**PRESENTER'S TITLE  
AND ORGANIZATION: SENIOR MINING ENGINEER  
RAYTHEON SERVICES NEVADA  
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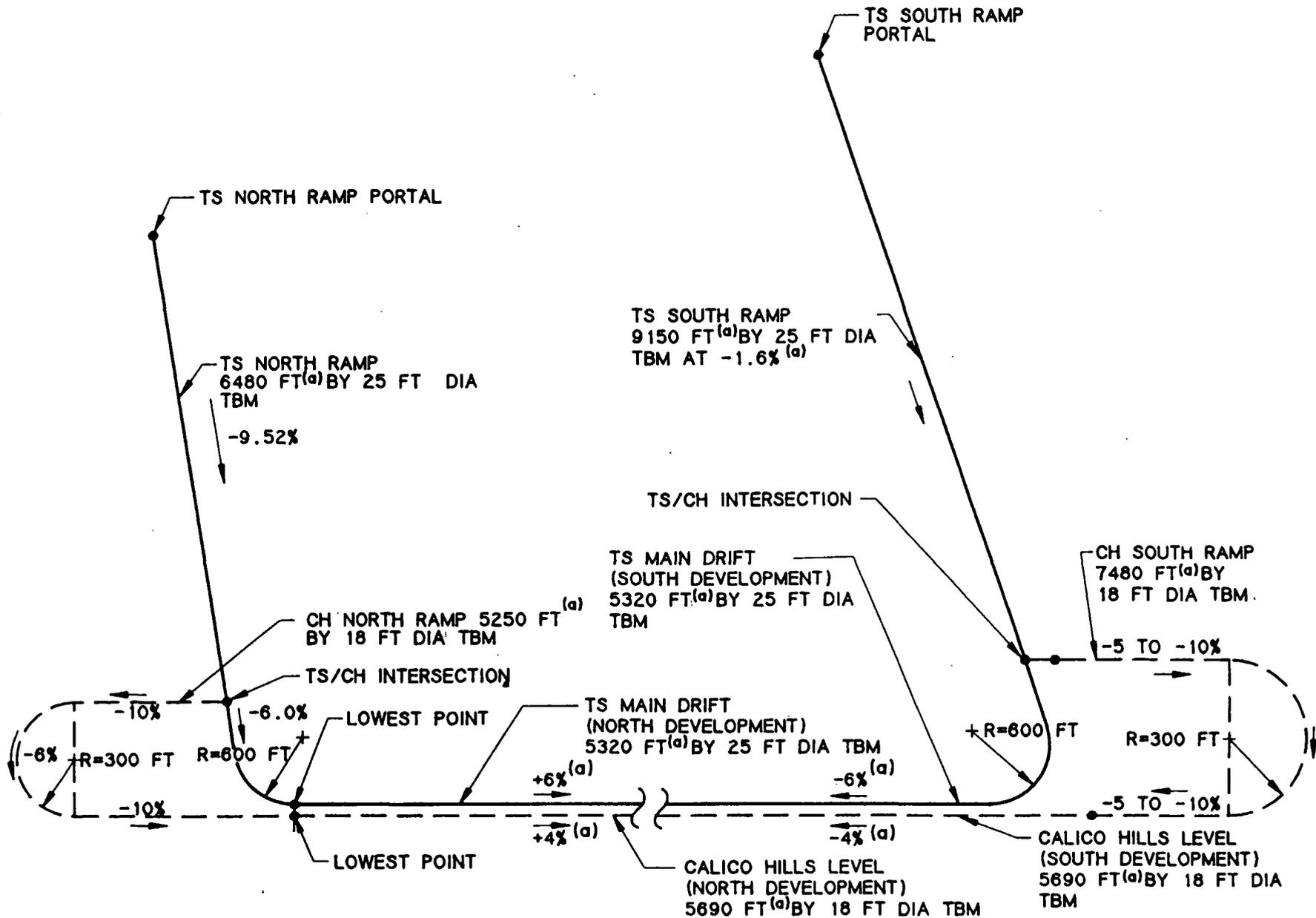
**PRESENTER'S  
TELEPHONE NUMBER: (702) 794-7977**

