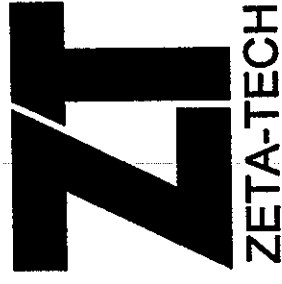


# Computerized Maintenance Planning and Reporting Systems



Allan M. Zarembski, Ph.D., P.E.

ZETA-TECH Associates, Inc.

900 Kings Highway North

Cherry Hill, NJ 08034

Phone: (609) 779-7795 Fax: (609) 779-7436

# Computerized MOW Systems

- Inspection
  - Track inspection
  - Automated
- Data bases
- Planning systems
  - Short term
  - Medium term
  - Long term

# Inspection Support

- Hand held computers for track inspectors
- Automated “checking” of exception
- Verification by supervisors
- Input into data base

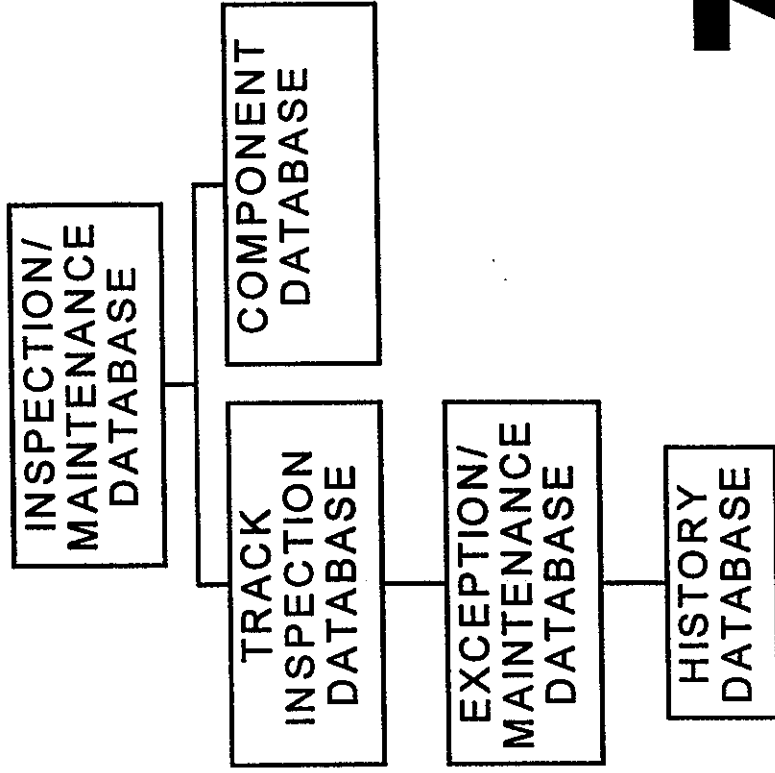
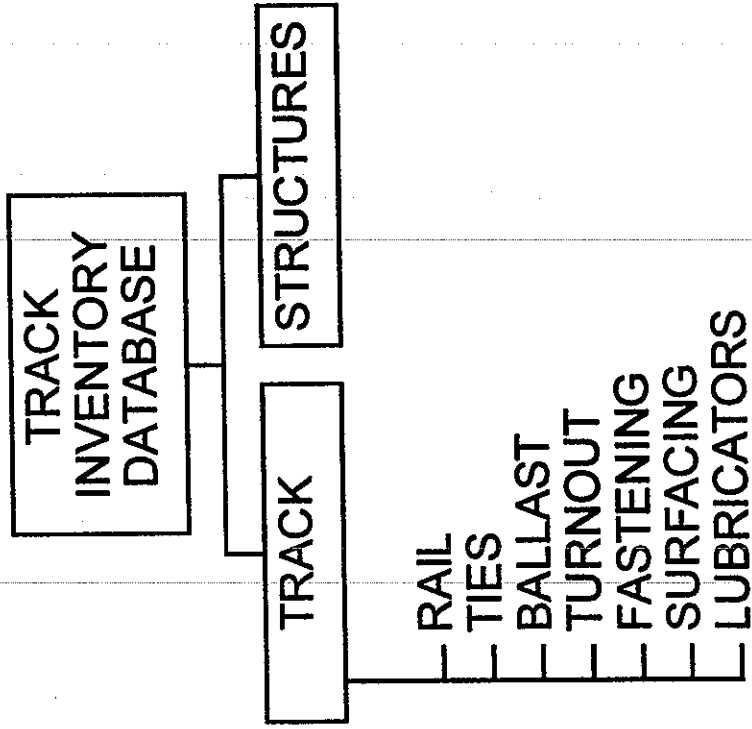
# Data Bases

