
MSD Toilet Seat Feasibility Assessment

Table of Contents

Tidy Bits	1
Rough Toilet Dimensions	1
Material Properties	1
Material Properties Citation	2
Loading Conditions	2
Max Deflection	2
Plot	2
Weight	3
Results	3

P17011

Tidy Bits

```
clc
clear
format compact
close all
```

Rough Toilet Dimensions

```
y1=14.25;           %[in] Toilet Seat Total Width
y2=8+(1/8);        %[in] Toilet Seat Arm Gap
y3=(y1-y2)/2;     %[in] Toilet Seat Arm Width
x1=18.5;           %[in] Toilet Seat Length
x2=11+(13/16);    %[in] Toilet Seat Arm Length
x3=x1-x2;         %[in] Toilet Seat Back Width
t=1;              %[in] Toilet Seat Thickness
A1=x1*y3;         %[in^2]
A3=A1;           %[in^2]
A2=x3*y2;         %[in^2]
At=A1+A2+A3;     %[in^2] Total Area
V=At*t;          %[in^3] Seat Volume
```

Material Properties

```
Eal=10000e03;      %[psi] Modulus of Elasticity Aluminum 6061
rhoal=0.0975;     %[lb/in^3] Density 6061
Ebr=14100e03;     %[psi] Modulus of Elasticity Brass
rhobr=0.307;      %[lb/in^3] Density UNS C36000
Es=29000e03;     %[psi] Modulus of Elasticity 1018 Steel
rhos=0.284;       %[lb/in^3] Density 1018
I=(1/12)*y3*t^3;  %[in^4] Moment of Inertia
```

Material Properties Citation

```
%6061 AL http://asm.matweb.com/search/SpecificMaterial.asp?bassnum=MA6061t6  
%UNS C36000 Brass http://www.matweb.com/search/datasheet.aspx?matguid=d6b982d35b1d  
%AISI 1018 http://www.matweb.com/search/datasheet\_print.aspx?matguid=3a9cc570fbb24
```

Loading Conditions

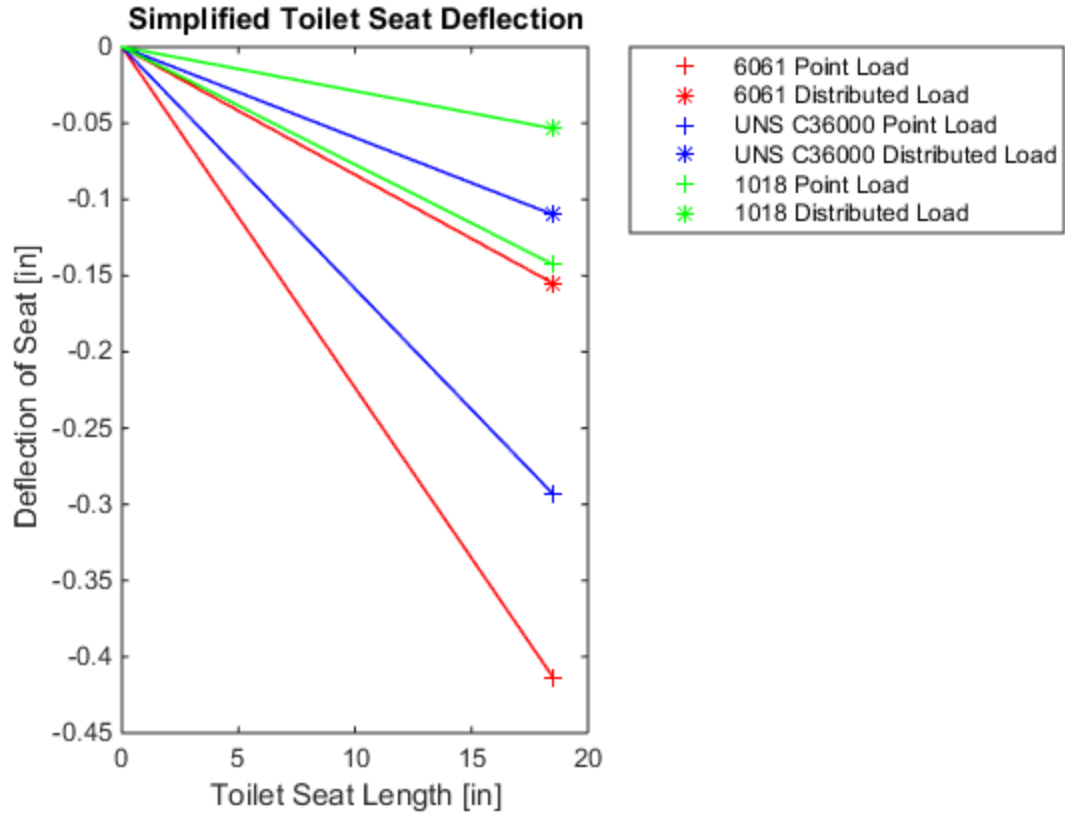
```
X=x1;           %[in] Load Position in X  
Y=(y1/2);      %[in] Load Position in Y  
F=500;         %[lb] Applied Load  
Mx=F*Y;        %[lb-in] Reaction Moment in X  
My=F*X;        %[lb-in] Reaction Moment in Y  
w=F/x1;        %[lb/in] Distributed Load
```