**SEPTEMBER 18 - 19, 1991**

# **UNDERGROUND TRANSPORTATION METHODS**

- **MUCK HAULAGE**
  - **MAIN HAULAGE**
  - **SECONDARY HAULAGE**
  
- **PERSONNEL TRANSPORT**
  - **OPERATIONS AND MAINTAINANCE PERSONNEL**
  - **TEST PERSONNEL**
  - **VISITORS**
  - **AMBULANCE**
  
- **TRANSPORTATION OF MATERIALS/SUPPLIES**

# GENERAL MECHANICAL MINING PLAN



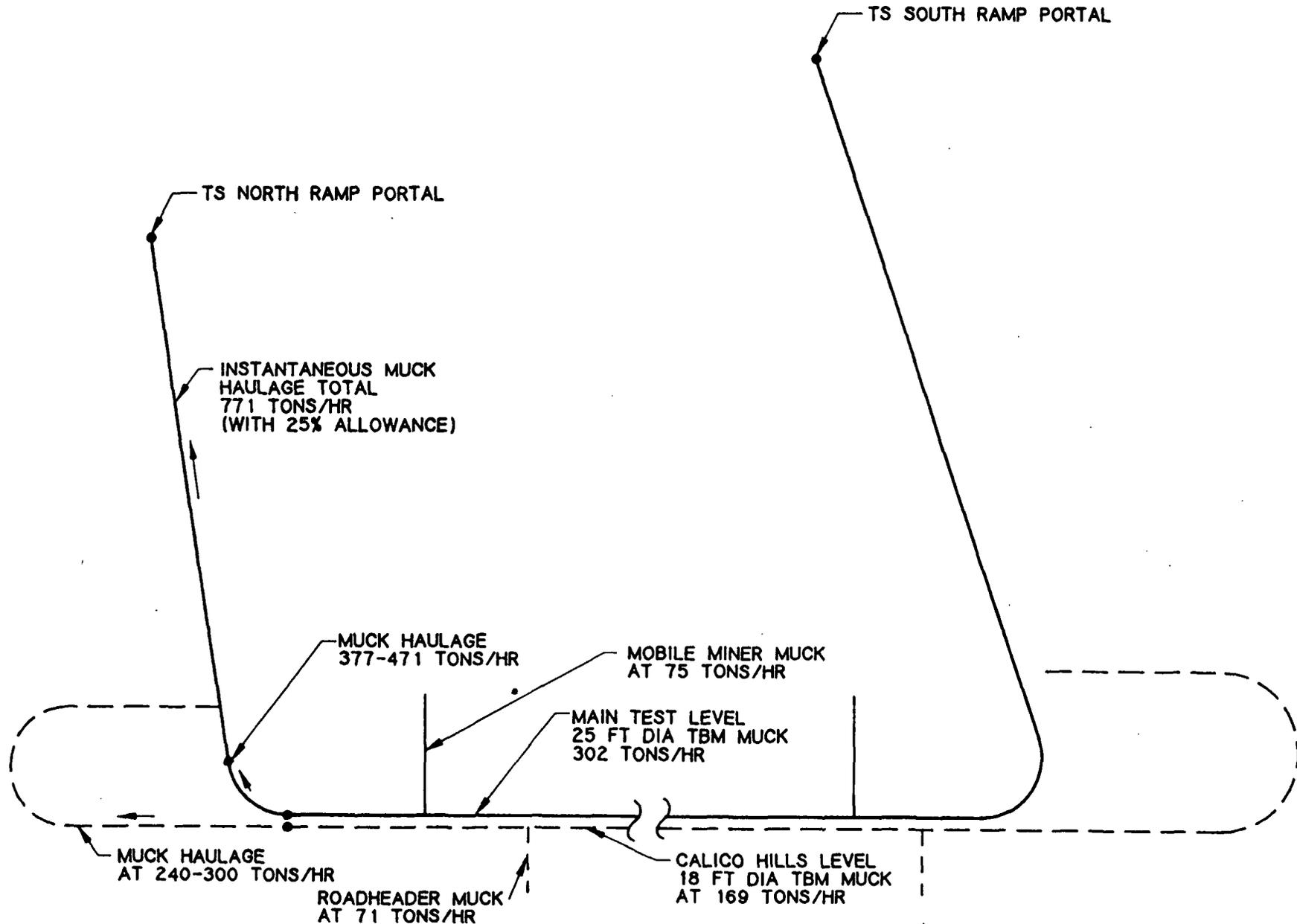
NOT TO SCALE

(a) APPROXIMATE SLOPE DISTANCE AND HAUL GRADE

# HAULAGE SYSTEM CAPACITY

● TS TBM (25' DIA X 8.8 FT/HR)	302 TONS/HR
● TS MECHANICAL MINER (14' X 22' X 3.5 FT/HR)	75 TONS/HR
● CH TBM (18' DIA X 9.5 FT/HR)	169 TONS/HR
● CH MECHANICAL MINER (14' X 16' X 4.5 FT/HR)	71 TONS/HR
● UNCERTAINTY ALLOWANCE (25%)	154 TONS/HR
<hr/>	
● TOTAL	771 TONS/HR

# HAULAGE CAPACITY PLAN



NOT TO SCALE