- Inventory of Track and Components
- Track Geometry
- Track Maintenance History
- Structures, Signals, Other Systems
- Interact with Inspection and Planning Systems

# Work Planning

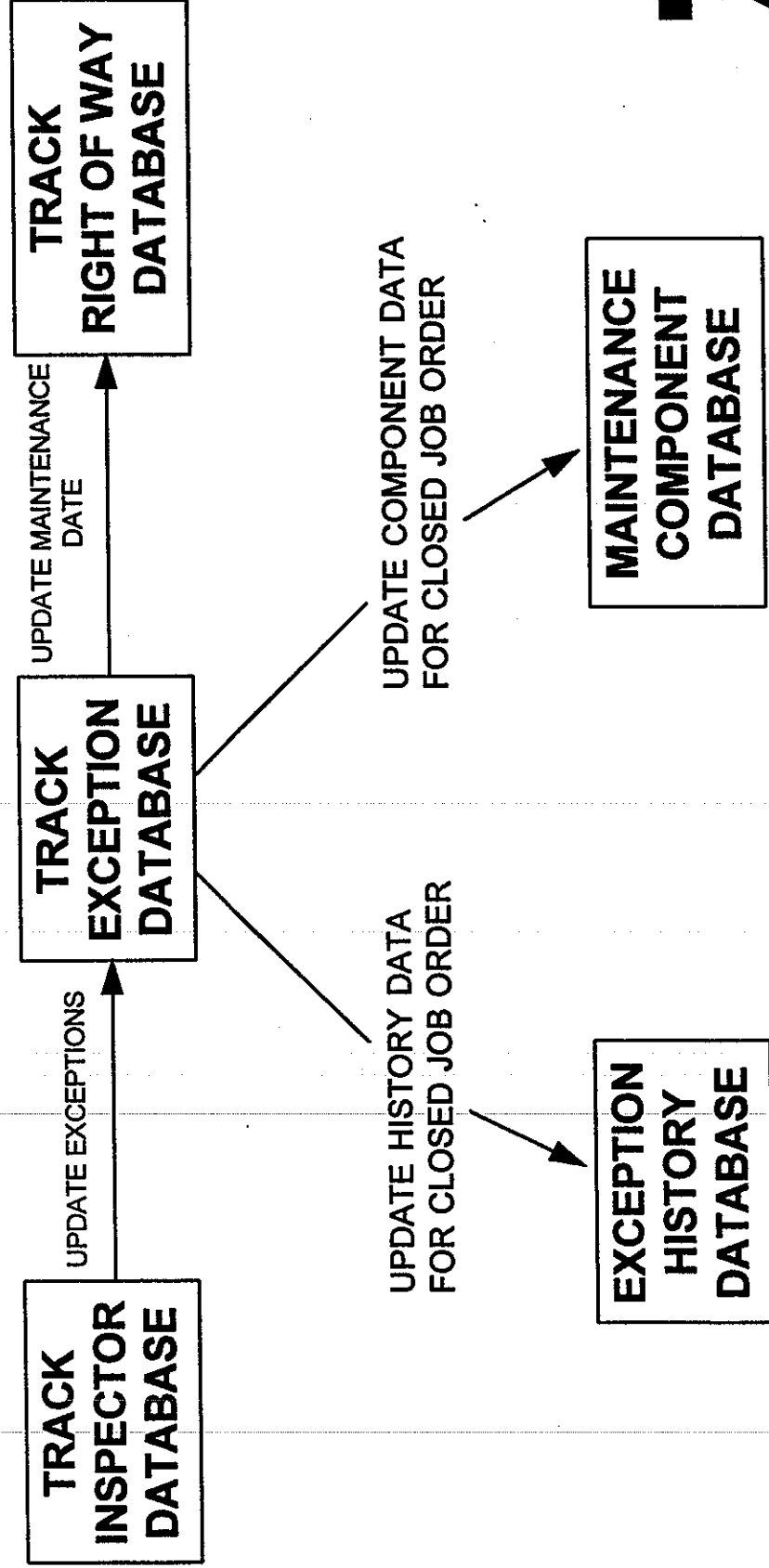
- Response to exceptions
  - Priority defects - immediate
  - Maintenance defects - job order system
- Work planned from Job Order System
- Automated record keeping
- Automated inventory control
- Updated system data base

