DelDOT Bridge Management Program

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DelDOT Bridge Management Engineer

DelDOT Bridge Management Program

Agenda

1. Background
2. Current State of Bridge Inventory
3. Key Issues Affecting Our Bridge Inventory
4. Bridge Asset Management
    - A. Deficiency Formula Prioritization Process
    - B. Bridge Preservation Mechanisms
    - C. Performance Measures
    - D. Effectiveness of Bridge Program

DelDOT Bridge Management Program

Background

- Maintain approximately 13,268 lane miles
- ~90% of all roads and 98% of bridges are State-owned
- Bridge Structural Deficiency Percentage is in the top 5 in the nation among states
- Manage 1,626 state-owned bridges
- Inspect, maintain and manage:
  - 37 dams
  - 500 overhead sign structures
  - 150 high mast lighting structures
  - one parking garage

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Bridge Management Section Core Functions

- Inspect Bridge, Dam, Cantilevered Traffic Signals, High Mast Lighting and Overhead Sign Structures
- Maintain Bridge, Cantilevered Traffic Signals, High Mast Lighting and Overhead Sign Structure Databases
- Maintain Bridge Load Ratings
- Process Overweight Vehicle Permits
- Maintain Pontis Bridge Preservation/Deterioration Models
- Prioritize Bridge Preservation Needs
- Respond to High Priority Reports

DELDOT BRIDGE MANAGEMENT PROGRAM

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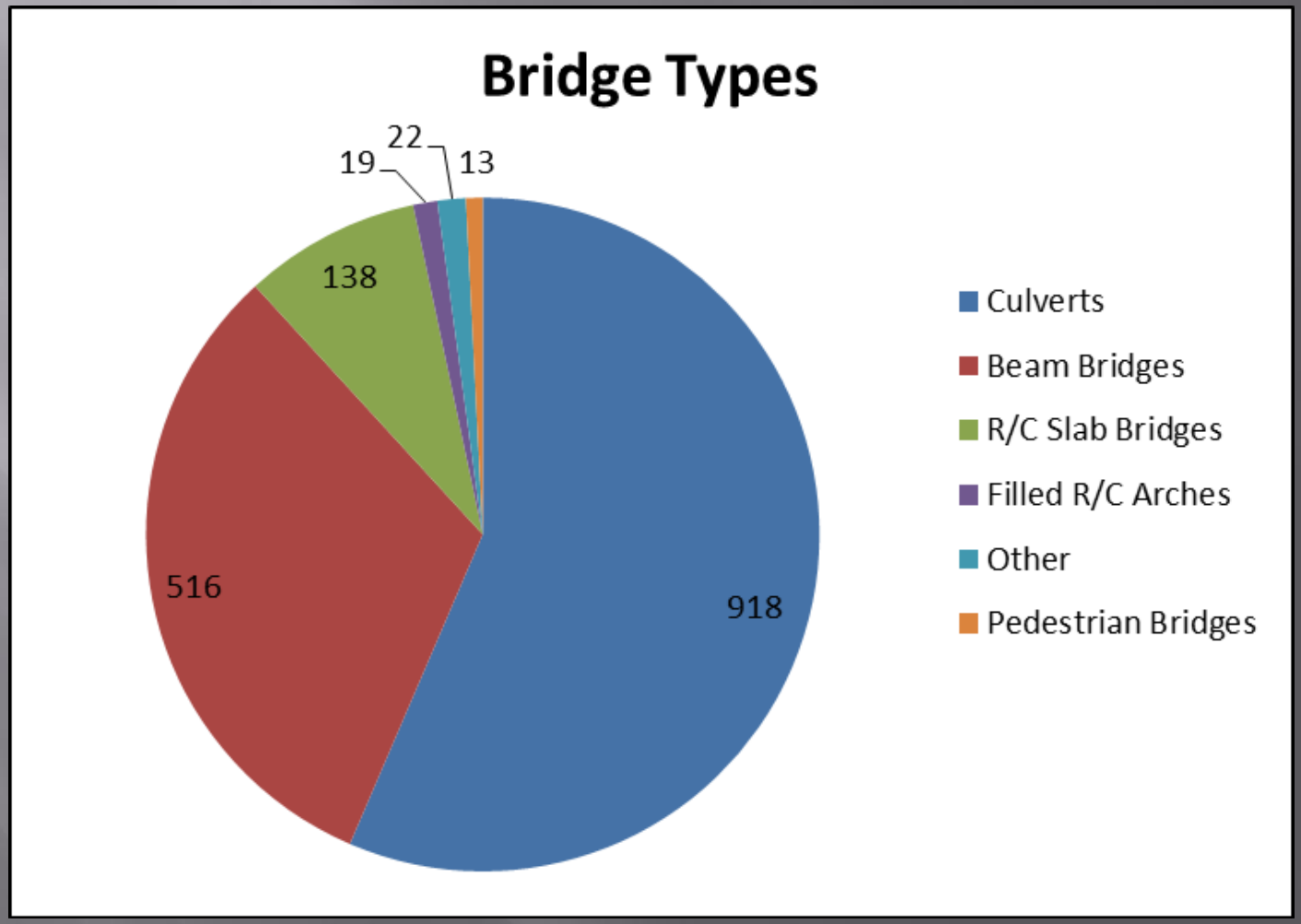
Current State of Bridge Inventory

