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diary on          % begin recording

% FEMA appeal for The Town of Harpswell, Cumberland county, Maine
% TRANSECT ID: YK-15
% calculation by SJH, Ransom Consulting, Inc. 06-Feb-2020
% 100-year wave runup using TAW methodology
% including berm and weighted average with foreshore if necessary
%
% chk nld 20181015
%
% This script assumes that the incident wave conditions provided
% as input in the configuration section below are the
% appropriate values located at the end of the foreshore
% or toe of the slope on which the run-up is being calculated
% the script does not attempt to apply a depth limit or any other
% transformation to the incident wave conditions other than
% conversion of the peak wave period to the spectral mean wave
% as recommended in the references below
%
%
% references:
%
% Van der Meer, J.W., 2002. Technical Report Wave Run-up and
% Wave Overtopping at Dikes. TAW Technical Advisory Committee on
% Flood Defence, The Netherlands.
%
% FEMA. 2007, Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update
%
%
%-----
% CONFIG
%-----
fname='infiles/YK-15sta_ele_include.csv'; % file with station, elevation, include
                                     % third column is 0 for excluded points
imgname='logfiles/YK-15-runup';
SWEL=9.2819; % 100-yr still water level including wave setup.
H0=6.2414; % significant wave height at toe of structure
Tp=12.7769; % peak period, 1/fma,
T0=Tp/1.1;

gamma_berm=0.97227; % this may get changed automatically below
gamma_rough=1;
gamma_beta=1;
gamma_perm=1;

setupAtToe=0.18011;
maxSetup=1.0731; % only used in case of berm/shallow foreshore weighted average

plotTitle='Iterative TAW for YK-15'

plotTitle =

Iterative TAW for YK-15

% END CONFIG
%-----

SWEL=SWEL+setupAtToe

SWEL =

          9.46201

SWEL_fore=SWEL+maxSetup

SWEL_fore =

          10.53511

% FIND WAVELENGTH USING DEEPWATER DISPERSION RELATION
% using English units
L0=32.15/(2*pi)*T0^2

L0 =

          690.345868498104

% Find Hb (Munk, 1949)
%Hb=H0/(3.3*(H0/L0)^(1/3))
%Db=-Hb/.78+SWEL; % depth at breaking

% The toe elevation here is only used to determine the average
% structure slope, it is not used to depth limit the wave height.
% Any depth limiting or other modification of the wave height
% to make it consistent with TAW guidance should be performed
% prior to the input of the significant wave height given above.
Ztoe=SWEL-1.5*H0

Ztoe =

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0.0999099999999995

% read the transect
[sta,dep,inc] = textread(fname,'%n%n%n%[^\\n]', 'delimiter', ',', 'headerlines', 0);

% remove unselected points
k=find(inc==0);
sta(k)=[];
dep(k)=[];

sta_org=sta; % used for plotting purposes
dep_org=dep;

% initial guess at maximum run-up elevation to estimate slope
Z2=SWEL+1.5*H0

Z2 =

    18.82411

% determine station at the max runup and -1.5*H0 (i.e. the toe)
top_sta=-999;
toe_sta=-999;
for kk=1:length(sta)-1
    if ((Z2 > dep(kk)) & (Z2 <= dep(kk+1))) % here is the intersection of z2 with profile
        top_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Z2)
    end
    if ((Ztoe > dep(kk)) & (Ztoe <= dep(kk+1))) % here is the intersection of Ztoe with profile
        toe_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Ztoe)
    end
end
toe_sta =

    0.137300683371296

% check to make sure we got them, if not extend the end slopes outward
S=diff(dep)./diff(sta);
if toe_sta== -999
    dy=dep(1)-Ztoe;
    toe_sta=sta(1)-dy/S(1)
end
if top_sta== -999
    dy=Z2-dep(end);
    top_sta=sta(end)+dy/S(end)
end
top_sta =

    139.009591194968

% just so the reader can tell the values aren't -999 anymore
top_sta

top_sta =

    139.009591194968

toe_sta

toe_sta =

    0.137300683371296

% check for case where the toe of slope is below SWL-1.5*H0
% in this case interpolate setup from the setupAtToe(really setup as first station), and the max setup
% also un-include points seaward of SWL-1.5*H0
if Ztoe > dep(1)
    dd=SWEL_fore-dep;
    k=find(dd<0,1); % k is index of first land point
    staAtSWL=interp1(dep(k-1:k),sta(k-1:k),SWEL_fore);
    dsta=staAtSWL-sta(1);
    dsetup=maxSetup-setupAtToe;
    dsetdsta=dsetup/dsta;
    setup=setupAtToe+dsetdsta*(toe_sta-sta(1));
    sprintf('-!!- Location of SWEL-1.5*H0 is %4.1f ft landward of toe of slope',dsta)
    sprintf('-!!- Setup is interpolated between setup at toe of slope and max setup')
    sprintf('-!!- setup is adjusted to %4.2f feet',setup)
    SWEL=SWEL-setupAtToe+setup;
    sprintf('-!!- SWEL is adjusted to %4.2f feet',SWEL)
    k=find(dep < SWEL-1.5*H0)
    sta(k)=[];
    dep(k)=[];
else
    sprintf('-!!- The User has selected a starting point that is %4.2f feet above the elevation of SWEL-1.5H0\\n',de
    sprintf('-!!- This may be reasonable for some cases. However the user may want to consider:\\n')
    sprintf('-!!- 1) Selecting a starting point that is at or below %4.2f feet elevation, or\\n', Ztoe)
    sprintf('-!!- 2) Reducing the incident wave height to a depth limited condition.\\n')

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end

ans =

-!!- Location of SWEL-1.5*H0 is 73.7 ft landward of toe of slope

ans =

-!!- Setup is interpolated between setup at toe of slope and max setup

ans =

-!!-      setup is adjusted to 0.28 feet

ans =

-!!-      SWEL is adjusted to 9.56 feet

k =

    1
    2
    3
    4
    5
    6
    7
    8
    9

% now iterate converge on a runup elevation
tol=0.001; % convergence criteria
R2del=999;
R2_new=3*H0; %initial guess
R2=R2_new;
iter=0;
R2_all=[];
topStaAll=[];
Berm_Segs=[];
TAW_ALWAYS_VALID=1;
while(abs(R2del) > tol && iter <= 25)
    iter=iter+1;
    sprintf('!----- STARTING ITERATION %d -----!',iter)
    % elevation of toe of slope
    Ztoe
    % station of toe slope (relative to 0-NAVD88 shoreline)
    toe_sta
    % station of top of slope/extent of 2% run-up
    top_sta
    % elevation of top of slope/extent of 2% run-up
    Z2
    % incident significant wave height
    H0
    % incident spectral peak wave period
    Tp
    % incident spectral mean wave period
    T0