# M.O.W.I.S.

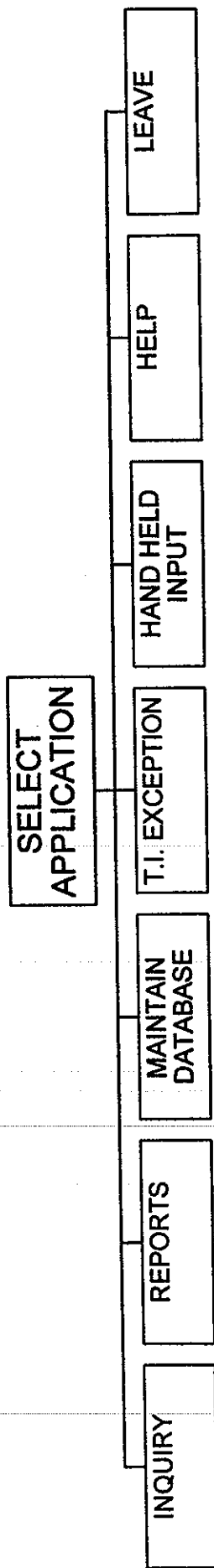


# M.O.W.I.S. System Database

## Flow Chart



# Inspection/Reporting System Overview





# Baltimore Mass Transit Administration

## Job Order Summary (Light Rail)

EXCEPTION REFERENCE	CHAIN MARKER N/E	CHAIN MARKER S/E	TR NO	SW ID NO	CMP CDE	DF CDE
LT392	N 400	N 405	1		F02	D02
LT393	NW 450	NW 451	1	123	J06	D02
TE356	WE 222		1		R01	D01
TE357	MW 347+15	NW 346+25	2		R01	D25
TE358	NW 347+15		2	RA9A	S05	D32
TE359	NW 342+05		2	RA1A	S05	D32
TE361	NW 228+20		2	P05B	S05	D29
TE362	NW 421+10		1		R01	D32
TE363	NW 378+0		1		C03	D18



Baltimore Mass Transit Administration  
 History Report (Light Rail)

EXCP. REF. NO.	CHAIN MARK. N/E	TRK. LOC.	SWITCH ID NO	COMP DEF. CODE CODE	LABOR HOURS	WORK ORDER CLOSEOUT DATE
TE338	NW 439+80	ML		J01 D32	5	4/30/91
TE340	MW 347+15	ML 2		R01 D25	52	5/21/91
TE341	NW 347+15	ML 2	RA9A	S05 D32	52	6/13/91
TE342	NW 342+05	ML 2	RA1A	S05 D32	200	9/03/91
TE343	NW 231+13	ML 2	PO7B	S11 D32	55	7/27/91
TE344	NW 228+20	ML 2	PO5B	S05 D29	65	7/27/91
TE345	NW 421+10	ML 1		R01 D32	28	5/16/91
TE346	NW 378+0	ML 1		C03 D18	20	5/20/91
TE347	NW 389+65	ML 1	RP3B	S11 D18	6	5/08/91
TE348	NW 421+30	ML-1		R01 D32	28	6/19/91



# Baltimore Mass Transit Administration Component Inventory Report (Light Rail)

COMPONENT NAME	NO IN STOCK
10' END APPROACH	7
11'-0" SW. PTS. LEFT HAND	15
11'-0" SW. PTS. RIGHT HAND	9
12' END APPROACH	69
16' END APPROACH	2
19'-6" SWITCH POINT, L.H.	8
19'-6" SWITCH POINT, L.H. STR.	5
19'-6" SWITCH POINT, R.H. CURVE	3
19'-6" SWITCH POINT, R.H. STR.	6
30'-0" STOCK RAIL-L.H. CUR. TO L.H.	6
30'-0" STOCK RAIL-R.H. CUR. TO R.H.	9
30'-0" STOCK RAIL-R.H. STR. TO L.H.	1
30'-0" STOCK RAIL-L.H. STR. TO R.H.	4
31' TWIN TIE PLATE ASMBLY.	53
39" TWIN TIE PLATES	77
39' 0" CONTROL-COOLED RAIL	10
39' 0" HEAT-TREATED RAIL	58
39' THIRD RAIL - COMPOSITE	93
39'-0" CLOSURE RAIL	23