As of 1/1/15, we have 1,626 bridges in our inventory



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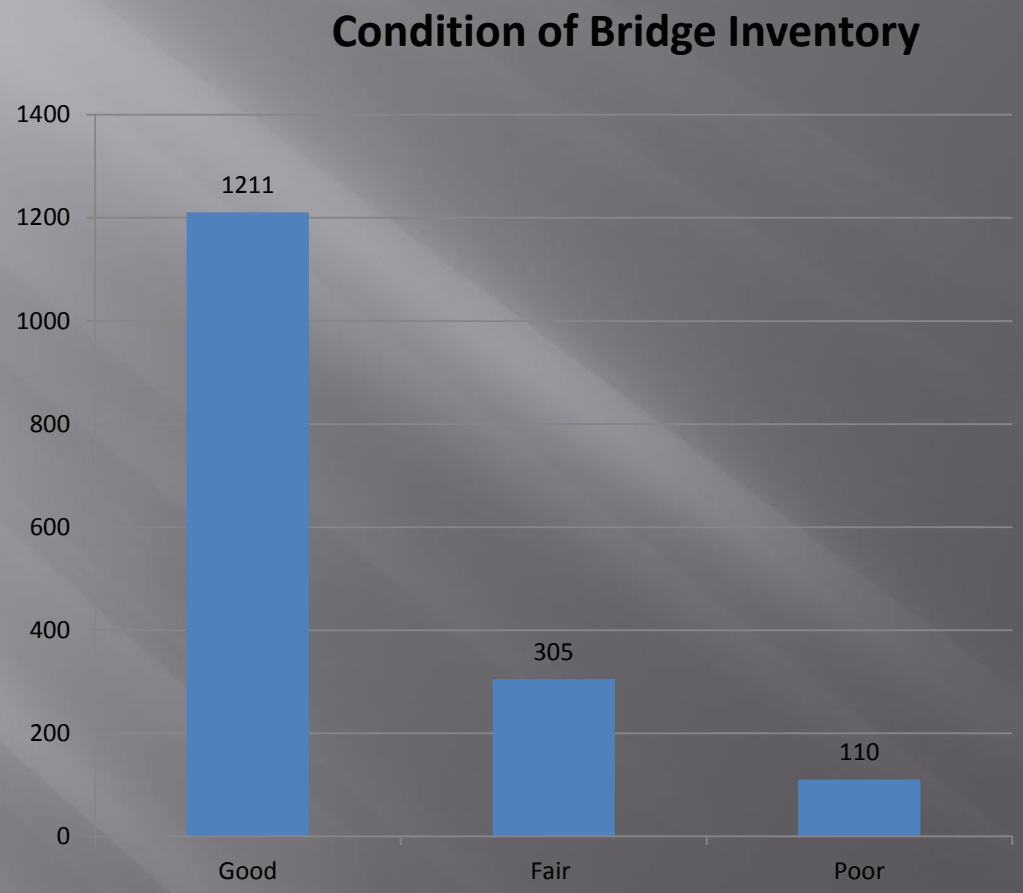
Current State of Bridge Inventory



Total of 1626 Bridges

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Current State of Bridge Inventory

2014 Bridge Performance

6.8% of Bridge Inventory is Structurally Deficient (SD)

25.6% of Bridge Inventory is Fair & Structurally Deficient (74.4% Good)

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Key Issues Affecting Our Bridge Inventory

1. **Corrugated Metal Pipes (CMP's)**
2. **R/C Decks**
3. Scour
4. Paint of Steel Bridges
5. Substructure Deterioration (Joints)

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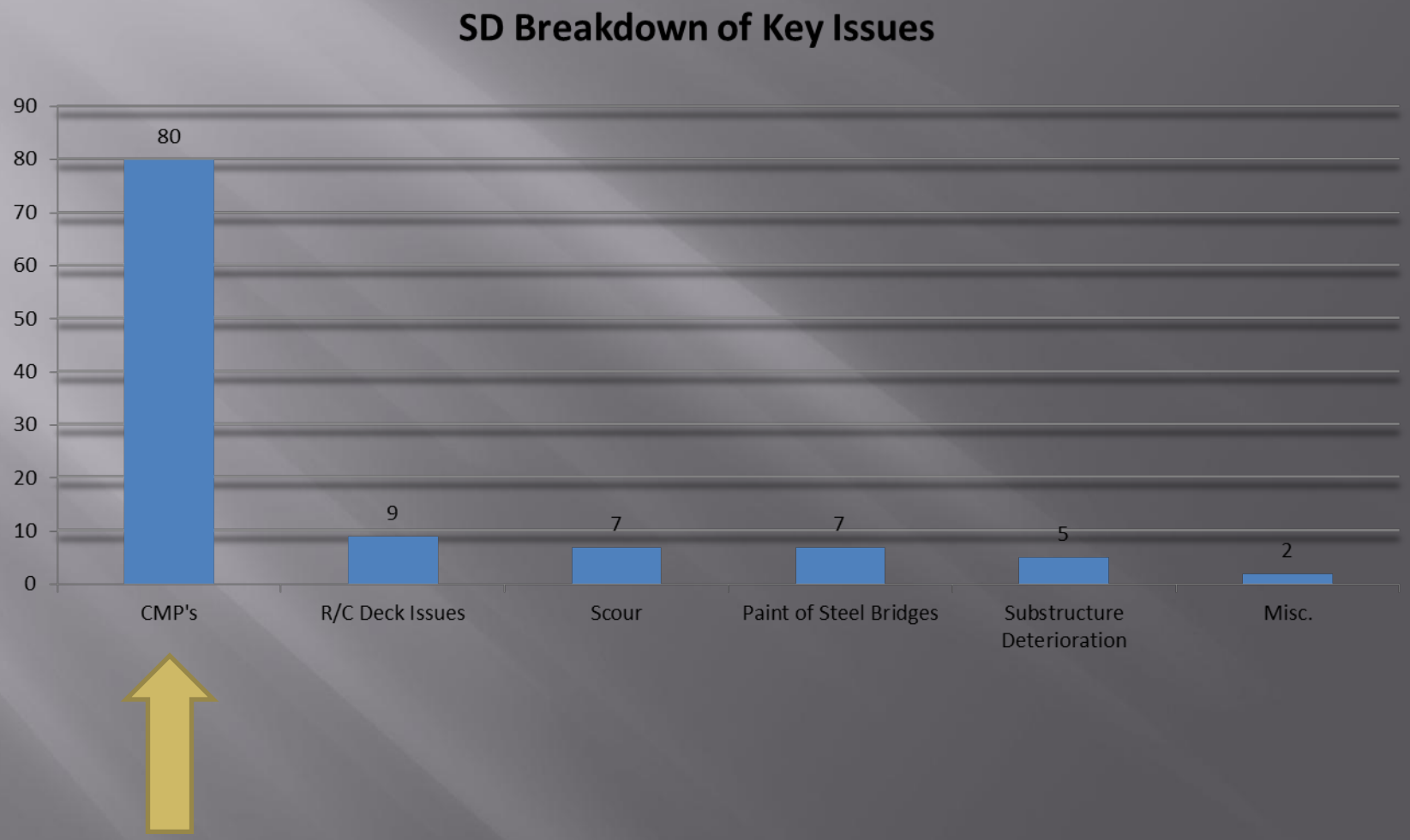
Key Issues Affecting Our Bridge Inventory