GOOD FOR NORTH OR SOUTH RAMP DEVELOPM

# **HAULAGE REQUIREMENTS**

- **TONNAGE: 771 TPH (INSTANTANEOUS)**
- **HAULAGE DISTANCE: UP TO 4 MILES**
- **HAULAGE GRADE: 1.6 - 10%**
- **PRODUCT SIZE: LESS THAN 12 INCHES**
- **EXCAVATION AREAS: TWO LEVELS, TWO HEADINGS PER LEVEL**
- **PLANNED DEVELOPMENTS:**
  - **TS NORTH AND SOUTH RAMPS, AND MAIN DRIFT**
  - **TS EAST/WEST DRIFT**
  - **TS IMBRICATE DRIFT**
  - **TS MAIN TEST AREA**
  - **CH NORTH AND SOUTH RAMPS, AND MAIN DRIFT**
  - **CH EAST AND WEST GHOST DANCE DRIFTS**
  - **CH IMBRICATE DRIFT**
  - **CH SOLITARIO DRIFT**

# **MAIN HAULAGE SYSTEM OPTIONS**

- **RAIL AND DIESEL LOCOMOTIVES**
- **RAIL AND ELECTRIC (TROLLEY) LOCOMOTIVES**
- **MONORAIL AND ELECTRIC CABLE HOIST**
- **RUBBER-TIRED/DIESEL VEHICLES**
- **RUBBER-TIRED/ELECTRIC (TROLLEY) VEHICLES**
- **CONVEYOR**