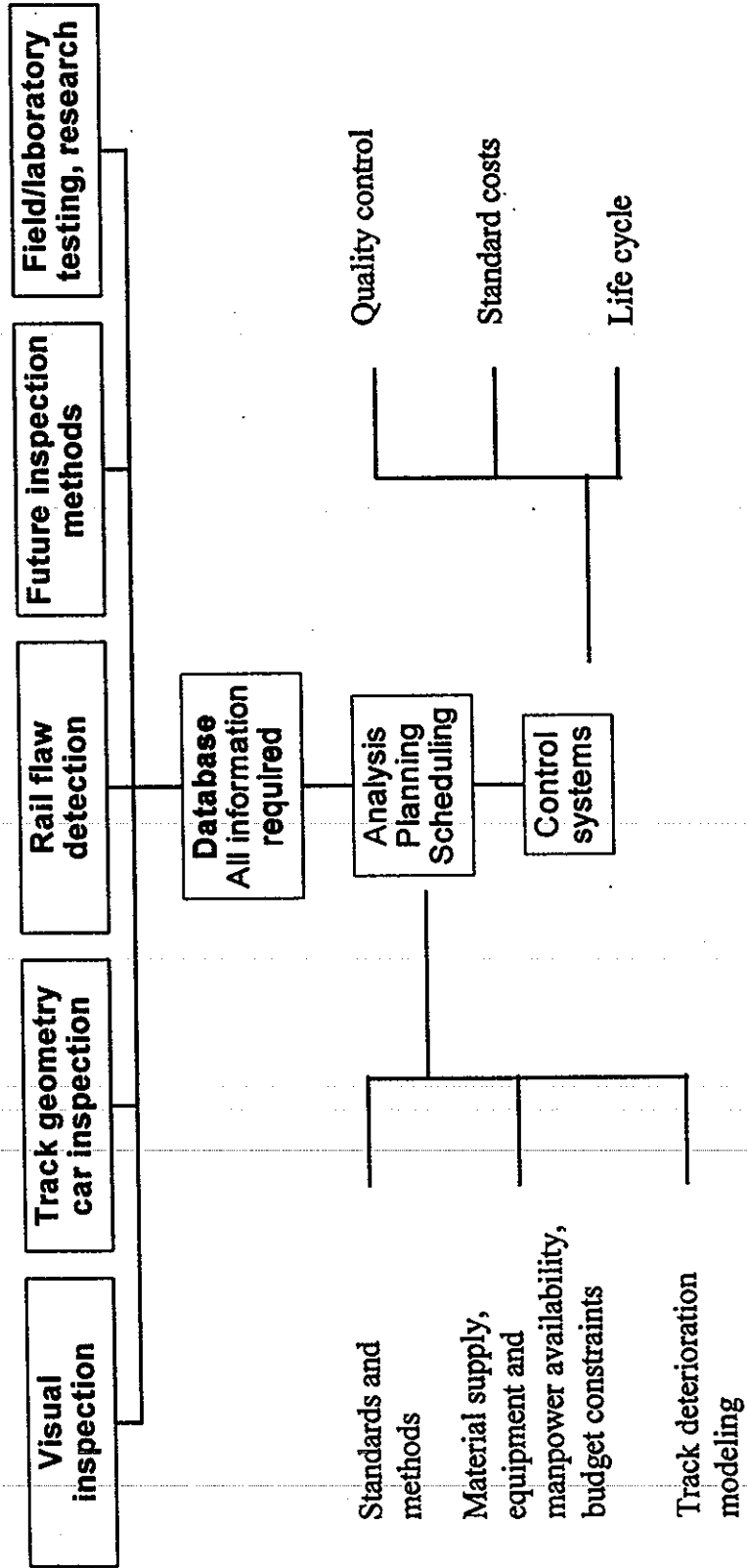
# Maintenance Planning

- Forecast of
  - Work requirements
  - Component requirements
  - Equipment and manpower needs
  - Budget requirements
- Forecast can be
  - Segment specific
  - System wide
- Predict component requirements
  - Rail
  - Ties
  - Surfacing
  - Turnouts
- Alternative analyses
  - Economic trade-offs