    R2=R2_new
    Z2=R2+SWEL
    % determine slope for this iteration
    top_sta=-999;
    for kk=1:length(sta)-1
        if ((Z2 > dep(kk)) & (Z2 <= dep(kk+1))) % here is the intersection of z2 with profile
            top_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Z2)
            break;
        end
    end
    if top_sta==-999
        dy=Z2-dep(end);
        top_sta=sta(end)+dy/S(end)
    end

    % get the length of the slope (not accounting for berm)
    Lslope=top_sta-toe_sta

    % loop over profile segments to determine berm factor
    % re-calculate influence of depth of berm based on this run-up elevation
    % check for berm, berm width, berm height
    berm_width=0;
    rdh_sum=0;
    Berm_Segs=[];
    Berm_Heights=[];
    for kk=1:length(sta)-1
        ddep=dep(kk+1)-dep(kk);
        dsta=sta(kk+1)-sta(kk);
        s=ddep/dsta;
        if (s < 1/15) % count it as a berm if slope is flatter than 1:15 (see TAW manual)
            sprintf('Berm Factor Calculation: Iteration %d, Profile Segment: %d',iter,kk)

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        berm_width=berm_width+dsta; % tally the width of all berm segments
        % compute the rdh for this segment and weight it by the segment length
        dh=SWEL-(dep(kk)+dep(kk+1))/2
        if dh < 0
            chi=R2;
        else
            chi=2* H0;
        end
        if (dh <= R2 & dh >=-2*H0)
            rdh=(0.5-0.5*cos(3.14159*dh/chi)) ;
        else
            rdh=1;
        end
        rdh_sum=rdh_sum + rdh * dsta
        Berm_Segs=[Berm_Segs, kk];
        Berm_Heights=[Berm_Heights, (dep(kk)+dep(kk+1))/2];
    end
    if dep(kk) >= Z2 % jump out of loop if we reached limit of run-up for this iteration
        break
    end
end
sprintf('!----- End Berm Factor Calculation, Iter: %d -----!',iter)
berm_width
rB=berm_width/Lslope
if (berm_width > 0)
    rdh_mean=rdh_sum/berm_width
else
    rdh_mean=1
end
gamma_berm=1- rB * (1-rdh_mean)
if gamma_berm > 1
    gamma_berm=1
end
if gamma_berm < 0.6
    gamma_berm =0.6
end
% Iribarren number
slope=(Z2-Ztoe)/(Lslope-berm_width)
Irb=(slope/(sqrt(H0/L0)))
% runup height
gamma_berm
gamma_perm
gamma_beta
gamma_rough
gamma=gamma_berm*gamma_perm*gamma_beta*gamma_rough

% check validity
TAW_VALID=1;
if (Irb*gamma_berm < 0.5 | Irb*gamma_berm > 10 )
    sprintf('!!! - - Iribarren number: %6.2f is outside the valid range (0.5-10), TAW NOT VALID - - !!!\n', Irb)
    TAW_VALID=0;
else
    sprintf('!!! - - Iribarren number: %6.2f is in the valid range (0.5-10), TAW RECOMMENDED - - !!!\n', Irb*gamma_berm)
end
islope=1/slope;
if (slope < 1/8 | slope > 1)
    sprintf('!!! - - slope: 1:%3.1f V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!\n', islope)
    TAW_VALID=0;
else
    sprintf('!!! - - slope: 1:%3.1f V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!\n', islope)
end
if TAW_VALID == 0
    TAW_ALWAYS_VALID=0;
end

if (Irb*gamma_berm < 1.8)
    R2_new=gamma*H0*1.77*Irb
else
    R2_new=gamma*H0*(4.3-(1.6/sqrt(Irb)))
end

% check to see if we need to evaluate a shallow foreshore
if berm_width > 0.25 * L0;
    disp('! Berm_width is greater than 1/4 wave length')
    disp('! Runup will be weighted average with foreshore calculation assuming depth limited wave height on')
    % do the foreshore calculation
    fore_H0=0.78*(SWEL_fore-min(Berm_Heights))
    % get upper slope
    fore_toe_sta=-999;
    fore_toe_dep=-999;
    for kk=length(dep)-1:-1:1
        ddep=dep(kk+1)-dep(kk);
        dsta=sta(kk+1)-sta(kk);
        s=ddep/dsta;
        if s < 1/15
            break
        end
        fore_toe_sta=sta(kk);
        fore_toe_dep=dep(kk);
        upper_slope=(Z2-fore_toe_dep)/(top_sta-fore_toe_sta)
    end
    fore_Irb=upper_slope/(sqrt(fore_H0/L0));
    fore_gamma=gamma_perm*gamma_beta*gamma_rough;
    if (fore_Irb < 1.8)
        fore_R2=fore_gamma*fore_H0*1.77*fore_Irb;
    end
end

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else
    fore_R2=fore_gamma*fore_H0*(4.3-(1.6/sqrt(fore_Irb)));
end
if berm_width >= L0
    R2_new=fore_R2
    disp('berm is wider than one wavelength, use full shallow foreshore solution');
else
    w2=(berm_width-0.25*L0)/(0.75*L0)
    w1=1-w2
    R2_new=w2*fore_R2 + w1*R2_new
end
end % end berm width check