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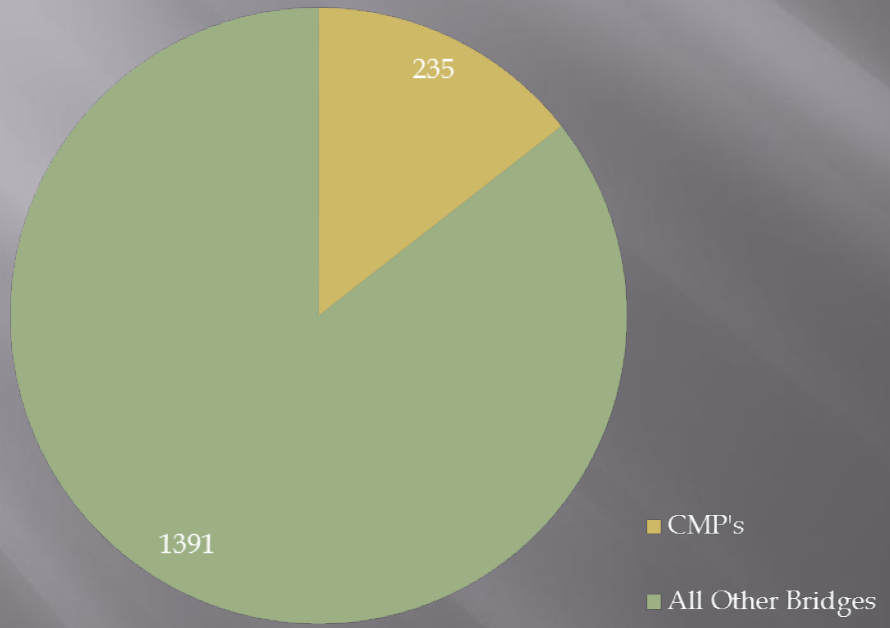
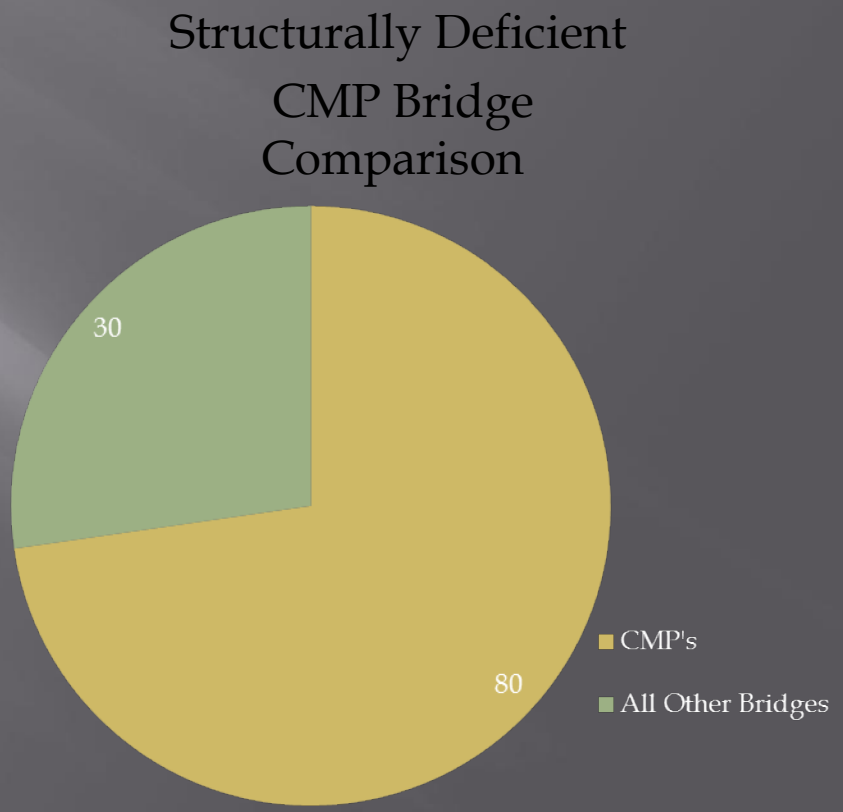
Key Issues Affecting Our Bridge Inventory

1. Corrugated Metal Pipes (CMP's):





CMP Bridges account for ~14.5% of our inventory, but they account for ~72.3% of the number of Structurally Deficient bridges in our inventory.