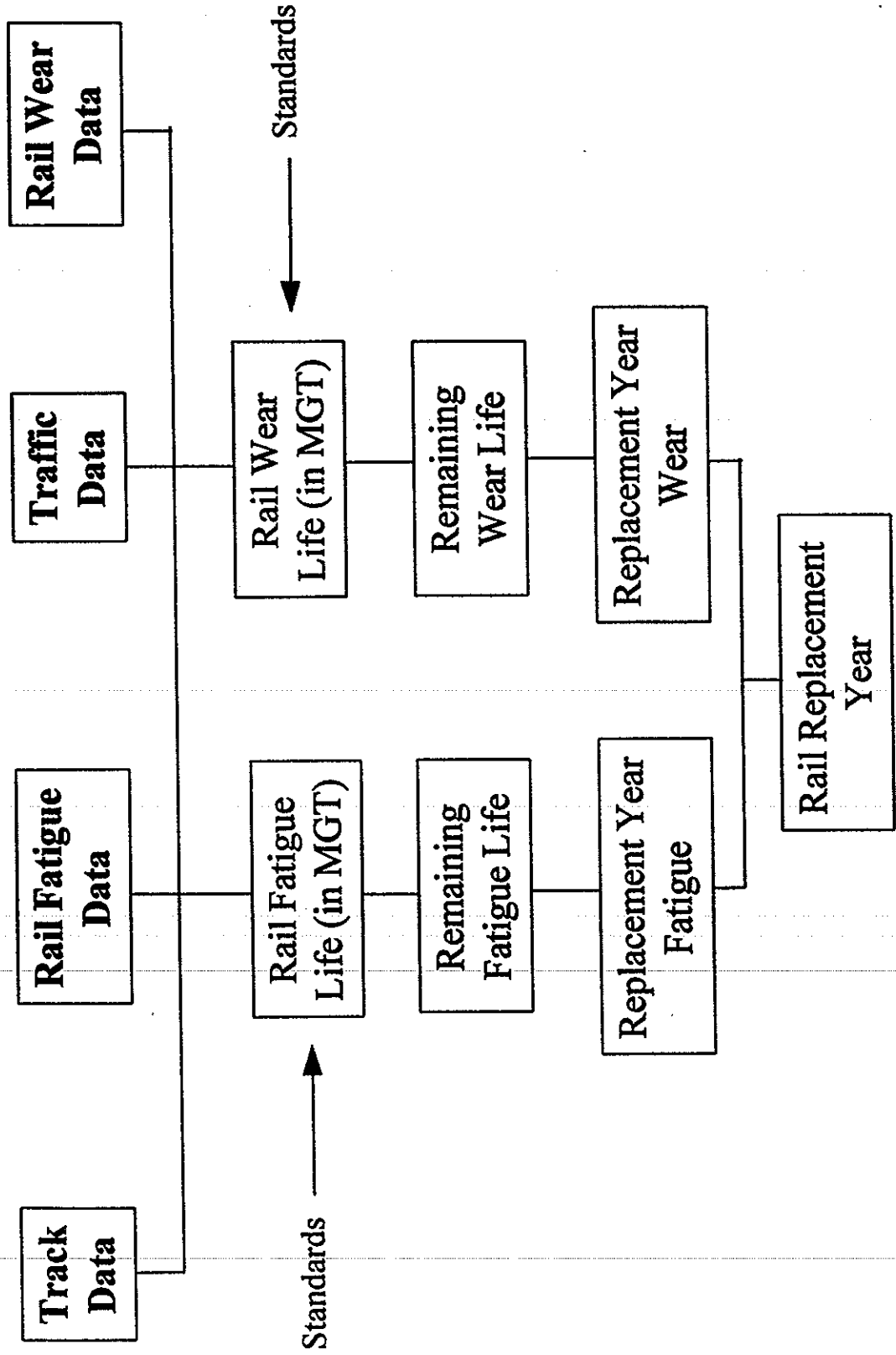
# Maintenance Planning Systems

- **Short Term**
  - Immediate response to priority defects
  - Job scheduling
  - Time horizon < 6 months
- **Medium Term**
  - Response to maintenance defects
  - Scheduling of contractors
  - Scheduling of internal work forces
  - Time horizon 6 to 24 months
- **Long Term**
  - Forecast of component, equipment & manpower needs
  - Multi-year budget forecasts
  - Long term scheduling
  - Time horizon > 24 months