% convergence criterion
R2del=abs(R2-R2_new)
R2_all(iter)=R2_new;
% get the new top station (for plot purposes)
Z2=R2_new+SWEL
top_sta=-999;
for kk=1:length(sta)-1
    if ((Z2 > dep(kk)) & (Z2 <= dep(kk+1))) % here is the intersection of z2 with profile
        top_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Z2)
        break;
    end
end
if top_sta== -999
    dy=Z2-dep(end);
    top_sta=sta(end)+dy/S(end);
end
topStaAll(iter)=top_sta;
end
ans =
!----- STARTING ITERATION 1 -----!
Ztoe =
    0.0999099999999995
toe_sta =
    0.137300683371296
top_sta =
    139.009591194968
Z2 =
    18.82411
H0 =
    6.2414
Tp =
    12.7769
T0 =
    11.6153636363636
R2 =
    18.7242
Z2 =
    28.2847933979306
top_sta =
    287.762474810226
Lslope =
    287.625174126855
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 51
dh =
    0.62044339793057
rdh_sum =
    0.00608326474456938
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 52
dh =
    0.57329339793057
rdh_sum =
    0.0112786210205525
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 53
dh =
    0.52614339793057
rdh_sum =
    0.0156557422356077
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 54
dh =
    0.47704339793057
rdh_sum =
    0.0192549676367879
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 58
dh =
    0.148243397930569
rdh_sum =
    0.0196029164348988
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 87
dh =
    -5.98750660206943
rdh_sum =
    0.251389086452627
ans =
!----- End Berm Factor Calculation, Iter: 1 -----!
berm_width =
    6
rB =

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0.0208604828079261
rdh_mean =
0.0418981810754378
gamma_berm =
0.980013533478082
slope =
0.10007941756384
Irb =
1.05253640463838
gamma_berm =
0.980013533478082
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.980013533478082
ans =
!!! - - Iribaren number: 1.03 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:10.0 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
11.3952663845299
R2del =
7.32893361547014
Z2 =
20.9558597824604
ans =
!----- STARTING ITERATION 2 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
172.52766953554
Z2 =
20.9558597824604
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
11.3952663845299
Z2 =
20.9558597824604
top_sta =
172.52766953554
Lslope =
172.390368852169
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.559517705584329
ans =
!----- End Berm Factor Calculation, Iter: 2 -----!
berm_width =
6
rB =
0.0348047285933081
rdh_mean =

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0.0932529509307214
gamma_berm =
0.968440915054361
slope =
0.125343491491326
Irb =
1.31823896551901
gamma_berm =
0.968440915054361
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.968440915054361
ans =
!!! - - Iribaren number: 1.28 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.0 V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!
R2_new =
14.1033588731152
R2del =
2.70809248858536
Z2 =
23.6639522710458
ans =
!----- STARTING ITERATION 3 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
215.107740110781
Z2 =
23.6639522710458
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
14.1033588731152
Z2 =
23.6639522710458
top_sta =
215.107740110781
Lslope =
214.97043942741
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.402184420469069
ans =
!----- End Berm Factor Calculation, Iter: 3 -----!
berm_width =
6
rB =
0.0279108142309308
rdh_mean =
0.0670307367448448
gamma_berm =

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slope = 0.973960068210117
Irb = 0.112762562664904
gamma_berm = 1.18592518995645
gamma_perm = 0.973960068210117
gamma_beta = 1
gamma_rough = 1
gamma = 0.973960068210117
ans =
!!! - - Iribaren number: 1.16 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.9 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new = 12.7600897277018
R2del = 1.34326914541338
Z2 = 22.3206831256324
ans =
!----- STARTING ITERATION 4 -----!
Ztoe = 0.0999099999999995
toe_sta = 0.137300683371296
top_sta = 193.987156063401
Z2 = 22.3206831256324
H0 = 6.2414
Tp = 12.7769
T0 = 11.6153636363636
R2 = 12.7600897277018
Z2 = 22.3206831256324
top_sta = 193.987156063401
Lslope = 193.84985538003
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 51
dh = 0.62044339793057
rdh_sum = 0.00608326474456938
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 52
dh = 0.57329339793057
rdh_sum = 0.0112786210205525
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 53
dh = 0.52614339793057
rdh_sum = 0.0156557422356077
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 54
dh = 0.47704339793057
rdh_sum = 0.0192549676367879
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 58
dh = 0.148243397930569
rdh_sum = 0.0196029164348988
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 87
dh = -5.98750660206943
rdh_sum = 0.471355124267988
ans =
!----- End Berm Factor Calculation, Iter: 4 -----!
berm_width = 6
rB = 0.0309517899213151
rdh_mean = 0.0785591873779981
gamma_berm = 0.971479757542798
slope =

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Irb = 0.118290073104814
gamma_berm = 1.24405808188013
gamma_perm = 0.971479757542798
gamma_beta = 1
gamma_rough = 1
gamma = 0.971479757542798
ans =
!!! - - Iribaren number: 1.21 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.5 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new = 13.351488796225
R2del = 0.591399068523152
Z2 = 22.9120821941556
ans =
!----- STARTING ITERATION 5 -----!
Ztoe = 0.0999099999999995
toe_sta = 0.137300683371296
top_sta = 203.285883555903
Z2 = 22.9120821941556
H0 = 6.2414
Tp = 12.7769
T0 = 11.6153636363636
R2 = 13.351488796225
Z2 = 22.9120821941556
top_sta = 203.285883555903
Lslope = 203.148582872532
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 51
dh = 0.62044339793057
rdh_sum = 0.00608326474456938
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 52
dh = 0.57329339793057
rdh_sum = 0.0112786210205525
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 53
dh = 0.52614339793057
rdh_sum = 0.0156557422356077
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 54
dh = 0.47704339793057
rdh_sum = 0.0192549676367879
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 58
dh = 0.148243397930569
rdh_sum = 0.0196029164348988
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 87
dh = -5.98750660206943
rdh_sum = 0.438984926669583
ans =
!----- End Berm Factor Calculation, Iter: 5 -----!
berm_width = 6
rB = 0.029535032512458
rdh_mean = 0.0731641544449305
gamma_berm = 0.97262587316782
slope = 0.115710556280818
Irb =

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1.21692927328269
gamma_berm =
0.97262587316782
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.97262587316782
ans =
!!! - - Iribaren number: 1.18 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.0757449067675
R2del =
0.275743889457516
Z2 =
22.636338304698
ans =
!----- STARTING ITERATION 6 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
198.950287809716
Z2 =
22.636338304698
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.0757449067675
Z2 =
22.636338304698
top_sta =
198.950287809716
Lslope =
198.812987126345
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.45367907178888
ans =
!----- End Berm Factor Calculation, Iter: 6 -----!
berm_width =
6
rB =
0.0301791149900435
rdh_mean =
0.07561317863148
gamma_berm =
0.972102823822639
slope =
0.11688231503789
Irb =
1.22925267383092
gamma_berm =

```