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Key Issues Affecting Our Bridge Inventory

1. Corrugated Metal Pipes (CMP's):

Factors Affecting Past, Current & Future Condition of Our CMP Inventory

A. Dropped Bridges

- Roughly 160 CMP Bridges Removed from Inventory in 80's & 90's

B. Found Bridges

- 24 CMP Bridges Found in 2014 / 16 are SD
- 12 CMP Bridges Found in 2015 / 8 are SD

C. Expected Design Life vs. Average Age of CMP Inventory

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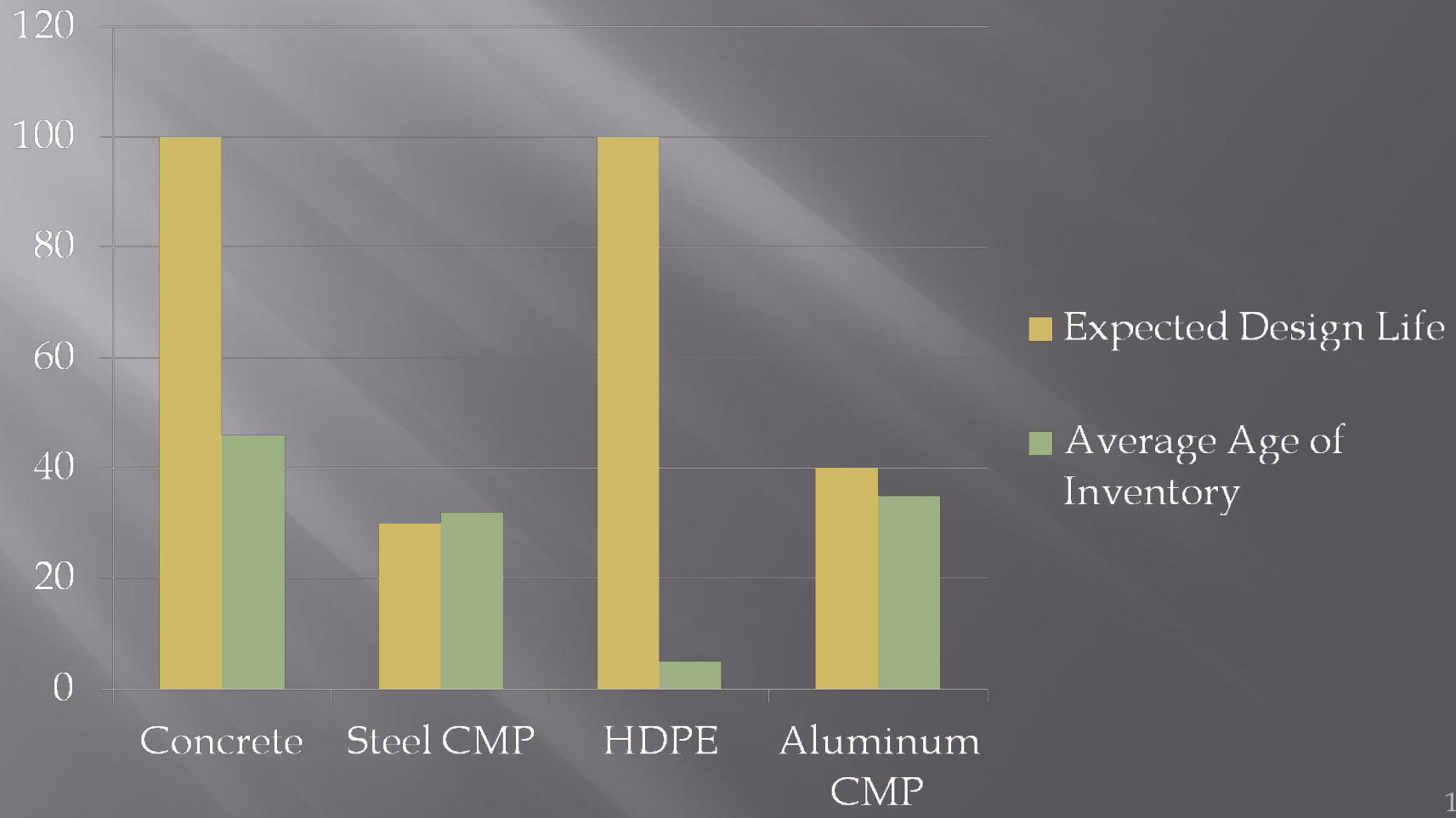
Key Issues Affecting Our Bridge Inventory

