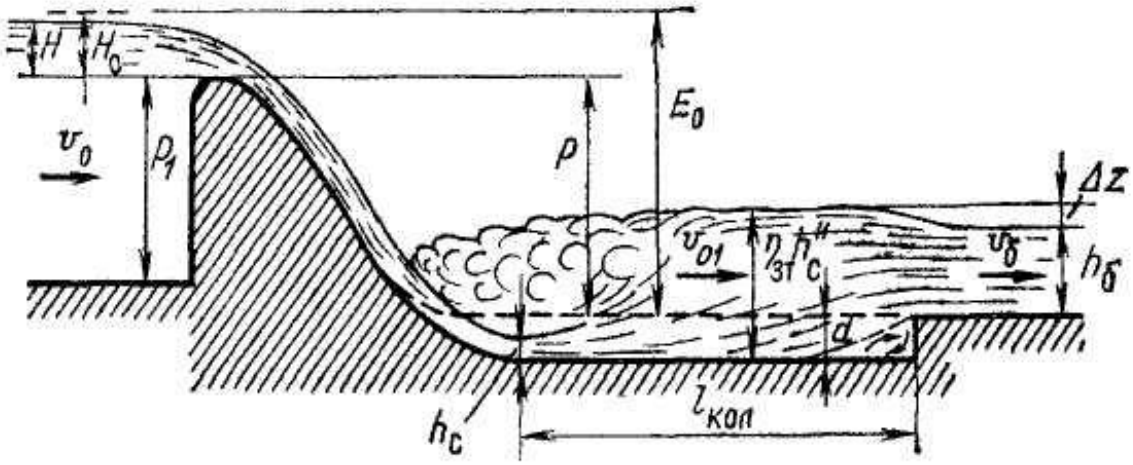
«Gidravlika va gidroinformatika» kafedrasi

Topshiriq № 3.2

Suv zarbini kamaytiruvchi inshootlar. Oqim energiyasini so'ndirgichlar. Energiyani so'ndiruvchi xovuz hisobi.

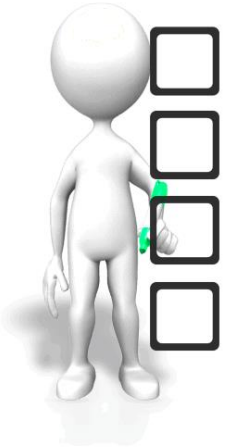


Аллаёров Д.Ш.

Amaliyot topshirig’idan asosiy maqsad:

Energiya so’ndiruvchi hovuz yoкi devor turidagi energiya so’ndirgich haqida umumiy tushunchaga ega bo’lish;

Sarf $Q=Q_{MK}$ bo’lganda, energiyani so’ndiruvchi inshoatning o’lchamlari hisobini bajarishdan iborat



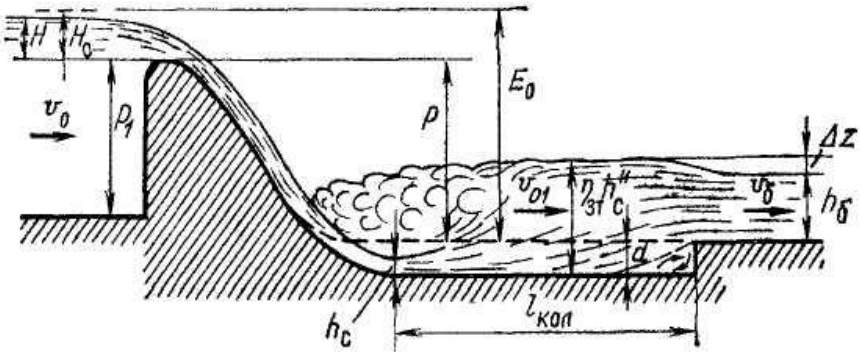
Чугаев Р.Р., 1982. Гидравлика (техническая механика жидкости) с.462-479