```

0.972102823822639
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.972102823822639
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.2010552683118
R2del =
0.125310361544315
Z2 =
22.7616486662424
ans =
!----- STARTING ITERATION 7 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
200.920576513243
Z2 =
22.7616486662424
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.2010552683118
Z2 =
22.7616486662424
top_sta =
200.920576513243
Lslope =
200.783275829872
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.446917288010514
ans =
!----- End Berm Factor Calculation, Iter: 7 -----!
berm_width =
6
rB =
0.0298829669712329
rdh_mean =
0.074486214668419
gamma_berm =
0.972342902121516
slope =
0.116343349138638
Irb =
1.22358436316694
gamma_berm =
0.972342902121516
gamma_perm =

```

```

1
gamma_beta =
1
gamma_rough =
1
gamma =
0.972342902121516
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.143427973929
R2del =
0.0576272943827796
Z2 =
22.7040213718596
ans =
!----- STARTING ITERATION 8 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
200.014486978922
Z2 =
22.7040213718596
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.143427973929
Z2 =
22.7040213718596
top_sta =
200.014486978922
Lslope =
199.877186295551
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.450009254625427
ans =
!----- End Berm Factor Calculation, Iter: 8 -----!
berm_width =
6
rB =
0.0300184333750227
rdh_mean =
0.0750015424375712
gamma_berm =
0.972232995429663
slope =
0.116589846406174
Irb =
1.22617677781165
gamma_berm =
0.972232995429663
gamma_perm =
1
gamma_beta =

```

```

1
gamma_rough =
1
gamma =
0.972232995429663
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.1697862373223
R2del =
0.0263582633932824
Z2 =
22.7303796352529
ans =
!----- STARTING ITERATION 9 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
200.42892508259
Z2 =
22.7303796352529
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.1697862373223
Z2 =
22.7303796352529
top_sta =
200.42892508259
Lslope =
200.291624399219
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.448591311516428
ans =
!----- End Berm Factor Calculation, Iter: 9 -----!
berm_width =
6
rB =
0.029956320030841
rdh_mean =
0.0747652185860713
gamma_berm =
0.972283370784299
slope =
0.11647681522675
Irb =
1.22498802757609
gamma_berm =
0.972283370784299
gamma_perm =
1
gamma_beta =
1
gamma_rough =

```

```

1
gamma = 0.972283370784299
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new = 13.157700150674
R2del = 0.0120860866482602
Z2 = 22.7182935486046
ans =
!----- STARTING ITERATION 10 -----!
Ztoe = 0.0999099999999995
toe_sta = 0.137300683371296
top_sta = 200.238892273655
Z2 = 22.7182935486046
H0 = 6.2414
Tp = 12.7769
T0 = 11.6153636363636
R2 = 13.157700150674
Z2 = 22.7182935486046
top_sta = 200.238892273655
Lslope = 200.101591590284
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 51
dh = 0.62044339793057
rdh_sum = 0.00608326474456938
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 52
dh = 0.57329339793057
rdh_sum = 0.0112786210205525
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 53
dh = 0.52614339793057
rdh_sum = 0.0156557422356077
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 54
dh = 0.47704339793057
rdh_sum = 0.0192549676367879
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 58
dh = 0.148243397930569
rdh_sum = 0.0196029164348988
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 87
dh = -5.98750660206943
rdh_sum = 0.44924070584552
ans =
!----- End Berm Factor Calculation, Iter: 10 -----!
berm_width = 6
rB = 0.0299847689981659
rdh_mean = 0.0748734509742533
gamma_berm = 0.972260294133393
slope = 0.11652858363134
Irb = 1.22553247649243
gamma_berm = 0.972260294133393
gamma_perm = 1
gamma_beta = 1
gamma_rough = 1
gamma =

```

```

0.972260294133393
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.1632356924805
R2del =
0.00553554180651439
Z2 =
22.7238290904111
ans =
!----- STARTING ITERATION 11 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
200.325929094513
Z2 =
22.7238290904111
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.1632356924805
Z2 =
22.7238290904111
top_sta =
200.325929094513
Lslope =
200.188628411141
ans =
Berm Factor Calculation: Iteration 11, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 11, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 11, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 11, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 11, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 11, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.448943113997963
ans =
!----- End Berm Factor Calculation, Iter: 11 -----!
berm_width =
6
rB =
0.0299717323986924
rdh_mean =
0.0748238523329938
gamma_berm =
0.972270868080471
slope =
0.116504860637417
Irb =
1.22528298148798
gamma_berm =
0.972270868080471
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.972270868080471
ans =

```

```

!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.1606990385011
R2del =
0.00253665397939962
Z2 =
22.7212924364317
ans =
!----- STARTING ITERATION 12 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
200.286044597981
Z2 =
22.7212924364317
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.1606990385011
Z2 =
22.7212924364317
top_sta =
200.286044597981
Lslope =
200.14874391461
ans =
Berm Factor Calculation: Iteration 12, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 12, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 12, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 12, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 12, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 12, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.449079450791231
ans =
!----- End Berm Factor Calculation, Iter: 12 -----!
berm_width =
6
rB =
0.0299777049940408
rdh_mean =
0.0748465751318718
gamma_berm =
0.972266023555077
slope =
0.116515729024654
Irb =
1.22539728444363
gamma_berm =
0.972266023555077
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.972266023555077
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =

```



```

!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =      13.1618611786255
R2del =      0.00116214012432181
Z2 =      22.722454576556
ans =
!----- STARTING ITERATION 13 -----!
Ztoe =      0.0999099999999995
toe_sta =      0.137300683371296
top_sta =      200.304317241445
Z2 =      22.722454576556
H0 =      6.2414
Tp =      12.7769
T0 =      11.6153636363636
R2 =      13.1618611786255
Z2 =      22.722454576556
top_sta =      200.304317241445
Lslope =      200.167016558074
ans =
Berm Factor Calculation: Iteration 13, Profile Segment: 51
dh =      0.62044339793057
rdh_sum =      0.00608326474456938
ans =
Berm Factor Calculation: Iteration 13, Profile Segment: 52
dh =      0.57329339793057
rdh_sum =      0.0112786210205525
ans =
Berm Factor Calculation: Iteration 13, Profile Segment: 53
dh =      0.52614339793057
rdh_sum =      0.0156557422356077
ans =
Berm Factor Calculation: Iteration 13, Profile Segment: 54
dh =      0.47704339793057
rdh_sum =      0.0192549676367879
ans =
Berm Factor Calculation: Iteration 13, Profile Segment: 58
dh =      0.148243397930569
rdh_sum =      0.0196029164348988
ans =
Berm Factor Calculation: Iteration 13, Profile Segment: 87
dh =      -5.98750660206943
rdh_sum =      0.449016982401097
ans =
!----- End Berm Factor Calculation, Iter: 13 -----!
berm_width =
6
rB =      0.0299749684197308
rdh_mean =      0.0748361637335162
gamma_berm =      0.972268243224835
slope =      0.116510749238349
Irb =      1.22534491197283
gamma_berm =      0.972268243224835
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =      0.972268243224835
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =

```