1. Corrugated Metal Pipes (CMP's):

Factors Affecting Past, Current & Future Condition of Our CMP Inventory



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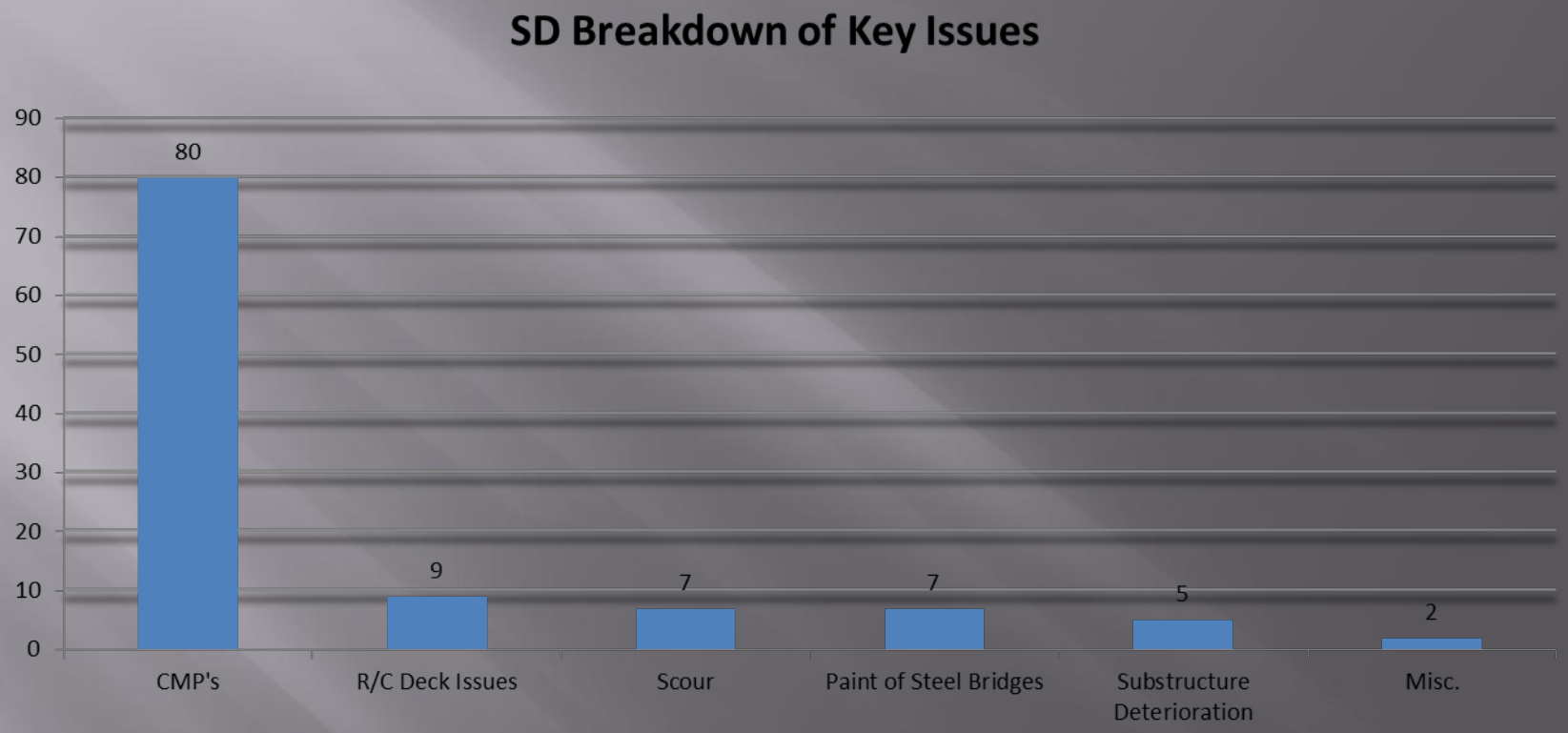
Key Issues Affecting Our Bridge Inventory



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Key Issues Affecting Our Bridge Inventory

2. R/C Decks:

Factors Affecting Current & Future Condition of Our R/C Deck Inventory

A. Harsh Winters
- Freeze/Thaw Cycles
- Use of Deicing Agents
- Snow Plow Damage

B. Inspection Limitations
- Traffic Volume
- Nighttime Vs. Daytime Lane Closures
- Sound

C. Interstate Deck Bubble
- Ten Year Outlook

D. Past Project Decisions
- Repair Methods & Decisions
- Material Selection

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Deficiency Formula Prioritization Process

1. Bridge Inspections
    - -Element Level Breakdown of Bridge
    - -Condition State Assignment for Each Element

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Bridge Inspections

Sample Bridge Element Data – Bridge 1-229B

PONTIS DATA

Elements	ID	ENV	UNITS	TOTAL	CS1	CS2	CS3	CS4	CS5	Comments
Concrete Deck - Bare	12	2	(SF)	28670	0	28670	0	0	0	For Notes See MSPE Report
Concrete Deck - Protected w/ Coated Bars	26	2	(SF)	860	860	0	0	0	0	For Notes See MSPE Report
Reinforced Concrete Sidewalk	56	2	(LF)	1052	989	57	2	4	0	For Notes See MSPE Report
Drains/Downspouts/Scuppers	65	2	(EA)	14	8	0	6	0	0	For Notes See MSPE Report
Painted Steel Open Girder/Beam	107	2	(LF)	4920	3952	667	301	0	0	For Notes See MSPE Report
Painted Steel Pin and/or Pin and Hanger Assembly	161	2	(EA)	60	0	16	23	21	0	For Notes See MSPE Report
Reinforced Concrete Column or Pile	205	2	(LF)	116	115	1	0	0	0	For Notes See MSPE Report
Reinforced Concrete Abutment	215	2	(LF)	120	34	65	21	0	0	For Notes See MSPE Report
Reinforced Concrete Pier Cap	234	2	(LF)	348	329	5	14	0	0	For Notes See MSPE Report
Strip Seal Expansion Joint	300	2	(LF)	60	0	0	60	0	0	For Notes See MSPE Report
Compression Joint Seal	302	2	(LF)	480	120	360	0	0	0	For Notes See MSPE Report
Open Expansion Joint	304	2	(LF)	77	55	22	0	0	0	For Notes See MSPE Report
Elastomeric Bearing	310	2	(EA)	20	20	0	0	0	0	For Notes See MSPE Report
Fixed Bearing	313	2	(EA)	60	60	0	0	0	0	For Notes See MSPE Report
Reinforced Conc Approach Slab w/ or w/o AC Ovly	321	2	(EA)	2	0	1	1	0	0	For Notes See MSPE Report
Bridge Railing - Metal Uncoated	330	2	(LF)	1180	1152	10	18	0	0	For Notes See MSPE Report
Bridge Railing - Reinforced Concrete	331	2	(LF)	526	500	25	1	0	0	For Notes See MSPE Report
Bridge Railing - Metal Coated	334	2	(LF)	569	157	0	412	0	0	For Notes See MSPE Report
Steel Fatigue	356	1	(EA)	1	0	1	0	0	0	For Notes See MSPE Report
Pack Rust	357	1	(EA)	1	1	0	0	0	0	For Notes See MSPE Report
Deck Cracking	358	1	(EA)	1	1	0	0	0	0	For Notes See MSPE Report
Soffit (or Under Surface) of Concrete Deck or Slab	359	1	(EA)	1	0	1	0	0	0	For Notes See MSPE Report
Scour	361	1	(EA)	1	0	1	0	0	0	For Notes See MSPE Report
Section Loss	363	1	(EA)	1	1	0	0	0	0	For Notes See MSPE Report
Erosion	364	1	(EA)	1	1	0	0	0	0	For Notes See MSPE Report
Painted Steel Diaphragm	381	2	(EA)	361	199	116	45	1	0	For Notes See MSPE Report
Reinforced Concrete Wingwalls	390	2	(LF)	72	71	1	0	0	0	For Notes See MSPE Report