# **MAIN HAULAGE SYSTEM**

## **RECOMMENDATION: CONVEYORS**

- **HIGH CAPACITY**
- **HIGH RELIABILITY**
- **COST EFFECTIVE**
- **WELL- PROVEN**

# CONVEYOR OPTIONS

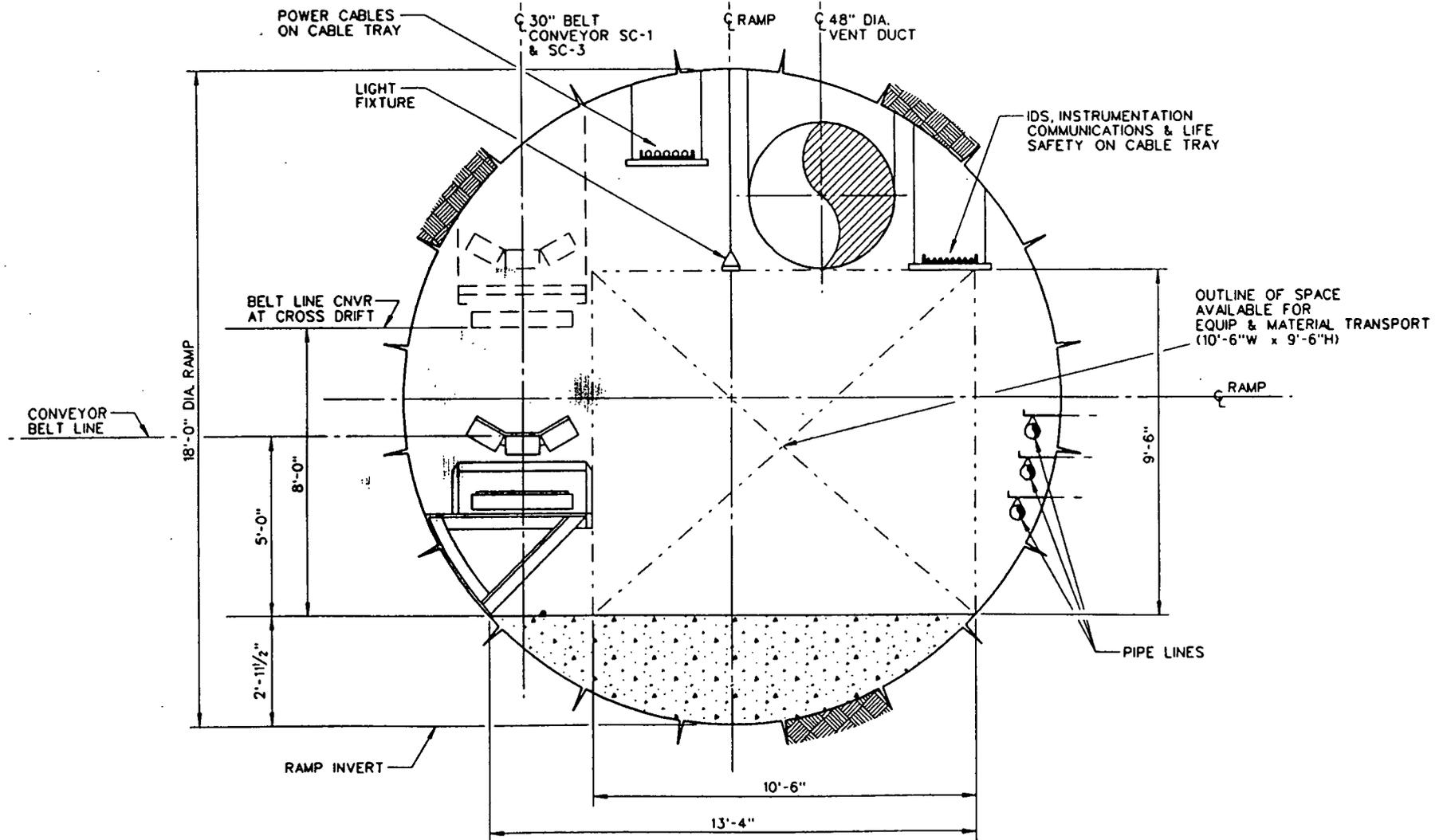
- **WIRE ROPE SUPPORTED - TOP MOUNTED**
- **RIGID FRAME SUPPORTED - SIDE MOUNTED**
- **SPECIAL CONVEYORS FOR CURVES**

**FURTHER EVALUATION OF CONVEYOR OPTIONS  
IS REQUIRED IN TITLE II**

# **CONVEYOR EVALUATION CONSIDERATIONS**

- **CLEARANCE ENVELOPE**
- **SAFETY ISSUES**
- **MAINTAINABILITY ISSUES**
- **OPERABILITY ISSUES**
- **IMPACT TO TESTING**

# 18'-0" DIAMETER RAMP CROSS-SECTION



# **SECONDARY HAULAGE**

## **PRELIMINARY RECOMMENDATIONS**

- **CONVEYORS IN LONGER DRIFTS**
- **RUBBER-TIRED VEHICLES FOR SHORTER DRIFTS AND ALCOVES**

**FURTHER EVALUATION OF SECONDARY HAULAGE OPTIONS IS REQUIRED IN TITLE II**

# **SECONDARY HAULAGE OPTION LOAD - HAUL - DUMP (LHD)**

- **HAULING MUCK**
- **HAULING MATERIALS AND SUPPLIES**
- **CLEARING AND CLEANING ROADWAYS AND DITCHES**
- **MUCKING UPHILL (12-15% GRADE MAX.)**
- **MUCKING DOWNHILL (-17% GRADE MAX.)**
- **EFFICIENCY LIMITATION 300 - 500 FT (ONE WAY)**
- **TRAVEL SPEED UP TO 15 MPH (AVG = 6 - 8 MPH)**