```

13.1613286985788
R2del =
0.000532480046684825
Z2 =
22.7219220965094
% final 2% runoff elevation
Z2=R2_new+SWEL
Z2 =
22.7219220965094
diary off
diary on % begin recording
% FEMA appeal for The Town of Harpswell, Cumberland county, Maine
% TRANSECT ID: YK-15
% calculation by SJH, Ransom Consulting, Inc. 19-Feb-2020
% 100-year wave runoff using TAW methodology
% including berm and weighted average with foreshore if necessary
%
% chk nld 20200220
%
% This script assumes that the incident wave conditions provided
% as input in the configuration section below are the
% appropriate values located at the end of the foreshore
% or toe of the slope on which the run-up is being calculated
% the script does not attempt to apply a depth limit or any other
% transformation to the incident wave conditions other than
% conversion of the peak wave period to the spectral mean wave
% as recommended in the references below
%
% references:
%
% Van der Meer, J.W., 2002. Technical Report Wave Run-up and
% Wave Overtopping at Dikes. TAW Technical Advisory Committee on
% Flood Defence, The Netherlands.
%
% FEMA. 2007, Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update
%
%
%-----
% CONFIG
%-----
fname='inpfiles/YK-15sta_ele_include.csv'; % file with station, elevation, include
% third column is 0 for excluded points
imgname='logfiles/YK-15-runup';
SWEL=9.2819; % 100-yr still water level including wave setup.
H0=6.2414; % significant wave height at toe of structure
Tp=12.7769; % peak period, 1/fma,
T0=Tp/1.1;
gamma_berm=0.97227; % this may get changed automatically below
gamma_rough=1;
gamma_beta=1;
gamma_perm=1;
setupAtToe=0.18011;
maxSetup=1.0731; % only used in case of berm/shallow foreshore weighted average
plotTitle='Iterative TAW for YK-15'
plotTitle =
Iterative TAW for YK-15
% END CONFIG
%-----
SWEL=SWEL+setupAtToe
SWEL =
9.46201
SWEL_fore=SWEL+maxSetup
SWEL_fore =
10.53511
% FIND WAVELENGTH USING DEEPWATER DISPERSION RELATION
% using English units
L0=32.15/(2*pi)*T0^2
L0 =
690.345868498104
% Find Hb (Munk, 1949)
%Hb=H0/(3.3*(H0/L0)^(1/3))
%Db=-Hb/.78+SWEL; % depth at breaking
% The toe elevation here is only used to determine the average
% structure slope, it is not used to depth limit the wave height.
% Any depth limiting or other modification of the wave height
% to make it consistent with TAW guidance should be performed
% prior to the input of the significant wave height given above.
Ztoe=SWEL-1.5*H0
Ztoe =
0.0999099999999995
% read the transect
[sta,dep,inc] = textread(fname,'%n%n%n%[^\\n]','delimiter',' ','headerlines',0);
% remove unselected points
k=find(inc==0);
sta(k)=[];
dep(k)=[];
sta_org=sta; % used for plotting purposes
dep_org=dep;
% initial guess at maximum run-up elevation to estimate slope
Z2=SWEL+1.5*H0
Z2 =
18.82411
% determine station at the max runup and -1.5*H0 (i.e. the toe)
top_sta=-999;
toe_sta=-999;

```

```

for kk=1:length(sta)-1
    if ((Z2 > dep(kk)) & (Z2 <= dep(kk+1))) % here is the intersection of z2 with profile
        top_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Z2)
    end
    if ((Ztoe > dep(kk)) & (Ztoe <= dep(kk+1))) % here is the intersection of Ztoe with profile
        toe_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Ztoe)
    end
end
toe_sta =
    0.137300683371296
% check to make sure we got them, if not extend the end slopes outward
S=diff(dep)./diff(sta);
if toe_sta== -999
    dy=dep(1)-Ztoe;
    toe_sta=sta(1)-dy/S(1)
end
if top_sta== -999
    dy=Z2-dep(end);
    top_sta=sta(end)+dy/S(end)
end
top_sta =
    139.009591194968
% just so the reader can tell the values aren't -999 anymore
top_sta
top_sta =
    139.009591194968
toe_sta
toe_sta =
    0.137300683371296
% check for case where the toe of slope is below SWL-1.5*H0
% in this case interpolate setup from the setupAtToe(really setup as first station), and the max setup
% also un-include points seaward of SWL-1.5*H0
if Ztoe > dep(1)
    dd=SWEL_fore-dep;
    k=find(dd<0,1); % k is index of first land point
    staAtSWL=interp1(dep(k-1:k),sta(k-1:k),SWEL_fore);
    dsta=staAtSWL-sta(1);
    dsetup=maxSetup-setupAtToe;
    dsetdsta=dsetup/dsta;
    setup=setupAtToe+dsetdsta*(toe_sta-sta(1));
    sprintf('--!!- Location of SWEL-1.5*H0 is %4.1f ft landward of toe of slope',dsta)
    sprintf('--!!- Setup is interpolated between setup at toe of slope and max setup')
    sprintf('--!!-      setup is adjusted to %4.2f feet',setup)
    SWEL=SWEL-setupAtToe+setup;
    sprintf('--!!-      SWEL is adjusted to %4.2f feet',SWEL)
    k=find(dep < SWEL-1.5*H0)
    sta(k)=[];
    dep(k)=[];
else
    sprintf('--!!- The User has selected a starting point that is %4.2f feet above the elevation of SWEL-1.5H0\n',de
    sprintf('--!!- This may be reasonable for some cases. However the user may want to consider:\n')
    sprintf('--!!-      1) Selecting a starting point that is at or below %4.2f feet elevation, or\n', Ztoe)
    sprintf('--!!-      2) Reducing the incident wave height to a depth limited condition.\n')
end
ans =
--!!- Location of SWEL-1.5*H0 is 73.7 ft landward of toe of slope
ans =
--!!- Setup is interpolated between setup at toe of slope and max setup
ans =
--!!-      setup is adjusted to 0.28 feet
ans =
--!!-      SWEL is adjusted to 9.56 feet
k =
    1
    2
    3
    4
    5
    6
    7
    8
    9
% now iterate converge on a runup elevation
tol=0.01; % convergence criteria
R2del=999;
R2_new=3*H0; %initial guess
R2=R2_new;
iter=0;
R2_all=[];
topStaAll=[];
Berm_Segs=[];
TAW_ALWAYS_VALID=1;
while(abs(R2del) > tol && iter <= 25)
    iter=iter+1;
    sprintf ('!----- STARTING ITERATION %d -----!',iter)
    % elevation of toe of slope
    Ztoe
    % station of toe slope (relative to 0-NAVD88 shoreline)
    toe_sta
    % station of top of slope/extent of 2% run-up
    top_sta
    % elevation of top of slope/extent of 2% run-up
    Z2
    % incident significant wave height
    H0
    % incident spectral peak wave period

```

