FAILED PINION
(front part)
ONE OF NINE DRIVE PINIONS
FAILED PINION
(Front Part)
FAILED PINION
(Rear Part)
BROKEN MAIN GEAR TOOTH

Found during initial inspection

Crushed and indentation caused by broken pinion running out of mesh with main gear
BROKEN PINION GEAR TOOTH

Top of tooth damaged by main gear when out of mesh
BROKEN PINION GEAR TOOTH

Chunk of gear tooth and broken support bearing outer race
Assembly and pinion removed to show damaged teeth of main gear
DAMAGED GEAR TEETH ON MAIN GEAR
SPLINED DRIVE SHAFT

One end connects to gear box and other end connects to the splined pocket of the drive pinion
SPLINED SHAFT

Mounted in gear box output
Splined pocket of pinion receives drive shaft connected to output of gear box
SPLINED DRIVE SHAFT OF BROKEN PINION

Destroyed when pinion failed
INSIDE MAIN BEAM

Looking out front of TBM

Cutterhead has been removed and bolted to the tunnel face.
Bearing Bypass Cavern

*In tunnel side wall*

Blasted 300 ft. from tunnel face behind TBM trailing gear
Bearing Bypass Chamber

Housing new main bearing and man-lift
ROCK BOLTS & STRAPS

Supporting roof bypass cavern
FRACTURED ROCK

- Fractured rock above Bypass cavern prevent TBM gripper from being used to walk past cavern.
- A “walking shoe” was fabricated and bolted to the tunnel floor.
Walking shoe attached to tunnel floor allows moving TBM without using the gripper as it moves past bearing bypass cavern.
Bypass Cavern

Looking back from face

Note: gripper shoe is off the wall
OVERHEAD MONORAIL SYSTEM

50 ton monorail system to lift and move main bearing
MAIN BEARING

Damaged main bearing removed from TBM on 8/16/06