Total Elements: 27

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Deficiency Formula Prioritization Process

2. Preservation Actions (Work) & Costs
    - -Preservation & Deterioration Models
    - -Lowest Long-Term Cost
    - -Applied to Each Condition State for Each Element

3. Recommended Work & Associated Cost
    - -Cost for recommended work is calculated for each bridge
    - -Deficiency List $1,500 Threshold

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Deficiency Formula Prioritization Process

4. Deficiency Formula
   - -Calculated for each bridge on Deficiency List
   - -Bridges ranked by Deficiency Points

5. Deficiency Formula Factors
   - -Conditional Deficiencies (50%)
   - -Functional Importance (50%)

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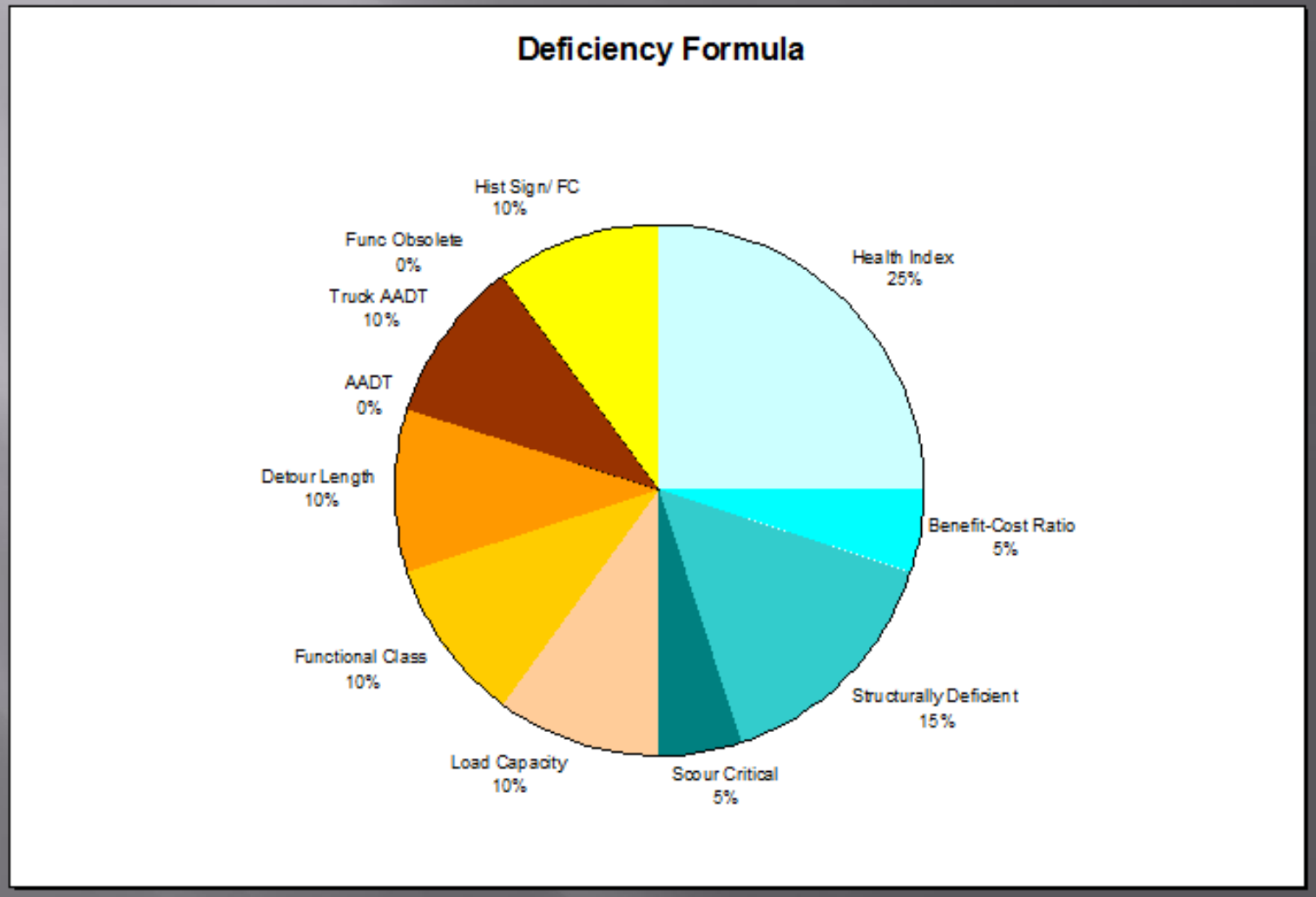
Deficiency Formula Prioritization Process