# Maintenance Planning Overview



# Rail Predict



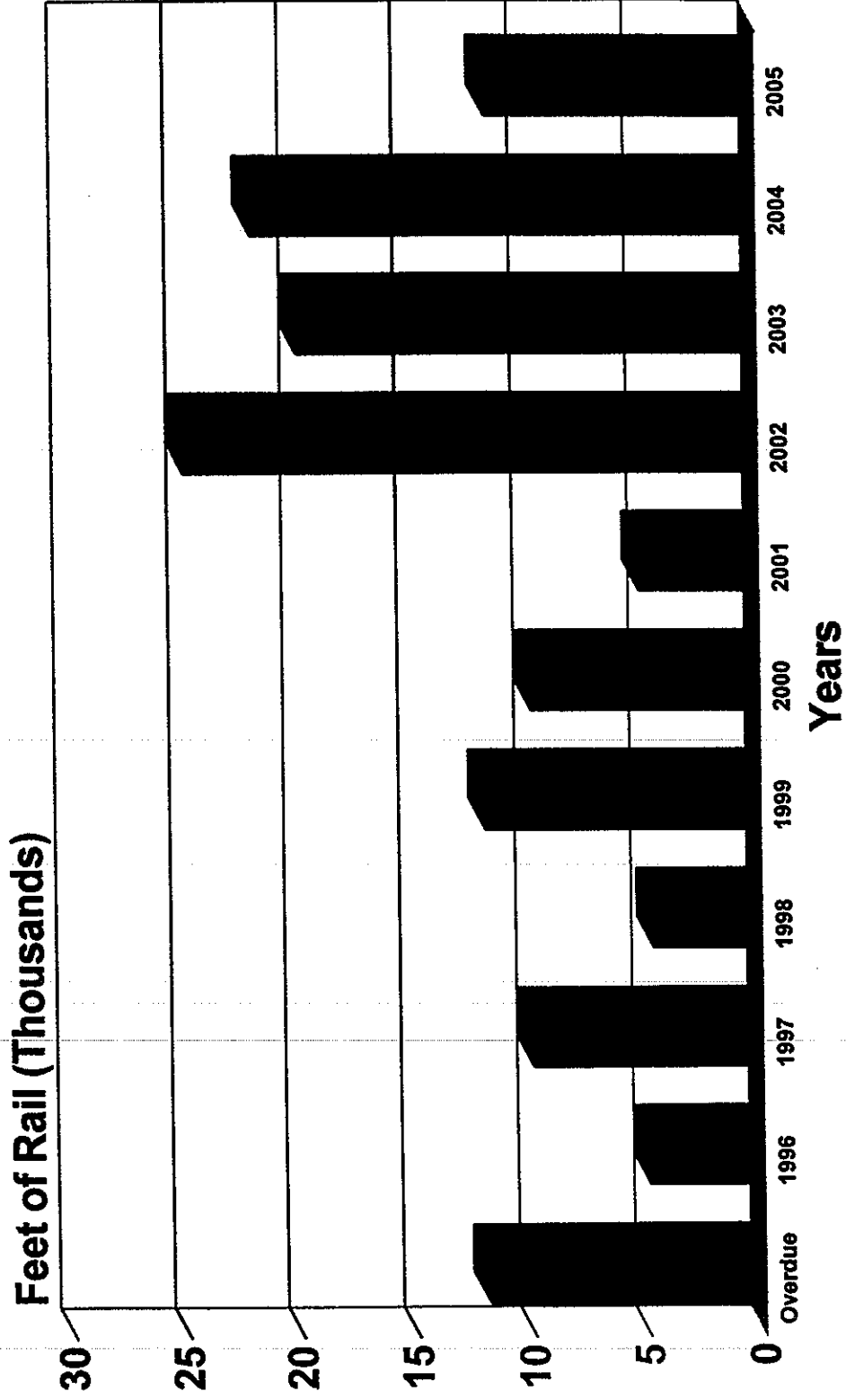
# Track Maintenance Planning Using Forecasting Software

From MP	Length (ft)/Rail WGT	Curve/ Dir	Year Laid	Defect/ Mile/ Year	Annual MGT	Repl. Year
0.00	106 136	0.00 T	1981	0.00	22	2001.4
0.02	349 136	5.00 L	1981	0.50	22	1995.5
0.06	910 132	0.00 T	1978	0.00	22	1994.7
0.24	1198 136	2.50 R	1992	0.00	22	1995.8
0.46	200 136	0.00 T	1981	1.00	22	2001.4
0.50	1625 136	5.00 R	1981	0.00	22	1997.7
0.81	255 136	0.00 T	1981	0.00	22	2001.4
0.85	160 136	5.00 R	1981	0.00	22	1997.6
0.88	1,100 136	0.00 T	1981	0.50	22	2001.4