```

Tp
% incident spectral mean wave period
T0

R2=R2_new
Z2=R2+SWEL
% determine slope for this iteration
top_sta=-999;
for kk=1:length(sta)-1
    if ((Z2 > dep(kk)) & (Z2 <= dep(kk+1))) % here is the intersection of z2 with profile
        top_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Z2)
        break;
    end
end
if top_sta== -999
    dy=Z2-dep(end);
    top_sta=sta(end)+dy/S(end)
end

% get the length of the slope (not accounting for berm)
Lslope=top_sta-toe_sta
% loop over profile segments to determine berm factor
% re-calculate influence of depth of berm based on this run-up elevation
% check for berm, berm width, berm height
berm_width=0;
rdh_sum=0;
Berm_Segs=[];
Berm_Heights=[];
for kk=1:length(sta)-1
    ddep=dep(kk+1)-dep(kk);
    dsta=sta(kk+1)-sta(kk);
    s=ddep/dsta;
    if (s < 1/15) % count it as a berm if slope is flatter than 1:15 (see TAW manual)
        sprintf('Berm Factor Calculation: Iteration %d, Profile Segment: %d',iter, kk)
        berm_width=berm_width+dsta; % tally the width of all berm segments
        % compute the rdh for this segment and weight it by the segment length
        dh=SWEL-(dep(kk)+dep(kk+1))/2
        if dh < 0
            chi=R2;
        else
            chi=2* H0;
        end
        if (dh <= R2 & dh >=-2*H0)
            rdh=(0.5-0.5*cos(3.14159*dh/chi)) ;
        else
            rdh=1;
        end
        rdh_sum=rdh_sum + rdh * dsta
        Berm_Segs=[Berm_Segs, kk];
        Berm_Heights=[Berm_Heights, (dep(kk)+dep(kk+1))/2];
    end
    if dep(kk) >= Z2 % jump out of loop if we reached limit of run-up for this iteration
        break
    end
end
sprintf('!----- End Berm Factor Calculation, Iter: %d -----!',iter)
berm_width
rB=berm_width/Lslope
if (berm_width > 0)
    rdh_mean=rdh_sum/berm_width
else
    rdh_mean=1
end
gamma_berm=1- rB * (1-rdh_mean)
if gamma_berm > 1
    gamma_berm=1
end
if gamma_berm < 0.6
    gamma_berm =0.6
end
% Iribarren number
slope=(Z2-Ztoe)/(Lslope-berm_width)
Irb=(slope/(sqrt(H0/L0)))
% runup height
gamma_berm
gamma_perm
gamma_beta
gamma_rough
gamma=gamma_berm*gamma_perm*gamma_beta*gamma_rough
% check validity
TAW_VALID=1;
if (Irb*gamma_berm < 0.5 | Irb*gamma_berm > 10 )
    sprintf('!!! - - Iribarren number: %6.2f is outside the valid range (0.5-10), TAW NOT VALID - - !!!\n', Irb)
    TAW_VALID=0;
else
    sprintf('!!! - - Iribarren number: %6.2f is in the valid range (0.5-10), TAW RECOMMENDED - - !!!\n', Irb)
end
islope=1/slope;
if (slope < 1/8 | slope > 1)
    sprintf('!!! - - slope: 1:%3.1f V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!\n', islope)
    TAW_VALID=0;
else
    sprintf('!!! - - slope: 1:%3.1f V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!\n', islope)
end
if TAW_VALID == 0
    TAW_ALWAYS_VALID=0;
end

```

```

end
if (Irb*gamma_berm < 1.8)
    R2_new=gamma*H0*1.77*Irb
else
    R2_new=gamma*H0*(4.3-(1.6/sqrt(Irb)))
end
% check to see if we need to evaluate a shallow foreshore
if berm_width > 0.25 * L0;
    disp('!   Berm_width is greater than 1/4 wave length')
    disp('!   Runup will be weighted average with foreshore calculation assuming depth limited wave height on
    % do the foreshore calculation
    fore_H0=0.78*(SWEL_fore-min(Berm_Heights))
    % get upper slope
    fore_toe_sta=-999;
    fore_toe_dep=-999;
    for kk=length(dep)-1:-1:1
        ddep=dep(kk+1)-dep(kk);
        dsta=sta(kk+1)-sta(kk);
        s=ddep/dsta;
        if s < 1/15
            break
        end
        fore_toe_sta=sta(kk);
        fore_toe_dep=dep(kk);
        upper_slope=(Z2-fore_toe_dep)/(top_sta-fore_toe_sta)
    end
    fore_Irb=upper_slope/(sqrt(fore_H0/L0));
    fore_gamma=gamma_perm*gamma_beta*gamma_rough;
    if (fore_Irb < 1.8)
        fore_R2=fore_gamma*fore_H0*1.77*fore_Irb;
    else
        fore_R2=fore_gamma*fore_H0*(4.3-(1.6/sqrt(fore_Irb)));
    end
    if berm_width >= L0
        R2_new=fore_R2
        disp('berm is wider than one wavelength, use full shallow foreshore solution');
    else
        w2=(berm_width-0.25*L0)/(0.75*L0)
        w1=1-w2
        R2_new=w2*fore_R2 + w1*R2_new
    end
end % end berm width check
% convergence criterion
R2del=abs(R2-R2_new)
R2_all(iter)=R2_new;
% get the new top station (for plot purposes)
Z2=R2_new+SWEL
top_sta=-999;
for kk=1:length(sta)-1
    if ((Z2 > dep(kk)) & (Z2 <= dep(kk+1))) % here is the intersection of z2 with profile
        top_sta=interp1(dep(kk:kk+1),sta(kk:kk+1),Z2)
        break;
    end
end
if top_sta== -999
    dy=Z2-dep(end);
    top_sta=sta(end)+dy/S(end);
end
topStaAll(iter)=top_sta;
end
ans =
!----- STARTING ITERATION 1 -----!
Ztoe =
    0.0999099999999995
toe_sta =
    0.137300683371296
top_sta =
    139.009591194968
Z2 =
    18.82411
H0 =
    6.2414
Tp =
    12.7769
T0 =
    11.6153636363636
R2 =
    18.7242
Z2 =
    28.2847933979306
top_sta =
    287.762474810226
Lslope =
    287.625174126855
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 51
dh =
    0.62044339793057
rdh_sum =
    0.00608326474456938
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 52
dh =
    0.57329339793057
rdh_sum =

```