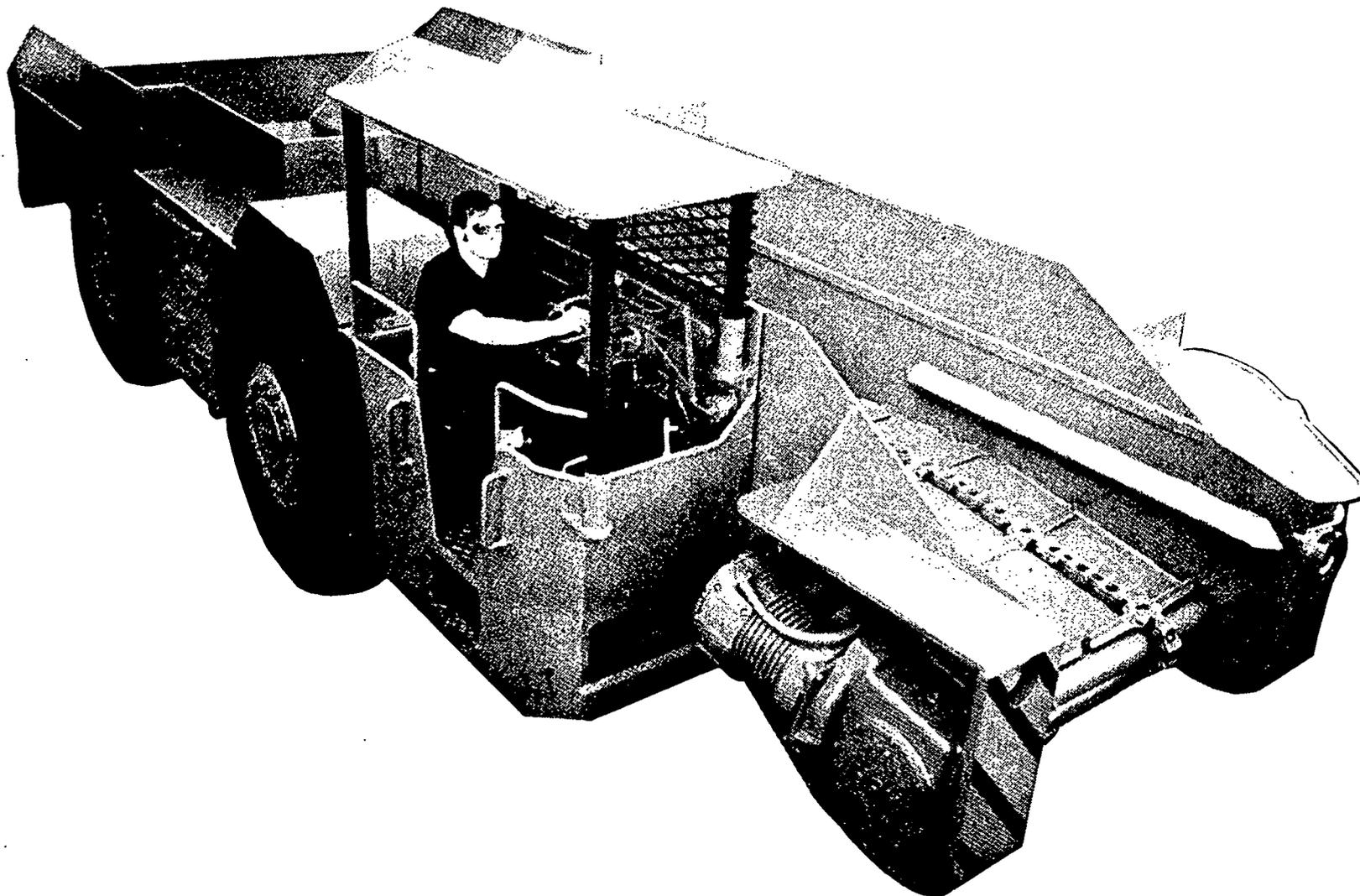
**LHD**



# **SECONDARY HAULAGE OPTION SHUTTLE CARS**

- **FUNCTION: HAULING MUCK**
- **OPERATION: LOAD - TRAM - UNLOAD  
WITHOUT TURN-AROUND**
- **BEST SUITED FOR WIDER ROADWAYS  
(14' OR WIDER)**
- **ELECTRIC OR DIESEL**