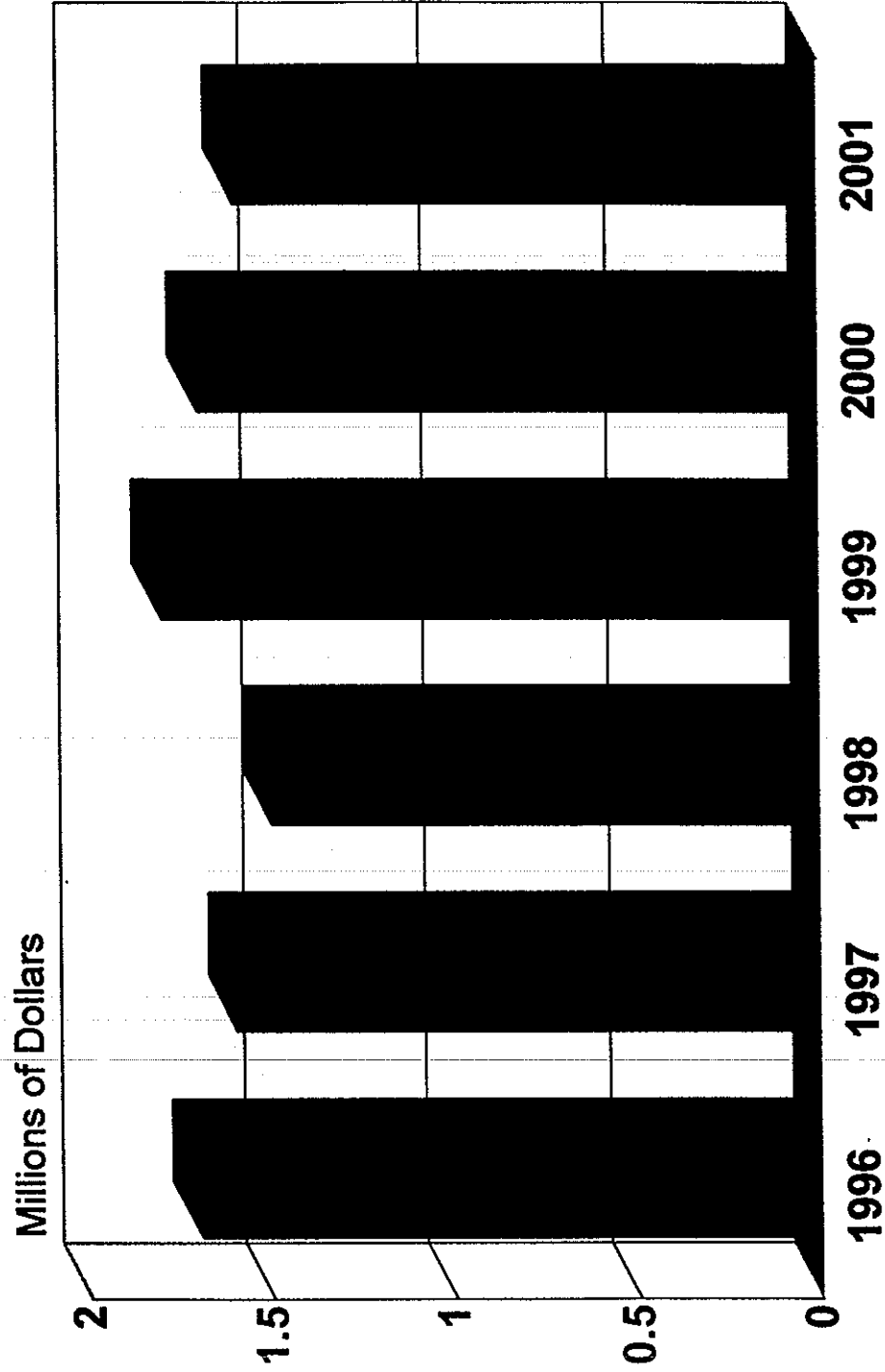




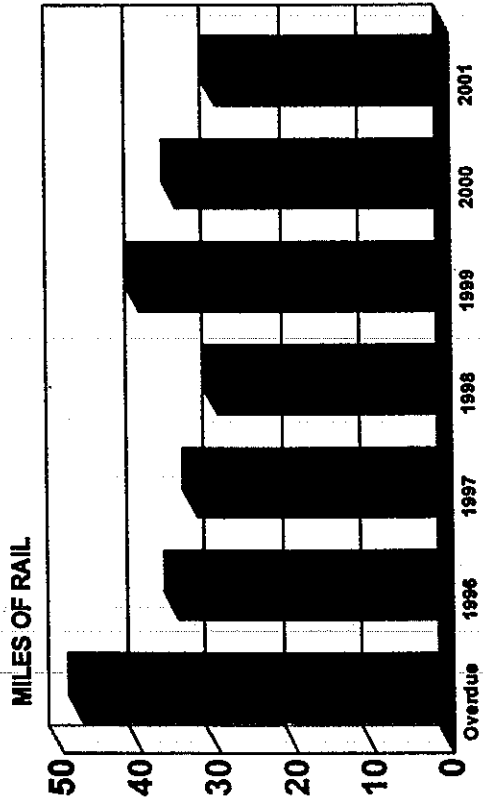
# Rail Replacement Forecasts



# Budget Forecast System Rail Purchases



### RAIL MAINTENANCE REQUIREMENTS



### SURFACING MAINTENANCE REQUIREMENTS

MILES OF SURFACING



### TIE MAINTENANCE REQUIREMENTS

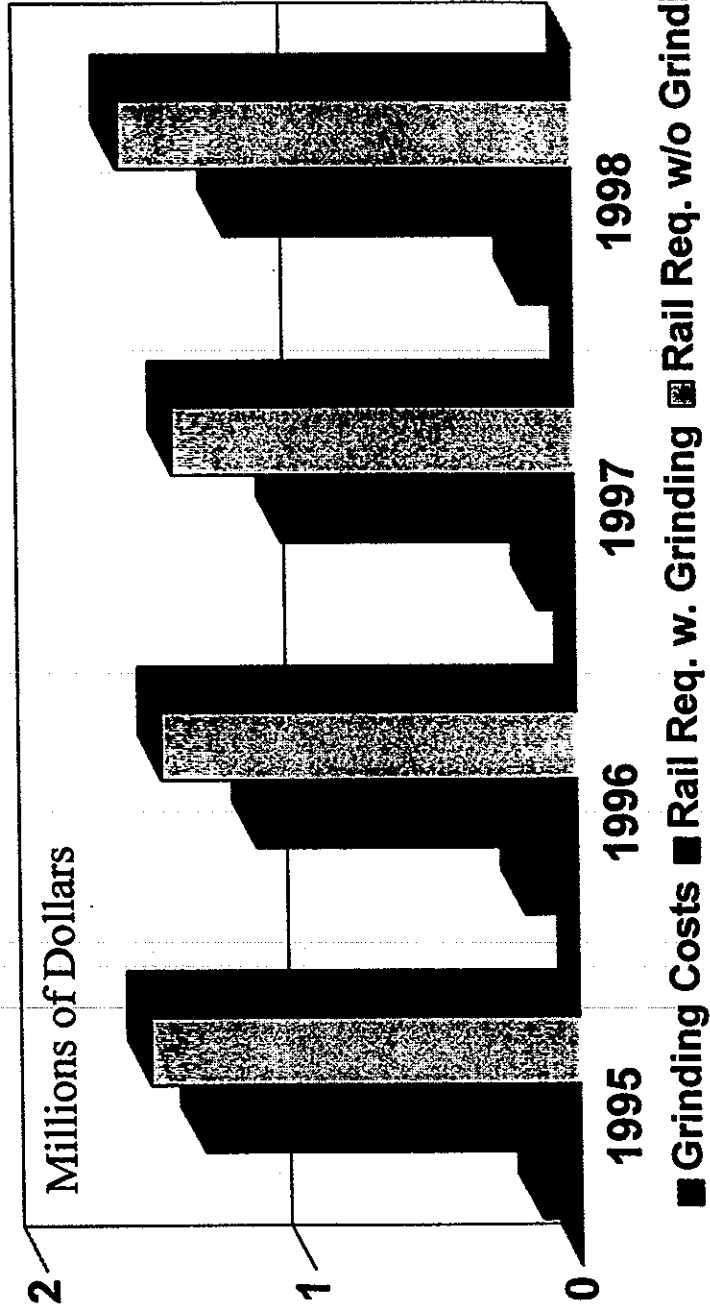
NO. OF TIES (Thousands)



# What If Capability

Analysis of alternate maintenance options/strategies

## SYSTEM RAIL BUDGET



# Summary

- New generation of computerized tools for
  - Inspection
  - Data Base
  - Forecasting
  - Planning
- Improve accuracy and reliability of information available
- Allow for timely response to short and medium term conditions
- Provide long term forecasts
  - Planning
  - Scheduling
  - Budgeting
- Supplemental analyses
  - What if analysis
  - Alternate MoW strategies
  - Effect of deferred maintenance