```

0.0112786210205525
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 1, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.251389086452627
ans =
!----- End Berm Factor Calculation, Iter: 1 -----!
berm_width =
6
rB =
0.0208604828079261
rdh_mean =
0.0418981810754378
gamma_berm =
0.980013533478082
slope =
0.10007941756384
Irb =
1.05253640463838
gamma_berm =
0.980013533478082
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.980013533478082
ans =
!!! - - Iribaren number: 1.03 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:10.0 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
11.3952663845299
R2del =
7.32893361547014
Z2 =
20.9558597824604
ans =
!----- STARTING ITERATION 2 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
172.52766953554
Z2 =
20.9558597824604
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
11.3952663845299
Z2 =
20.9558597824604
top_sta =
172.52766953554
Lslope =
172.390368852169
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =

```

```

Berm Factor Calculation: Iteration 2, Profile Segment: 53
dh =
    0.52614339793057
rdh_sum =
    0.0156557422356077
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 54
dh =
    0.47704339793057
rdh_sum =
    0.0192549676367879
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 58
dh =
    0.148243397930569
rdh_sum =
    0.0196029164348988
ans =
Berm Factor Calculation: Iteration 2, Profile Segment: 87
dh =
    -5.98750660206943
rdh_sum =
    0.559517705584329
ans =
!----- End Berm Factor Calculation, Iter: 2 -----!
berm_width =
    6
rB =
    0.0348047285933081
rdh_mean =
    0.0932529509307214
gamma_berm =
    0.968440915054361
slope =
    0.125343491491326
Irb =
    1.31823896551901
gamma_berm =
    0.968440915054361
gamma_perm =
    1
gamma_beta =
    1
gamma_rough =
    1
gamma =
    0.968440915054361
ans =
!!! - - Iribaren number: 1.28 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.0 V:H is in the valid range (1:8 - 1:1), TAW RECOMMENDED - - !!!
R2_new =
    14.1033588731152
R2del =
    2.70809248858536
Z2 =
    23.6639522710458
ans =
!----- STARTING ITERATION 3 -----!
Ztoe =
    0.0999099999999995
toe_sta =
    0.137300683371296
top_sta =
    215.107740110781
Z2 =
    23.6639522710458
H0 =
    6.2414
Tp =
    12.7769
T0 =
    11.6153636363636
R2 =
    14.1033588731152
Z2 =
    23.6639522710458
top_sta =
    215.107740110781
Lslope =
    214.97043942741
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 51
dh =
    0.62044339793057
rdh_sum =
    0.00608326474456938
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 52
dh =
    0.57329339793057
rdh_sum =
    0.0112786210205525
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 53
dh =

```

```

0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 3, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.402184420469069
ans =
!----- End Berm Factor Calculation, Iter: 3 -----!
berm_width =
6
rB =
0.0279108142309308
rdh_mean =
0.0670307367448448
gamma_berm =
0.973960068210117
slope =
0.112762562664904
Irb =
1.18592518995645
gamma_berm =
0.973960068210117
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.973960068210117
ans =
!!! - Iribaren number: 1.16 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - slope: 1:8.9 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
12.7600897277018
R2del =
1.34326914541338
Z2 =
22.3206831256324
ans =
!----- STARTING ITERATION 4 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
193.987156063401
Z2 =
22.3206831256324
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
12.7600897277018
Z2 =
22.3206831256324
top_sta =
193.987156063401
Lslope =
193.84985538003
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =

```



```

0.0156557422356077
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 4, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.471355124267988
ans =
!----- End Berm Factor Calculation, Iter: 4 -----!
berm_width =
6
rB =
0.0309517899213151
rdh_mean =
0.0785591873779981
gamma_berm =
0.971479757542798
slope =
0.118290073104814
Irb =
1.24405808188013
gamma_berm =
0.971479757542798
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.971479757542798
ans =
!!! - - Iribaren number: 1.21 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.5 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.351488796225
R2del =
0.591399068523152
Z2 =
22.9120821941556
ans =
!----- STARTING ITERATION 5 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
203.285883555903
Z2 =
22.9120821941556
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.351488796225
Z2 =
22.9120821941556
top_sta =
203.285883555903
Lslope =
203.148582872532
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =

```

```

Berm Factor Calculation: Iteration 5, Profile Segment: 54
dh =
    0.47704339793057
rdh_sum =
    0.0192549676367879
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 58
dh =
    0.148243397930569
rdh_sum =
    0.0196029164348988
ans =
Berm Factor Calculation: Iteration 5, Profile Segment: 87
dh =
    -5.98750660206943
rdh_sum =
    0.438984926669583
ans =
!----- End Berm Factor Calculation, Iter: 5 -----!
berm_width =
    6
rB =
    0.029535032512458
rdh_mean =
    0.0731641544449305
gamma_berm =
    0.97262587316782
slope =
    0.115710556280818
Irb =
    1.21692927328269
gamma_berm =
    0.97262587316782
gamma_perm =
    1
gamma_beta =
    1
gamma_rough =
    1
gamma =
    0.97262587316782
ans =
!!! - - Iribaren number: 1.18 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
    13.0757449067675
R2del =
    0.275743889457516
Z2 =
    22.636338304698
ans =
!----- STARTING ITERATION 6 -----!
Ztoe =
    0.0999099999999995
toe_sta =
    0.137300683371296
top_sta =
    198.950287809716
Z2 =
    22.636338304698
H0 =
    6.2414
Tp =
    12.7769
T0 =
    11.6153636363636
R2 =
    13.0757449067675
Z2 =
    22.636338304698
top_sta =
    198.950287809716
Lslope =
    198.812987126345
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 51
dh =
    0.62044339793057
rdh_sum =
    0.00608326474456938
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 52
dh =
    0.57329339793057
rdh_sum =
    0.0112786210205525
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 53
dh =
    0.52614339793057
rdh_sum =
    0.0156557422356077
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 54
dh =

```