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Database: ModelingMar2010

Delaware Department of Transportation

Print Date: 3/2/2010

DelDOT Deficiency Points - 2010 Def Formula

DF Rank	Bridge #	Dist	Des St	Des Cmts	NBI Length	SD Status	Suff Pts	Benefit	Cost	Health Index	PCI	Scour Critical	Func Class	Detour (km)	Historical	Frac. Cr	Truck Pct	ADT	Item 70	DF Points
1	3240 046	3	C	30-072-01	Y	SD	38.3	340000	298688	0	NA	8	8	6.45	5	N	5	2750	0	68
2	1652 331	1	D	27-071-03 Fall 2010 Construction	N	SD	40.3	186057	23552	0	NA	8	17	1.16	5	N	11	3887	0	67
3	1325 397	5	D	27-071-02 Summer 2010 Construction	N	SD	11	326504	355260	0.097	NA	8	17	6.45	5	N	11	6980	0	64.5768
4	1001 279	1	C	Construction	Y	SD	29.6	616589	227882	0.517	0.53	7	17	4.67	2	Y	5	5787	0	64.07006
5	1001A279	1	C	Construction	Y	SD	18.6	136151	52600	0.401	NA	8	17	4.67	2	N	5	5787	2	62.90788
6	2277A277	2	C	27-075-03 -	Y	SD	40.7	446305	92305	0.111	NA	8	9	5.31	5	N	4	311	0	62.72218
7	1404 427	5	D	30-071	N	SD	39.6	228160	124504	0.083	NA	8	9	2.12	5	N	5	4226	0	61.41656
8	1687 029	1	D	BD/$500,000/FY10	Y	SD	6	839522	437077	0.826	0.83	8	14	1.61	2	Y	11	14579	0	59.85844
9	3133 594	3	D	30-076-01 Spring 2011 Construction	Y	SD	40.6	187162	47151	0.228	NA	8	9	8	5	N	5	301	0	59.80562
10	3543 407	3		IHM -	N	SD	41	121984	26158	0.083	NA	8	9	2.9	5	N	5	32	0	59.41667
11	3553 066	3		IHM	N	SD	40.7	56878	15717	0.167	NA	8	9	2.41	5	N	5	725	0	59.33333
12	2581A381	2		BD - FY11 - no	Y	SD	40.5	117431	135000	0.155	NA	8	9	4.83	5	N	5	625	0	58.6309
13	3156 050	3	C	26-073-03	Y	SD	52	4501052	1400636	0.622	0.41	3	6	48.28	5	N	3	12798	5	57.95383
14	1501 006	1	D	BD/$22,500,000/FY11	Y	SD	16	6737386	3156206	0.74	NA	8	14	10.35	5	Y	11	66774	5	57.00752
15	1339 000	5			N	SD	19.9	15792	5928	0.784	0.43	6	9	320.26	5	Y	4	5	0	56.89471
16	1693 050	1	D	BD/$500,000/FY1	Y	SD	13.2	170348	158944	0.948	0.96	5	16	2.09	5	Y	11	11615	0	56.80451
17	2279A279	2		IHM -	N	SD	41	129738	135589	0.075	NA	8	9	2.9	5	N	5	94	0	56.62578
18	2010A040	2	D	30-07	Y	SD	40.8	397536	401574	0.157	NA	8	19	0.56	5	N	11	2042	0	56.57339
19	3533 405	3		IHM -	Y	SD	41	93357	44455	0.173	NA	8	9	0.64	5	N	5	534	0	56.17046
20	3143 583A	3		IHM	Y	SD	41	217990	47151	0.133	NA	8	9	0.03	5	N	5	4	0	56.16661
21	3462 390A	3	C	27-076-04	Y	SD	41	240811	54090	0.234	NA	8	9	1.77	5	N	5	85	0	55.65849
22	3359 446	3	D	30-076-01 Spring 2011 Construction	Y	SD	40.7	119638	125000	0.194	NA	8	9	4.18	5	N	5	447	0	55.64557
23	2254A254	2	D	03 Spring 2011 Construction	Y	SD	40.9	347699	90645	0.315	NA	8	9	2.57	5	N	5	247	0	55.62101
24	2501 000	2			Y	SD	18.2	213583	45731	0.719	0.38	8	19	0.8	2	N	11	5250	0	55.51804
25	3103 612A	3		BD - FY11- not in CTP	Y	SD	40.7	273124	330708	0.207	NA	8	9	4.02	5	N	5	430	0	55.32325
26	3633 113A	3		IHM - Done	N	SD	40.9	98803	52085	0.345	NA	8	9	0.64	5	N	11	1374	0	54.88069
27	3584 026	3		IHM	N	SD	69.4	125781	32544	0.314	NA	8	6	6.44	5	N	3	3751	5	54.6586
28	3101 614	3		IHM - Done	N	SD	40.9	64581	77180	0.24	NA	8	9	4.83	5	N	5	90	0	54.49549
29	3498 376	3	C	27-076-05	Y	SD	40.6	239768	57830	0.303	NA	8	9	1.58	5	N	5	1538	0	53.92151
30	2429A429	2	D	30-072-04 Spring 2012 Construction	Y	SD	40.8	128198	150000	0.267	NA	8	9	2.57	5	N	5	509	0	53.83333
31	1503 447	5	C	Construction	Y	SD	31.7	216532	223992	0.682	0.41	N	9	3.06	5	Y	4	385	0	53.45238
32	1501B6262	1	D	BD/FY11 -	Y	SD	64.4	118504	182147	0.745	NA	N	14	4.02	5	Y	11	31205	5	50.85526
33	1501A6262	1	D	BD/FY11 -	N	SD	69.9	177117	92618	0.789	NA	N	14	4	5	Y	11	11205	5	50.77065
34	3925 203	3	D	BD/$772,000/FY12,13	N	SD	27	6527	7758	0.41	NA	8	9	198.99	5	N	5	195	2	50.24437
35	3225 561	3		IHM	N	SD	69.8	149870	25722	0.291	NA	8	7	2.09	5	N	3	1139	5	49.726
36	2277C277	2	D	30-072-03 Spring 2011 Construction	Y	SD	40.8	125092	190000	0.447	NA	8	9	3.15	5	N	5	382	0	49.32624
37	3910 620	3	D	30-076-02 spring 2010 construction	N	SD	38.6	110966	89947	0.569	NA	8	9	4.99	5	N	5	463	0	49.27654
38	2033A033	2	D	30-072-05 Spring 2011 Construction	Y	SD	71.7	89963	59238	0.333	NA	8	7	4.54	5	N	3	4300	5	48.66667
39	3710 285	3		IHM / BD permits	N	SD	70.7	133730	185814	0.333	NA	8	7	6.36	5	N	7	5162	5	48.66667
40	1159 327	1	D	BD/$5,000	Y	SD	46.2	326451	424157	0.687	NA	3	19	1.21	5	Y	11	3737	5	48.31359
41	1248 355	5			N	SD	60.6	60092	112605	0.503	NA	8	17	8.88	5	N	7	20323	5	48.29955
42	2275C275	2	D	30-072-03 Spring 2011 Construction	Y	SD	69.9	140900	54598	0.168	NA	8	9	3.56	5	N	5	467	5	48.29153
43	2138A138	2		IHM	N	SD	69.7	117539	21799	0.297	NA	8	9	3.22	5	N	5	1277	5	47.08339
44	3684 246	3	D	30-073-02 Summer 2010 Construction	N	SD	66.9	141514	40668	0.262	NA	8	19	4.8	5	N	10	402	5	46.95636
45	3546 082	3		IHM	N	SD	69.9	120313	25583	0.288	NA	8	9	1.69	5	N	5	806	5	46.30479
46	3344 062	3	D	30-076-01 Spring 2011 Construction	Y	SD	69.8	106075	55684	0.291	NA	8	9	4.83	5	N	5	654	5	46.31282
47	3906 618	3	D		N	SD	70	151836	20956	0.279	NA	8	17	0	5	N	11	901	5	46.0207
48	2100A100	2			Y	SD	69.7	72627	36005	0.369	NA	8	17	1.51	5	N	11	2550	5	45.76262
49	2033B033	2			Y	SD	72.6	133145	69594	0.333	NA	8	7	1.19	5	N	3	4300	5	45.66667
50	1400 428	5		SMC	N	HO	59.2	152861	52777	0.279	NA	8	9	9.01	5	N	4	1060	0	45.52212
51	3907 634	3		IHM	N	SD	69.9	96698	21799	0.32	NA	8	9	1.88	5	N	5	451	5	45.49995
52	3265 375	3		IHM	N	SD	72.9	111161	31703	0.322	NA	8	9	3.86	5	N	4	379	5	45.43792
53	1457 472	5		IHM/SMC	N	SD	70	95255	14387	0.288	NA	8	9	3.54	5	N	5	89	5	45.30294
54	3459 381	3		IHM	N	SD	69.7	142174	34622	0.33	NA	8	9	4.35	5	N	4	1084	5	45.24489
55	3354 066	3		IHM / BD permits	N	SD	69.8	112491	26158	0.333	NA	8	9	3.22	5	N	5	725	5	45.16667
56	1221 301	1	D	BD/$655,000/FY12	N	SD	49.7	102046	27966	0.357	NA	6	9	1.61	5	N	4	1864	5	44.57046
57	2112B112	2			Y	SD	69.9	129459	62789	0.402	NA	8	9	5.87	5	N	5	229	5	44.44758
58	1421 461	5		IHM/SMC	N	SD	72.9	95667	132298	0.329	NA	8	9	6.28	5	N	5	298	5	44.26836