Kirish

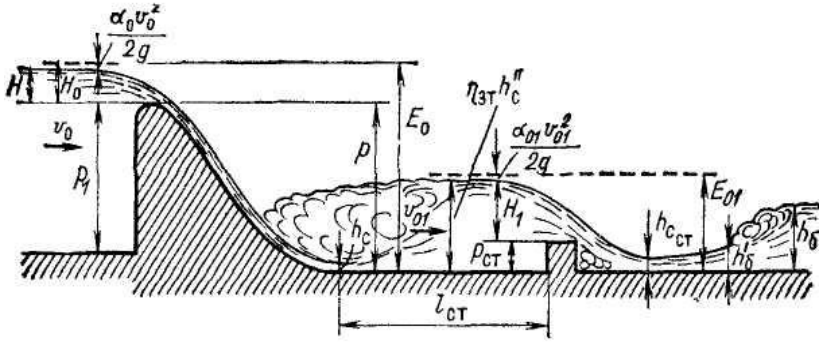
- Agar gidravlik saкrash xaydalgan bo'lsa, pastкi b'efga oqim zarbini кamaytirish uchun energiya so'ndiruvchi devor (to'siq) yoкi hovuz qullaniladi. Chunki siqilgan kesimda to 2-sakrash chuqurligiga qadar oqim tezligi nisabatan katta bo'ladi va inshoat havfsizligini ta'minlashda iqtisodiy samaradorlikni inobatga olib, kinetik energiyaning ma'lum darajada kamaytirib, potensiyal energiyaga qisman oshirishga tu'g'ri keladi, va haydalgan gidravlik sakrashni ko'milgan sakrash ko'rinishidagi b'eflarni tutashtirish kerak boladi.
- Pastki b'efdagi energiyani so'ndirish uchun qurilgan maxsus inshoatlarga **– energiya so'ndirgichlar** deyiladi.

Energiya so’ndirgichlar turlari

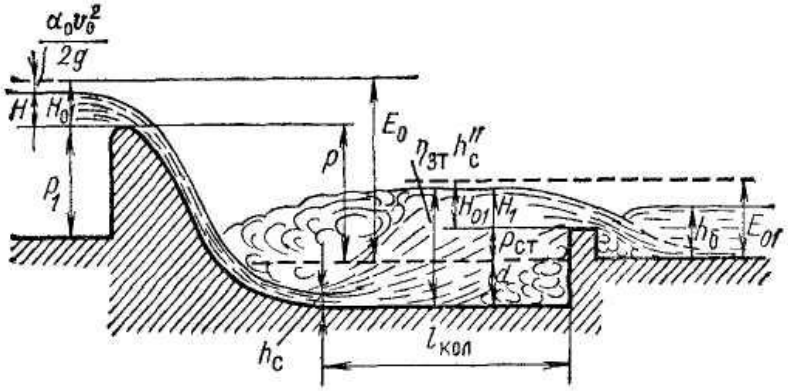
1. Energiyani so’ndiruvchi xovuz:



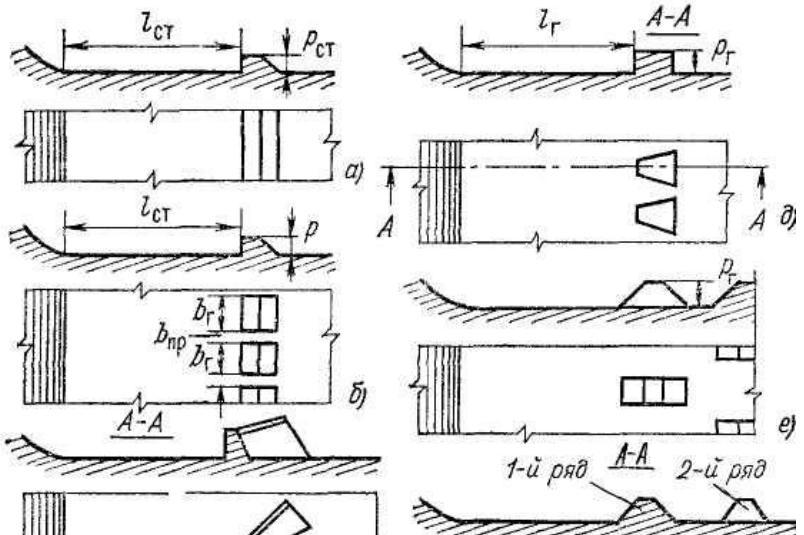
2. Energiya so’ndiruvchi devor (to’siq)



3. Energiyani so’ndiruvchi xovuz va devor aralash holda



4. maxsus energiya so’dirgichlar



BERILGAN:

Q_{mk}=	35	MK ning suv sarfi, m^3/s
ϑ_O^{MK}=	0.82	MK oqim tezligi, m/s (Topshiriq №3a, KMK boyicha), m/s
$h_{пб}$=	2.47	MK pastki b'efdagi oqim chuqurligi (Topshiriq №2.5, Gidravlik sakrash elementlarini hisobi boyicha), m
h_c= h'=	0.16	Siqilgan kesimdagi suv oqimining chuqurligi (Topshiriq №2.5, Gidravlik sakrash elementlarini hisobi boyicha), m
h"=	2.29	Ikkinchi tutashtirish chuqurligi (Topshiriq №2.5, Gidravlik sakrash elementlarini hisobi boyicha), m
b_{ts}=	30.47	Tezoqar-sharshara oxiridagi kengligi (Topshiriq №2.1, Keng ostonali suv o'tkazgich gidravlik hisobi), m
m=	1	Tezoqar-sharsharaning qiyalik koefficienti

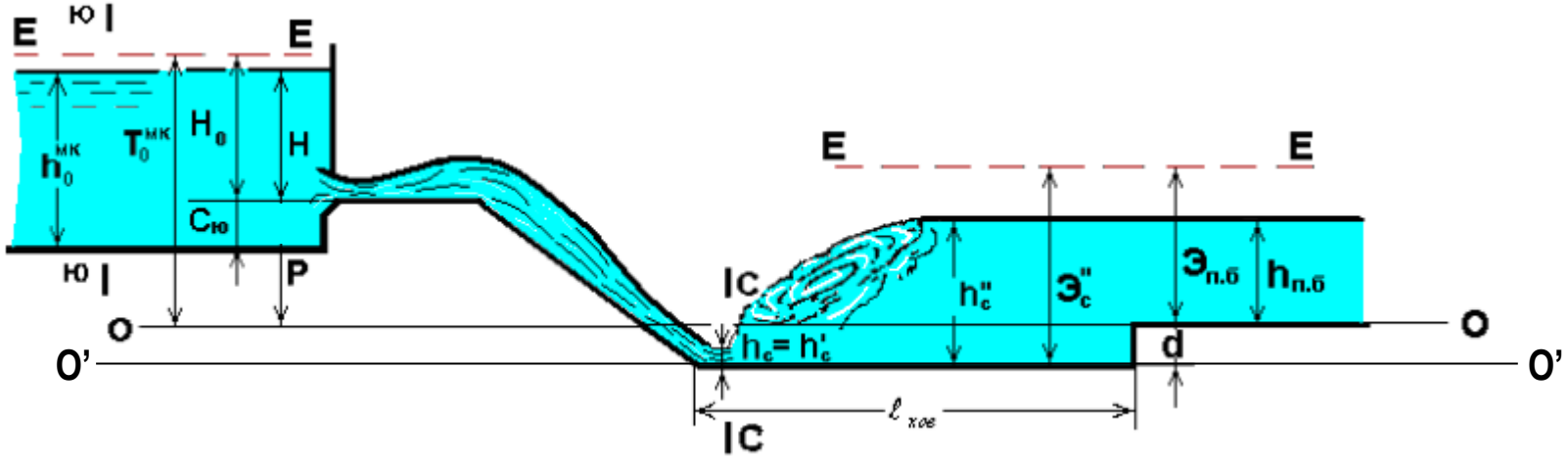
Talab qilinadi:

Sarf $Q=Q_{MK}$ bo'lganda quyidagi energiyani so'ndiruvchi inshoatning, ya'ni:

I. Energiyani so'ndiruvchi xovuz o'chamlari (hovuz chuqurligi - d, hovuz uzunligi - l_{hov}) aniqlansin.

ECHILISHI: I. Energiyani so’ndiruvchi xovuz uchun

1. Sxema masshtabda chiziladi va kesimlar (Ю-Ю va C-C) va taqqoslash tekisliklarini (O-O va O’-O’) belgilaymiz:



Quyidagi shartli belgilarni qabul qilamiz:

h_o^{MK} - MK normal chuqurligi, m;

T_o^{MK} - taqqoslash tekisligiga (O-O) nisbatan hisoblaganda Ю-Ю kesimdagi to’la solishtirma energiya, m;

H_o, H - darvoza oldidagi chuqurlik (to’la va geometrik naporlar), m;

P - yuqori va pastki b’eflardagi ostona balandliklar farqi, m;