```

0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 6, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.45367907178888
ans =
!----- End Berm Factor Calculation, Iter: 6 -----!
berm_width =
6
rB =
0.0301791149900435
rdh_mean =
0.07561317863148
gamma_berm =
0.972102823822639
slope =
0.11688231503789
Irb =
1.22925267383092
gamma_berm =
0.972102823822639
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.972102823822639
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.2010552683118
R2del =
0.125310361544315
Z2 =
22.7616486662424
ans =
!----- STARTING ITERATION 7 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
200.920576513243
Z2 =
22.7616486662424
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.2010552683118
Z2 =
22.7616486662424
top_sta =
200.920576513243
Lslope =
200.783275829872
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =

```

```

0.0192549676367879
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 7, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.446917288010514
ans =
!----- End Berm Factor Calculation, Iter: 7 -----!
berm_width =
6
rB =
0.0298829669712329
rdh_mean =
0.074486214668419
gamma_berm =
0.972342902121516
slope =
0.116343349138638
Irb =
1.22358436316694
gamma_berm =
0.972342902121516
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.972342902121516
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.143427973929
R2del =
0.0576272943827796
Z2 =
22.7040213718596
ans =
!----- STARTING ITERATION 8 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
200.014486978922
Z2 =
22.7040213718596
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.143427973929
Z2 =
22.7040213718596
top_sta =
200.014486978922
Lslope =
199.877186295551
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =

```

```

Berm Factor Calculation: Iteration 8, Profile Segment: 58
dh =
    0.148243397930569
rdh_sum =
    0.0196029164348988
ans =
Berm Factor Calculation: Iteration 8, Profile Segment: 87
dh =
    -5.98750660206943
rdh_sum =
    0.450009254625427
ans =
!----- End Berm Factor Calculation, Iter: 8 -----!
berm_width =
    6
rB =
    0.0300184333750227
rdh_mean =
    0.0750015424375712
gamma_berm =
    0.972232995429663
slope =
    0.116589846406174
Irb =
    1.22617677781165
gamma_berm =
    0.972232995429663
gamma_perm =
    1
gamma_beta =
    1
gamma_rough =
    1
gamma =
    0.972232995429663
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
    13.1697862373223
R2del =
    0.0263582633932824
Z2 =
    22.7303796352529
ans =
!----- STARTING ITERATION 9 -----!
Ztoe =
    0.0999099999999995
toe_sta =
    0.137300683371296
top_sta =
    200.42892508259
Z2 =
    22.7303796352529
H0 =
    6.2414
Tp =
    12.7769
T0 =
    11.6153636363636
R2 =
    13.1697862373223
Z2 =
    22.7303796352529
top_sta =
    200.42892508259
Lslope =
    200.291624399219
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 51
dh =
    0.62044339793057
rdh_sum =
    0.00608326474456938
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 52
dh =
    0.57329339793057
rdh_sum =
    0.0112786210205525
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 53
dh =
    0.52614339793057
rdh_sum =
    0.0156557422356077
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 54
dh =
    0.47704339793057
rdh_sum =
    0.0192549676367879
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 58
dh =

```

```

0.148243397930569
rdh_sum =
0.0196029164348988
ans =
Berm Factor Calculation: Iteration 9, Profile Segment: 87
dh =
-5.98750660206943
rdh_sum =
0.448591311516428
ans =
!----- End Berm Factor Calculation, Iter: 9 -----!
berm_width =
6
rB =
0.029956320030841
rdh_mean =
0.0747652185860713
gamma_berm =
0.972283370784299
slope =
0.11647681522675
Irb =
1.22498802757609
gamma_berm =
0.972283370784299
gamma_perm =
1
gamma_beta =
1
gamma_rough =
1
gamma =
0.972283370784299
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
13.157700150674
R2del =
0.0120860866482602
Z2 =
22.7182935486046
ans =
!----- STARTING ITERATION 10 -----!
Ztoe =
0.0999099999999995
toe_sta =
0.137300683371296
top_sta =
200.238892273655
Z2 =
22.7182935486046
H0 =
6.2414
Tp =
12.7769
T0 =
11.6153636363636
R2 =
13.157700150674
Z2 =
22.7182935486046
top_sta =
200.238892273655
Lslope =
200.101591590284
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 51
dh =
0.62044339793057
rdh_sum =
0.00608326474456938
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 52
dh =
0.57329339793057
rdh_sum =
0.0112786210205525
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 53
dh =
0.52614339793057
rdh_sum =
0.0156557422356077
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 54
dh =
0.47704339793057
rdh_sum =
0.0192549676367879
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 58
dh =
0.148243397930569
rdh_sum =

```

```

0.0196029164348988
ans =
Berm Factor Calculation: Iteration 10, Profile Segment: 87
dh =
    -5.98750660206943
rdh_sum =
    0.44924070584552
ans =
!----- End Berm Factor Calculation, Iter: 10 -----!
berm_width =
    6
rB =
    0.0299847689981659
rdh_mean =
    0.0748734509742533
gamma_berm =
    0.972260294133393
slope =
    0.11652858363134
Irb =
    1.22553247649243
gamma_berm =
    0.972260294133393
gamma_perm =
    1
gamma_beta =
    1
gamma_rough =
    1
gamma =
    0.972260294133393
ans =
!!! - - Iribaren number: 1.19 is in the valid range (0.5-10), TAW RECOMMENDED - - !!!
ans =
!!! - - slope: 1:8.6 V:H is outside the valid range (1:8 - 1:1), TAW NOT VALID - - !!!
R2_new =
    13.1632356924805
R2del =
    0.00553554180651439
Z2 =
    22.7238290904111
% final 2% runup elevation
Z2=R2_new+SWEL
Z2 =
    22.7238290904111
diary off
-1.000000e+00

```