DelDOT Bridge Management Program

Bridge Preservation Mechanisms

1. In-House Maintenance
   - A. CMP Culvert Replacements
   - B. Minor Concrete Repairs
   - C. Minor scour or erosion repairs
2. Structure Maintenance Contracts (SMC's)
   - A. Deck Patching
   - B. Joint repair/replacement
   - C. Minor Bridge Rehab Work
   - D. Emergency Bridge Repair Work
3. Bridge Design
   - A. Major Bridge Rehab Work
   - B. Bridge Replacement

DelDOT Bridge Management Program

Bridge Performance Measures

DelDOT Bridge Performance Goals

<5% of Bridge Inventory is Structurally Deficient (SD)

<25% of Bridge Inventory is Fair & Structurally Deficient (>75% Good)

DelDOT Bridge Management Program

Effectiveness of Bridge Program

2014 Bridge Performance

6.8% of Bridge Inventory is Structurally Deficient (SD)

25.6% of Bridge Inventory is Fair & Structurally Deficient (74.4% Good)

DelDOT Bridge Performance Standards

<5% of Bridge Inventory is Structurally Deficient (SD)

<25% of Bridge Inventory is Fair & Structurally Deficient (>75% Good)

DelDOT Bridge Management Program

Effectiveness of Bridge Program

Improving the Bridge Program

Need to address bridges in Fair Condition sooner and more efficiently before they become SD

Possible Options:

A. Modifications to the prioritization process

B. More emphasis on Preventative Bridge Maintenance

C. Addressing CMP's Quicker

D. Corridor/Zone bridge rehab projects

E. Review of other DOT's Processes

F. Review of Inspection Procedures

DelDOT Bridge Management Program

Conclusion:

Need a defined Bridge Management process

- **Systematic process w/ results that are reproducible**
- **Allow for some flexibility**
- **Funds are limited - A successful Bridge Management process will aid in justifying and maximizing bridge funding**
- **Using a defined process allows for less political intervention and scrutiny**
- **Need performance measures to track progress and evaluate the effectiveness of the Bridge Management Program**
- **Periodically review & evaluate effectiveness of the prioritization process**

DelDOT Bridge Management Program

Questions?

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