$C_ю$ - yuqori b’efdagi ostona balandligi, m

$h_{пб}$ - pastki b’efdagi oqim chuqurligi, m;

h_c - siqilgan kesimdagi suv oqimining chuqurligi, m;

h_c'' - gidravlik sakrashdan keyingi oqim chuqurligi (2-tutashtirish chuqurligi), m

$Э_c''$ va $Э_{пб}$ - sakrashdan keyingi va pastki b’efdagi kesimlarning solishtirma energiyalari, m

ℓ_{xov} - hovuzning uzunligi, m; **d - hovuzning chuqurligi, m**

2. Quyidagi hisoblash formulalaridan foydalalnamiz:
Sakrash ayni siqilgan kesimda bo'lishi sharti bajarilishi uchun quyidagi tenglamani yozamiz:

$$Э_c'' = Э_{п.б.} + d \qquad (1)$$

bu erda

$$Э_c'' = h_c'' + \frac{\alpha(\vartheta_c'')^2}{2g}; \text{ yoki } Э_c'' = h_c'' + \frac{\alpha Q_{мк}^2}{2g\omega^2}$$

$$Э_{п.б.} = h_{п.б.} + \frac{\alpha(\vartheta_{п.б.}'')^2}{2g}; \qquad (2)$$

Hovuzning uzunligi (l_{xov}) M.D.CHertousov formulasi yordamida quyidagicha aniqlanadi:

$$l_{xov} = \beta^* l_s \qquad (3)$$

Bu yerda β = 0.7 ÷ 0.8 - empirik koefficient (β = 0.75 deb olsak bo'ladi)

l_s = 2.5*(1.9*h" – h') - gidravlik sakrash uzunligi (Pavlovskiy formulasi), m

3. Hisoblash tanlash usulida bajariladi. Hovuz chuqurligi (***d***) ga bir necha qiymatlar berib,

h_c - siqilgan кesimdagi hamda ***h”*** – 2-tutashtirish chuqurligini ***d*** ga ortib borishi boyicha yozamiz . Hisoblash natijalarni jadvalda keltiramiz (**1-jadval**)

1-jadval: Energiyani so’ndiruvchi xovuz hisobi

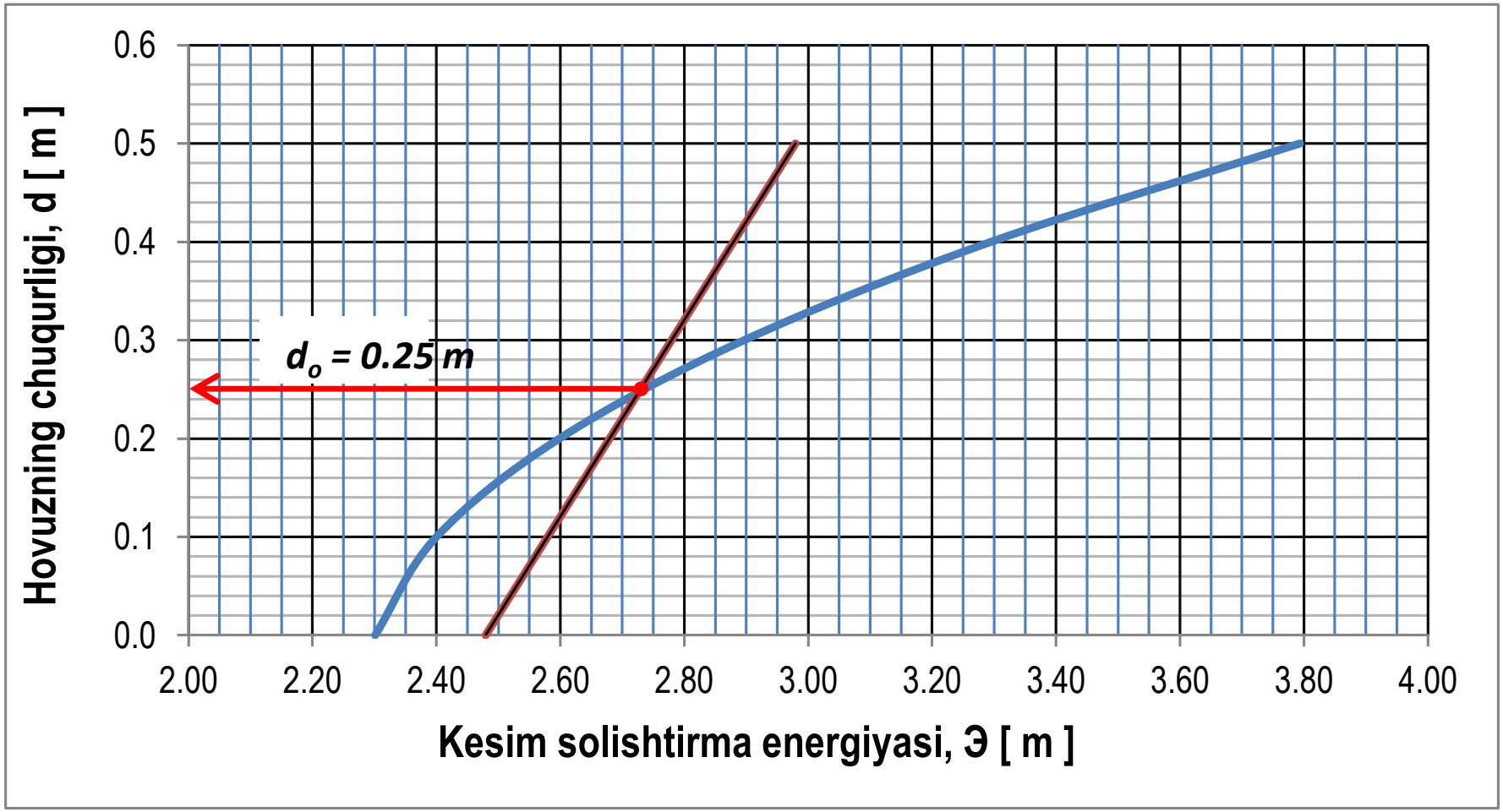
d, m	h', m	h'', m	ω'', m^2	$\alpha Q^2/2g \cdot (\omega'')^2$, m	$Э_c''$, m	$Э_{пб}$+d, m
0.0	0.16	2.29	75.0	0.01	2.30	2.48
0.1	0.26	2.39	78.5	0.01	2.40	2.58
0.2	0.46	2.59	85.6	0.01	2.60	2.68
0.3	0.76	2.89	96.4	0.01	2.90	2.78
0.4	1.16	3.29	111.1	0.01	3.30	2.88
0.5	1.66	3.79	129.8	0.00	3.79	2.98