Max Deflection

```
delpal=- (F*x1^3)/(3*Eal*I);    %[in] Deflection Point Load  
deldisal=- (w*x1^4)/(8*Eal*I);  %[in] Deflection Distributed Load  
delpbr=- (F*x1^3)/(3*Ebr*I);    %[in] Deflection Point Load  
deldisbr=- (w*x1^4)/(8*Ebr*I);  %[in] Deflection Distributed Load  
delps=- (F*x1^3)/(3*Es*I);      %[in] Deflection Point Load  
deldiss=- (w*x1^4)/(8*Es*I);    %[in] Deflection Distributed Load
```

Plot

```
plot(x1,delpal,'r+',x1,deldisal,'r*',x1,delpbr,'b+',x1,deldisbr,'b*',x1,delps,'g+',  
L1=line([0,x1],[0,delpal], 'LineWidth',1.0, 'Color', 'r');  
L2=line([0,x1],[0,deldisal], 'LineWidth',1.0, 'Color', 'r');  
L3=line([0,x1],[0,delpbr], 'LineWidth',1.0, 'Color', 'b');  
L4=line([0,x1],[0,deldisbr], 'LineWidth',1.0, 'Color', 'b');  
L5=line([0,x1],[0,delps], 'LineWidth',1.0, 'Color', 'g');  
L6=line([0,x1],[0,deldiss], 'LineWidth',1.0, 'Color', 'g');  
legend('6061 Point Load', '6061 Distributed Load', 'UNS C36000 Point Load', 'UNS C36000 Distributed Load')  
xlabel('Toilet Seat Length [in]')  
ylabel('Deflection of Seat [in]')  
title('Simplified Toilet Seat Deflection')
```



Weight

```
Wal=V*rhoal;  
Wbr=V*rhobr;  
Ws=V*rhos;
```

Results

```
fprintf('Point Load Deflections')  
fprintf('\n')  
fprintf('Applied Load [lb]='),disp(F)  
fprintf('6061 Aluminum [in]='),disp(delpal)  
fprintf('UNS C36000 Brass [in]='),disp(delpbr)  
fprintf('AISI1018 [in]='),disp(delps)  
fprintf('\n')  
fprintf('Distributed Load Deflections')  
fprintf('Applied Load [lb]='),disp(F)  
fprintf('6061 Aluminum [in]='),disp(deldisal)  
fprintf('UNS C36000 Brass [in]='),disp(deldisbr)  
fprintf('AISI1018 [in]='),disp(deldiss)  
fprintf('\n')  
fprintf('Rough Seat Weight')  
fprintf('\n')  
fprintf('Seat Thckness [in]='),disp(t)  
fprintf('6061 Aluminum [lb]='),disp(Wal)
```

MSD Toilet Seat
Feasability Assesment

```
fprintf('UNS C36000 Brass [lb]='),disp(Wbr)
fprintf('AISI1018 [lb]='),disp(Ws)
```

Point Load Deflections

```
Applied Load [lb]= 500
6061 Aluminum [in]= -0.4135
UNS C36000 Brass [in]= -0.2933
AISI1018 [in]= -0.1426
```

Distributed Load Deflections Applied Load [lb]= 500

```
6061 Aluminum [in]= -0.1551
UNS C36000 Brass [in]= -0.1100
AISI1018 [in]= -0.0535
```

Rough Seat Weight

```
Seat Thckness [in]= 1
6061 Aluminum [lb]= 16.3457
UNS C36000 Brass [lb]= 51.4681
AISI1018 [lb]= 47.6122
```

Published with MATLAB® R2014b