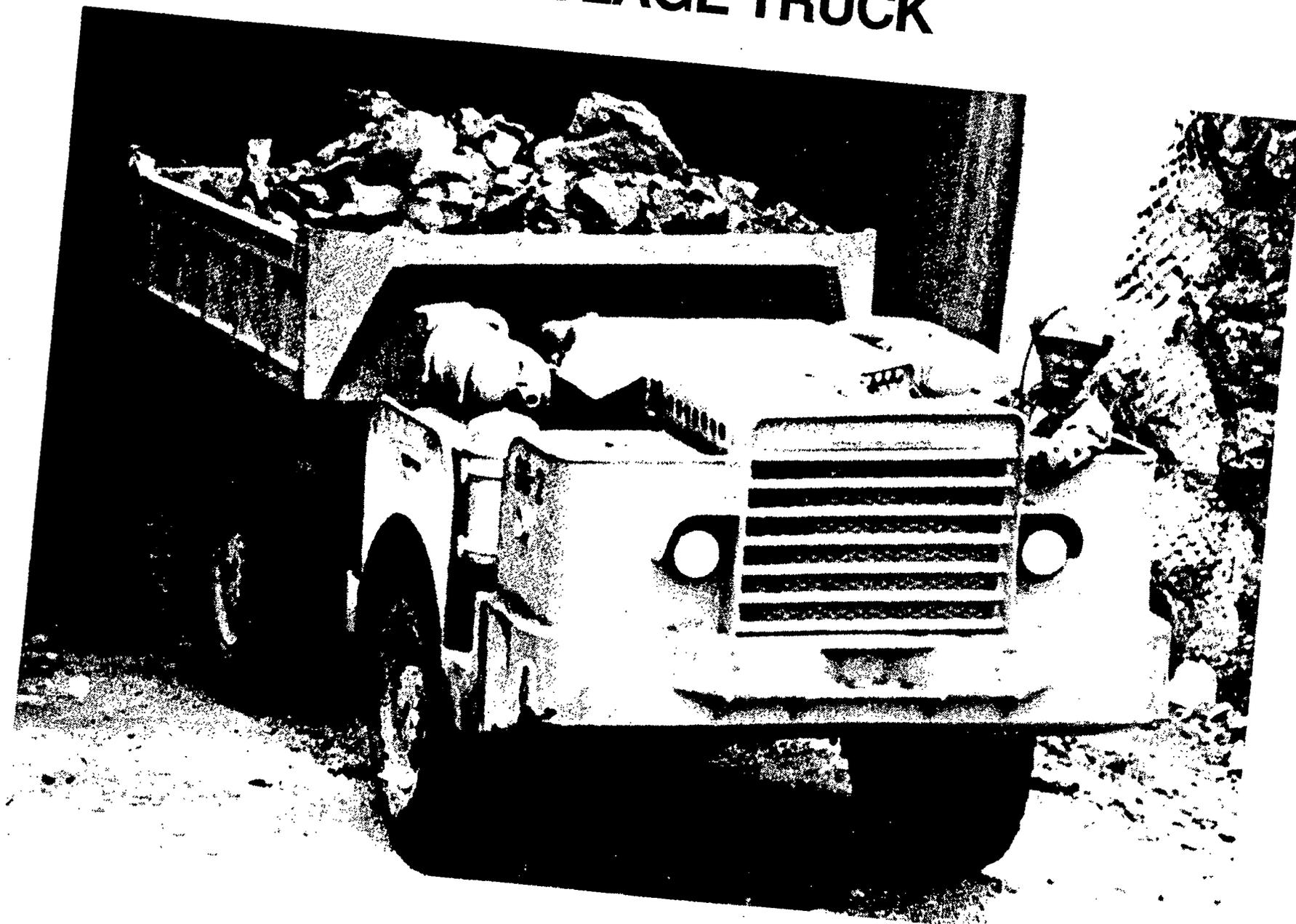
# SHUTTLE CAR



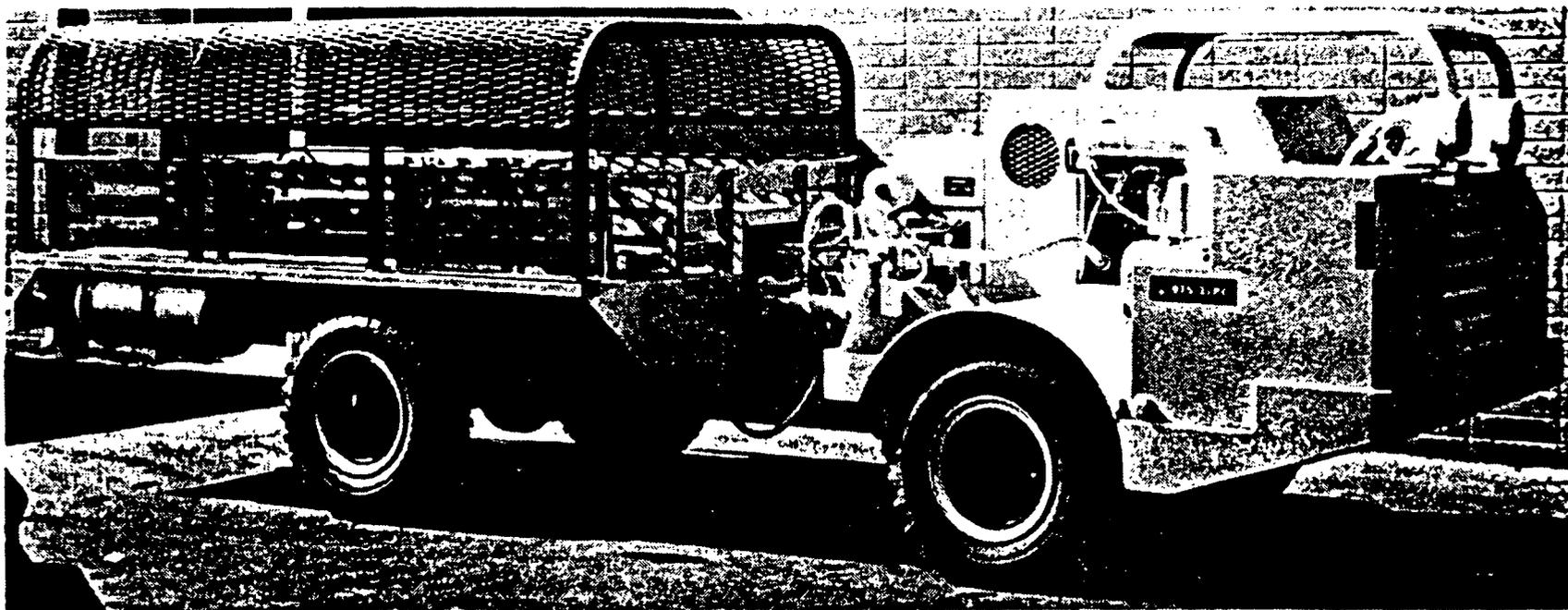
# **SECONDARY HAULAGE OPTION MINE TRUCKS**

- **FUNCTION: HAULING MUCK**
- **TYPES:**
  - **TIP DUMPERS**
  - **TELESCOPING DUMPERS**
  - **PUSH PLATE**

# HAULAGE TRUCK



# PERSONNEL CARRIER



# **UNDERGROUND TRANSPORTATION METHODS**

- **FUNCTION: TRANSPORT MATERIALS/SUPPLIES**
- **PRELIMINARY RECOMMENDATION: RUBBER -TIRED DIESEL VEHICLES**
- **FURTHER ANALYSIS REQUIRED IN TITLE II TO DETERMINE TYPES, SIZES, AND NUMBER OF VEHICLES**

# SUMMARY

## FUNCTION

## TITLE I RESULTS

## TITLE II DESIGN

**MAIN HAULAGE**

**BELT CONVEYORS  
RECOMMENDED**

**EVALUATE MOUNTING  
LOCATION OPTIONS**

**SECONDARY  
HAULAGE**

**LONGER DRIFTS: CONVEYORS**

**EVALUATE MOUNTING  
LOCATION OPTIONS**

**RUBBER-TIRED VEHICLES FOR  
SHORT DRIFTS/ALCOVES/MAIN  
TEST AREA**

**DEFINE SPECIFIC TYPES/  
SIZES**

**PERSONNEL  
TRANSPORT**

**RUBBER-TIRED VEHICLES**

**DEFINE SPECIFIC TYPES/  
SIZES**

**SUPPLIES  
TRANSPORT**

**RUBBER-TIRED VEHICLES**

**DEFINE SPECIFIC TYPES/  
SIZES**