Hisoblash formulalari: $\omega”=(b_{ts}+h”m)h”$; $Э_c'' = h” + \alpha Q^2/2g \cdot (\omega'')^2$;

$\omega_{пб} =(b_{ts}+ h_{пб}\, m)\, h_{пб}$; $Э_{пб}'' = h_{пб} + \alpha Q^2/2g \cdot (\omega_{пб})^2$

b_{ts}= 30.47 m m = 1 tezoqar-sharsharaning qiyalik koefficienti

1-jadvaldagi d, $Э_c''$ va $Э_{пб}$+d qiymatlari asosida $Э_c''$= f (d) va $Э_{пб}$+d = f(d) grafigini quramiz (**1-rasm**).



1-rasm: Energiya so'ndiruvchi hovuz chuqurligini aniqlash grafigi

1-rasmdan $Э_c''$= f (d) va $Э_{пб}$+d = f(d) chiziqlar kesishgan nuqtadan energiya so'ndiruvchi hovuzning nazariy chuqurligi **d_o= 0.25 m** - ning qiymatini olamiz.

4. Ko'milgan gidravlik sakrash kesimidagi hovuz chuqurligi - d, A=1.05 + 1.10 ko'milish darajasida quyidagicha topiladi:

$$D = (1.05 \div 1.10)\, d_0 + (0.05 \div 0.10) h_{пб} = 1.075*0.25 + 0.075*2.47 = \mathbf{0.45\ m}$$

5. Hovuzning uzunligini M.D.CHertousov va N.N.Pavlovskiy formulalari bo'yicha aniqlaymiz:

$$l_{xov} = \beta^* l_s = 0.75*10.5 = \mathbf{7.9\ m}$$

Bu yerda β = 0.7 ÷ 0.8 - empirik koefficient (β = 0.75 deb olsak bo'ladi)

$$l_s = 2.5*(1.9*h'' - h') = 2.5*(1.9*2.29 - 0.16) = 10.5\ m$$

JAVOB:

Energiyani so'ndiruvchi xovuz o'chamlari quyidagicha:

hovuz chuqurligi - d = 0.44 m,

hovuz uzunligi - l_{hov} = 7.9 m.